



5th International Conference on **Advances in Science, Engineering & Technology**

ICASET-2026

22nd - 23rd March, 2026 | Chennai, India



Organized by: IFERP Academy - India

5th International Conference on Advances in Science, Engineering & Technology
(ICASET-2026)

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Conference Theme



“Innovating for a Sustainable Future
through Science and Technology.”

Preface

We cordially invite you to attend the 5th International Conference on Advances in Science, Engineering & Technology (ICASET-2026) on 22nd-23rd March, 2026. The main objective of ICASET-2026 is to provide a platform for researchers, students, academicians as well as industrial professionals from all over the world to present their research results and development activities in relevant fields of Advances in Science, Engineering & Technology. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on cutting edge development of academia as well as industries. All accepted papers were subjected to strict peer-reviewing by a panel of expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results but also will provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities, research institutes and colleges. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in there view process, and to the authors for contributing their research result to the conference.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of ICASET-2026. We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

About ICASET - 2026

"Innovating for a Sustainable Future through Science and Technology" emphasizes the critical role of interdisciplinary research and innovation in solving global challenges. By fostering collaboration between academia, industry, and policymakers, ICASET 2026 aims to create practical, scalable solutions aligned with the United Nations Sustainable Development Goals (UN SDGs). This conference is dedicated to advancing knowledge, promoting ethical innovation, and empowering future leaders to build a sustainable, technologically advanced, and equitable world.

Objective of the Conference

The primary aim of ICASET 2026 is to **drive sustainable development and technological innovation through interdisciplinary collaboration**. by The conference focuses on:

- **Fostering Interdisciplinary Collaboration:** Bringing together experts from science, engineering, and technology to create integrated, future-ready solutions.
- **Linking Research with Real-World Practice:** Translating academic research into practical solutions for industries, communities, and policymakers.
- **Promoting Innovation Aligned with the UN SDGs:** Exchange knowledge on best practices in innovative and digital education.
- **Empowering Emerging Leaders:** Providing a platform for students, researchers, and professionals to enhance skills, broaden networks, and lead future innovations.

Scope of the Conference

- **Emerging Technologies & Innovations:** Artificial intelligence, machine learning, IoT, robotics, and automation.
- **Sustainable Engineering Solutions:** Renewable energy systems, green technologies, and eco-friendly infrastructure.
- **Advanced Materials & Manufacturing:** Nanotechnology, smart materials, and additive manufacturing.
- **Environmental & Climate Solutions:** Climate change mitigation, waste management, and water resource management.
- **Data-Driven Research & Applications:** Big data analytics, cloud computing, and cybersecurity.
- **Education & Research Integration:** Modern teaching methods, STEM education, and industry-academia collaboration.
- **Interdisciplinary Approaches:** Combining science, engineering, and technology to solve complex societal challenges.

About IFERP

The IFERP Academy is a committed professional organization that advances engineering, science, and technology. IFERP anticipates a global scientific community brought together by digital innovation. This organization puts a great emphasis on promoting research activities, communicating the newest insights, and driving industrial trends.

IFERP has built strong networks throughout Asia, the Middle East, Europe, and countries such as Iraq, Malaysia, Australia, and more. They have incorporated networking, research support, publications, and worked in other scientific areas.

IFERP excels in organizing International Conferences that connect researchers worldwide. It holds important international webinars, publishes journals and publications that are indexed by Web of Science and SCOPUS, and provides thorough research assistance and guidance. Engaging in Youth Empowerment projects and encouraging Industry-Institute Interaction are key components of IFERP's goal. The organization is committed to enabling professionals through faculty advancement, skill development, and persistent research and publication initiatives.

- **Global Community Building:** IFERP exerts a lot of effort in building new communities all over the world. As community organizers, we control the conversations & inculcate passion for innovation amongst diverse groups.
- **Promoting Innovation Schemes:** IFERP has several schemes for students, professionals, researchers & organizations to being distinct innovators across all technology streams & sub disciplines.
- **Publicizing Research Publication:** Publication of research is the crucial aspect of IFERP's activities. IFERP also serves as a support center for early - career researchers aspiring to publish world-class research papers.
- **Our Origin:** Established by the Technoarete Research & Development Association (TRADA), IFERP was meant to serve as an accelerant for technological innovation worldwide.
- **Facilitating Multi-Disciplinary Collaborations:** IFERP encourages networking & collaborative partnerships on all fronts to result in a diverse collaborative atmosphere to gain abundance knowledge.
- **Access To Critical Funding & Resources:** IFERP has dedicated itself to fund for various efficient projects & activities to make it achieve successful outcomes beyond just meeting expectations.

What IFERP Does

IFERP is committed to improving the professional experience by providing a world-class platform to professionals. Their dedication extends to the following activities:

- **Academic Resource Accessibility :** They make academic resources and support available to aspiring scholars in both rural and urban locations.
- **Diverse Educational Program :** They organize a wide range of educational events such as workshops, conferences, webinars, seminars, guest lectures, short-term training programs, and faculty development programs.
- **Drive Innovation:** They work hard to foster curiosity and creativity, and stay up to date on the newest trends and advancements in the dynamic field of Engineering, Science, and Technology.
- **Knowledge Sharing and Collaboration:** They believe in the strength of the exchange of knowledge and actively collaborate with institutions, organizations, and associations to contribute to our shared objective of a better future.
- **Publication & Recognition:** They also provide opportunities for research articles to be published in reputable journals and actively promote and encourage transdisciplinary research activities.

IIFERP Mission & Vision

IIFERP's Mission: Upskilling the knowledge hub through technological innovation & excellence for the benefit of humanity.

IIFERP's Vision: A Digitally equipped robust, dynamic & swift professional community integrating academics & industry for upgraded technical implementation.

IIFERP's Value: IIFERP values the restoration of high level technological research, learning, collaboration, resource sharing & community-building traditions.

IIFERP's Goal: To serve as the foundation for all technological progress and advancement activities around the world.

Managing Director, IFERP

Mr. A. Siddth Kumar Chhajer



Managing Director & Founder, IFERP
Technoarete Group, India



Message:

On behalf of IFERP & the organizing Committee, I express my hearty gratitude to the Participants, Keynote Speakers, Delegates, Reviewers and Researchers.

The goal of the 5th International Conference on Advances in Science, Engineering & Technology (ICASET-2026) is to provide knowledge enrichment and innovative technical exchange between international researchers or scholars and practitioners from the academia and industries in various fields of academics. This conference creates solutions in different ways and to share innovative ideas in the field of Advances in Science, Engineering & Technology. ICASET-2026 provides a world class stage to the Researchers, Professionals, Scientists, Academicians, and students to engage in very challenging conversations, assess the current body of research and determine knowledge and capability gaps.

ICASET-2026 will explore the new horizons of innovations from distinguished researchers, scientists and eminent authors in academia and industry working for the advancements in Advances in Science, Engineering & Technology from all over the world. ICASET-2026 hopes to set the perfect platform for participants to establish careers as successful and globally renowned specialists in various fields of Academics.

Chief Executive Officer, IFERP

Mr. Rudra Bhanu Satpathy



Chief Executive Officer & Founder, IFERP
Technoarete Group, India



Message:

IFERP is hosting the 5th International Conference on Advances in Science, Engineering & Technology (ICASET-2026) this year in month of March. The main objective of ICASET-2026 is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader.

I express my hearty gratitude to all my Colleagues, Staffs, Professors, Reviewers and Members of organizing committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to make this conference successful.

Keynote Speaker

Dr. Shilpa Bade-Gite



Director
Dr. D.Y. Patil School of Science &
Technology, Pune, India



Biography:

Dr. Shilpa Bade-Gite is a Professor and Head of the Department of Artificial Intelligence and Machine Learning at Symbiosis Institute of Technology, Pune, and a Research Faculty at the Symbiosis Centre for Applied AI. With over 17 years of experience, she is recognized for her work in AI, Machine Learning, Deep Learning, computer vision, and AI-driven automation, particularly in healthcare, autonomous systems, and biometric security. She is listed in the Stanford/Elsevier Top 2% Scientists 2025. Dr. Gite has authored 230+ research publications, including over 150 journal papers with strong visibility in top-tier journals, accumulating over 2,900 citations. She serves as a Guest Editor for leading SCI/Scopus-indexed journals and has edited books with De Gruyter and Springer. Her research collaborations span across Australia, the UK, South Korea, Malaysia, and the USA. As an academic leader, Dr. Gite has overseen curriculum development, accreditation processes, and several Centres of Excellence in collaboration with organizations like Tech Mahindra, Skoda, Intel, Bajaj Auto, and Philips India. She has mentored 5 PhD scholars and delivered 30+ expert talks at prestigious institutes including IIT Kharagpur and MNIT Jaipur. Her vision includes global alliances, interdisciplinary research, and the establishment of Centres of Excellence to drive innovation and societal impact.

Keynote Speaker

Prof. Dr. Amutha



Professor
SRM Institute of Science and Technology
Chennai, India



Biography:

Dr. B. Amutha is a Professor in the Department of Computing Technologies at SRM Institute of Science and Technology, with over three decades of academic experience. She holds a PhD in Computer Science and Engineering from SRM IST and has extensive expertise in 5G technologies, Cognitive Radio, SDN, IoT, Wireless Computing, and Smart City solutions. Dr. Amutha has an exceptional research record, with over 200 Scopus-indexed publications, 875 citations, an h-index of 15, and numerous SCI articles and book chapters. She has also published ten patents, six of which have been granted. A dedicated educator, she has guided eight PhD scholars and continues to mentor eight more. Her teaching portfolio includes advanced courses such as Wireless Sensor Networks, Cooperative Communication Systems, and Network Protocols. Dr. Amutha has received several awards for research excellence, reflecting her commitment to innovation and impactful scholarly contributions.

Keynote Speaker

Assoc. Prof. Dr. Azurah A. Samah



Associate Professor
University of Technology Malaysia (UTM)
Malaysia



Biography:

Assoc. Prof. Dr. Azurah A. Samah is an academic and researcher at the Faculty of Computing, Universiti Teknologi Malaysia (UTM). She specializes in Artificial Intelligence, Machine Learning, and Deep Learning, with applications in medical and dental imaging. Her expertise areas, include Soft Computing, Computation Mathematics and Statistics, and advanced Deep Learning for Machine Learning. Dr. Azurah holds a PhD in Operational Research from the University of Salford, United Kingdom (2010), a Master's degree from the University of Southampton (1996), and a Bachelor's degree in Computer Science from Universiti Teknologi Malaysia (1993). Over the years, she has built a strong academic foundation that bridges quantitative modelling, optimization techniques, and modern AI-driven methods. Her current research focuses on developing deep learning frameworks for medical and dental image classification, particularly involving X-rays, CT scans, and other radiographic modalities. She actively collaborates with clinicians and dental specialists to design AI systems that enhance diagnostic accuracy, support early disease detection, and improve clinical workflow efficiency.

Keynote Speaker

Assoc. Prof. Dr. K. Anitha



Associate Professor
SRM Institute of Science and Technology
Chennai, India



Biography:

Dr. K. Anitha is an Associate Professor in the Department of Computing Technologies, School of Computing, at SRM Institute of Science and Technology, Kattankulathur. She holds an M.E. in Computer Science and Engineering from Anna University, Chennai (2007), and a Ph.D. in Information and Communication Engineering from the same institution (2017). With 20 years of teaching experience, Dr. Anitha has authored over 50 research papers in renowned journals and conferences. Her research interests include Machine.

Keynote Speaker

Prof. Dr. PL. Chithra



Professor & Head
Department of Computer Science
University of Madras, Chennai, India



Biography:

Dr. PL. Chithra is the Professor and Head in the Department of Computer Science at the University of Madras. She has more than 33 years of experience in teaching. She has been serving as Organizing Chair and Program Chair of several International conferences, and Program Committees of several International conferences. Ph.D. and M.Phil. Research supervisor for Guiding Image Processing Techniques, Big data analytics, Medical Image Processing, Deep learning models, and Network Security. She has published more than 135 papers in national and international journals with 245 citations, 10 h-index, and 11 i10 index.

Keynote Speaker

Prof. Dr. Ujwalla Gawande



Dean of R & D and Professor
Department of Information Technology
Yeshwantrao Chavan College of
Engineering, Nagpur, India



Biography:

Dr. Ujwalla Haridas Gawande is a Professor in the Department of Information Technology at Yeshwantrao Chavan College of Engineering, Nagpur, with over 21 years of teaching and research experience. She holds a B.E. in Computer Technology, an M.Tech. in Computer Science and Engineering, and a Ph.D. in Computer Engineering. Her areas of specialization include Digital Image Processing, Computer Vision, Artificial Intelligence, Soft Computing, and Pattern Recognition. Dr. Gawande has published extensively with over 48 international journal papers, 48 international conference papers, and 6 book chapters, and holds 6 granted patents. She has guided multiple Ph.D. and postgraduate research scholars and has received significant research funding from agencies such as CSIR and AICTE. She currently serves as Dean (R&D) and has held several key academic and administrative leadership roles. Dr. Gawande is a recipient of the Best Engineering Teacher Award and Women in Education Award, and is an active member of leading professional bodies including IEI, ISTE, and IAE.

Keynote Speaker

**Assoc. Prof. Dr. Nabeel Zahran
Hamoud Al-Rawahi**



Dean, College of Engineering
Sultan Qaboos University
Seeb, Oman



Biography:

Dr. Nabeel Al-Rawahi obtained a bachelor's degree in Mechanical Engineering from Sultan Qaboos University in 1994. He obtained his master's (1997) and doctorate (2022) degrees from the University of Michigan, Ann Arbor, USA. In 2022, he returned to the College of Engineering as an Assistant Professor. He was appointed head of the Department of Mechanical and Industrial Engineering from 2011 to 2017. He has been the Dean of the College of Engineering since 2020. Dr. Nabeel has research interests in renewable energy, fluid dynamics, and decarbonization. He has around 50 scientific papers published in peer-reviewed journals and international conferences.

Session Speaker

Prof. Dr. Yahia Kourd



Professor
University of Souk Ahras
Souk Ahras, Algeria



Biography:

Prof. Dr. Yahia Kourd received his Ph.D. degree in Automatic and Control Engineering from the University of Annaba, Algeria, in 2012. He is currently a Professor at the University of Souk Ahras and a member of the Laboratory of Electrical Engineering and Renewable Energy. He was a visiting researcher at GREAH, Le Havre, France, from 2009 to 2013, and has established numerous collaborative research projects with teams in France, Germany, Tunisia, and Italy. Prof. Kourd has published more than 140 papers in international journals and conferences, contributed several book chapters, co-edited a book, and successfully supervised 13 Ph.D. theses. His research interests include fault diagnosis, prognostics, signal and image processing, and robotics.

Session Speaker

Prof. Dr. Mohammed Belloufi



Professor
University of Souk Ahras
Souk Ahras, Algeria



Biography:

Prof. Mohammed Belloufi is a mathematician and university professor at Mohamed-Chérif Messaadia University, Souk Ahras, Algeria, where he serves as Head of the Laboratory of Computer Science and Mathematics (LIM) and leader of the research team “Evolution Equations and Stochastic Calculus.” He obtained his Ph.D. in Mathematics (2014) and his Habilitation à Diriger des Recherches (HDR) in 2016. His research focuses on numerical analysis, nonlinear optimization, unconstrained and constrained optimization methods, and conjugate gradient algorithms. Pr. Belloufi has published extensively in international journals such as RAIRO–Operations Research, Numerical Functional Analysis and Optimization, and the Asian-European Journal of Mathematics. He has supervised several Master’s and Ph.D. theses and actively collaborates with international researchers, notably at the University of Limoges (France).

Session Speaker

Dr. Nallammai Singaram



Taylor's University
Subang Jaya, Malaysia



Biography:

Dr. Nallammai Singaram is a senior lecturer and researcher specializing in plant tissue culture, biochemical profiling, molecular biology, and data analytics. With over 30 years of experience, she has extensive expertise in in vitro cultivation and micropropagation of ornamental, medicinal, and crop plants, as well as the extraction of secondary metabolites such as artemisinin. Her experience spans both commercial and academic laboratories, including consultancy on large-scale plant propagation projects. At Taylor's University, she teaches Crop Biotechnology, Introduction to Biotechnology, and Biostatistics, integrating research-driven learning to nurture future biotechnologists. Her current research explores molecular markers, green nanoparticles, and transcriptomic analysis of bioactive plant compounds. Dr. Nallammai has contributed to multiple projects and published in SCOPUS- and ISI-indexed journals. Her commitment to advancing sustainable biotechnology continues to drive her research in molecular and environmental applications of plant science.

Session Speaker

Assoc. Prof. Dr. Akilandeswari P



Associate Professor
SRM Institute of Science and Technology
Chennai, India



Biography:

Dr. Akilandeswari is an Associate Professor in the Department of Computing Technologies at SRM Institute of Science and Technology (SRMIST), Chennai, with over 19 years of dedicated experience in teaching and research. She is an enthusiastic Machine Learning developer with expertise in Neural Networks, Data Science, and Generative AI. She received her B.E. in Electronics and Communication Engineering, M.E. in Computer Science and Engineering, and Ph.D. in Computer Science and Engineering. Her research and industrial collaborations include projects with Samsung, Intel, and several multidisciplinary initiatives. Her achievements include receiving the Excellence Award in Samsung Prism Worklets, serving as an active Book Reviewer for Taylor & Francis and CRC Press, and publishing over 20 research papers in reputed international journals and conferences. With a strong academic foundation and deep engagement in industry collaborations, Dr. Akilandeswari is committed to advancing AI-driven technologies and bridging the gap between research and real-world applications.

Session Speaker

**Prof. Dr. Ir. Mohammed Alias
Yusof**



Professor
Universiti Pertahanan Nasional Malaysia
Malaysia



Biography:

Prof. Ir. Dr. Mohammed Alias Yusof is an Professor in the Department of Civil Engineering, Universiti Pertahanan Nasional, Malaysia. He graduated with B. Eng (Hons) degree in Civil Engineering from Universiti Teknologi Malaysia (UTM), MSc. degree in Integrated Construction Project Management from Universiti Teknologi Mara (UiTM) and PhD degree in Civil Engineering from Universiti Pertahanan Nasional Malaysia. He is a Professional Engineer registered with the Board of Engineer Malaysia. His main research interests are in the blast resistant materials such as concrete, glass, and also military and commercial explosives. He has developed a blast resistant concrete and had obtained the patent for the blast resistant concrete panel from Intellectual Properties Corporation of Malaysia (MyIPO) Dr Mohammed Alias Yusof is author of "Blast Resistant Materials : Concrete and Glass", book. Dr. Mohammed Alias has published extensively in the areas of blast resistant materials and technology, with a total publication count of more than 100, has served as reviewer for prestigious journals. In 2024, Dr Mohammed Alias Yusof has been awarded a Distinguish Scientist by Venus International Foundation, Chennai, India for his valuable contribution in the field of blast resistant materials and civil Engineering.

Session Speaker

Prof. Dr. Sashikala Mishra



Professor
Symbiosis Institute of Technology (SIT)
Pune, India



Biography:

Dr. Sashikala Mishra is a Professor, Head of the Department of Computer Science and Engineering, and a senior researcher at Symbiosis Institute of Technology, Pune, Symbiosis International (Deemed University). She holds a Ph.D. in Computer Science and Engineering and has completed a Post-Doctoral Fellowship at National Taipei University, Taiwan. She has also served as a Visiting Professor at Sunway University. Dr. Mishra has over a decade of academic and research experience, with expertise in Agentive AI, Artificial Intelligence & Machine Learning, Knowledge Graphs, Data Science, and Intelligent Systems. She has published extensively in reputed journals and conferences, with 70+ Scopus-indexed publications, and serves as a reviewer for several Q1-Q4 journals and IEEE/Springer conferences. She is the recipient of multiple national and international awards, including the Prof. Indira Parikh 50 Women in Education Leaders Award, Dewang Mehta Best Professor Award, and Distinguished Researcher Award. An active member of ACM, IEEE, ISTE, and other professional bodies, she has also played a key role in mentoring Ph.D. scholars and leading impactful student initiatives through the SIT ACM Student Chapter.

Session Speaker

**Assoc. Prof. Ts. Dr. Nor Erne
Nazira Bazin**



Associate Professor
Faculty of Computing, Universiti
Teknologi Malaysia (UTM), Malaysia



Biography:

Ts. Dr. Nor Erne Nazira Bazin is an Associate Professor at the School of Computing, Universiti Teknologi Malaysia (UTM), specialising in Data Science, Machine Learning, Business Intelligence, and System Dynamics. She holds a PhD in System Dynamics Simulation and Modelling from the University of Salford, UK, and her research focuses on applying analytical and computational methods to real-world decision-making in public policy, environmental systems, and industrial operations. Her work includes predictive modelling, data analytics, simulation-based decision support, topic modelling, and the integration of system dynamics with data-driven approaches. She has led and contributed to research projects involving big data for policy modelling, hazardous chemical risk assessment, AI-assisted topic modelling, and analytics for supply chain and environmental applications. Dr. Erne has served in academic leadership roles such as Programme Coordinator for Micro-Credentials and Deputy Leader of the Applied Industrial Analytics (ALIAS) Research Group. She actively supports community and industry capacity-building through AI outreach programmes, analytics workshops, and STEM initiatives. A certified Professional Technologist (Ts.) with publications in indexed journals and conferences, she continues to advance practical, applied AI and data analytics solutions.

Session Speaker

Dr. Kelvin Lee Yong Ming



Senior Lecturer & Programme Director
Taylor's University
Malaysia



Biography:

Dr. Kelvin Lee Yong Ming is a Senior Lecturer and Programme Director at the School of Accounting and Finance, Taylor's University, Malaysia. He oversees the Bachelor of Banking and Finance (Hons) and Bachelor of Finance and Economics (Hons) programmes. Dr Kelvin actively contributes to teaching, research, and industry engagement in the areas of finance, sustainability, and financial literacy. His research interests include sustainable finance, ESG, climate finance, financial inclusion, and digital finance. Dr. Kelvin has published several research articles in reputable Scopus and Web of Science indexed journals and has secured competitive research funding for projects related to climate finance and sustainable development. His work focuses on addressing contemporary issues at the intersection of finance, sustainability, and economic development, particularly in emerging markets. Beyond academia, Dr. Kelvin is actively involved in industry collaboration and community engagement. He frequently conducts financial literacy workshops and webinars for students, SMEs, and the wider community. Through these initiatives, he aims to enhance financial awareness and promote responsible financial decision-making. Dr Kelvin also contributes to academic and professional communities by serving as a reviewer, session chair, and editorial board member for several international journals and conferences.

Session Speaker

Dr. Santosh Kumar Rai



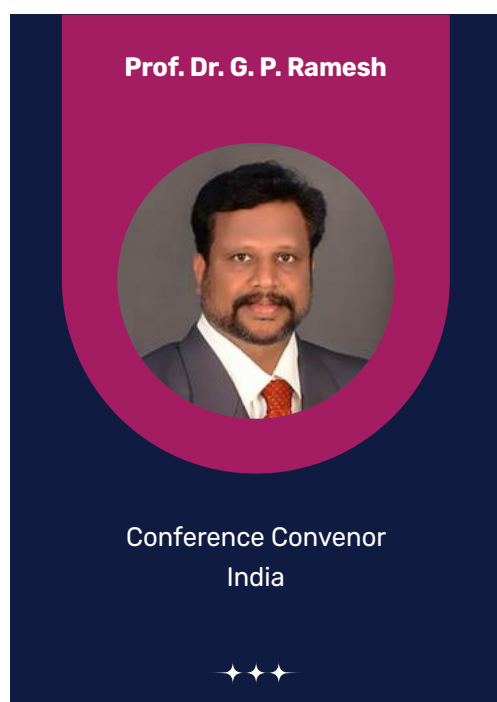
Assistant Professor
Sri Satya Sai University of Technology &
Medical Science, India



Biography:

Dr. Santosh Kumar Rai is the Assistant professor at SRM institute of science and Technology, Delhi-NCR camp, India, and a distinguished academic in the field of mechanical engineering. He completed his postgraduate studies at IIITDM Jabalpur and has published over 40 research papers in reputed national and international journals, including the Journal of Energy Storage and Nuclear Engineering and Design. His research interests span energy systems, thermal engineering, and advanced materials. In addition to his scholarly contributions, Dr. Rai serves as a reviewer for various renowned journals, actively contributing to the advancement of engineering research and innovation in India.

Convenor



Biography:

Prof.Dr.G.P.Ramesh is a distinguished academician, visionary technologist and ambitious researcher with over 26 years of multifaceted experience spanning higher education, advanced research and industry leadership. His career reflects a seamless integration of academic excellence and technological innovation, positioning him as a transformative force in engineering education and applied research. A dynamic leader and passionate educator, Dr.G.P.Ramesh has served as Professor and Head of Electronics and Communication Engineering at prestigious institutions across India and abroad. He has mentored undergraduate, postgraduate and doctoral scholars, successfully guiding Twenty-Two Ph.D. candidates and nurturing a culture of inquiry and excellence. His academic expertise encompasses artificial intelligence, machine learning, embedded systems, VLSI design and antenna technologies. With more than 125 publications in Scopus-indexed journals, his scholarly influence is evidenced by an H-index of 32 and an i10-index of 70, marking him as a prominent contributor to global research discourse. He has also organized Twelve International and Six National conferences, publishing proceedings with Springer and ensuring global visibility through Scopus and Web of Science. A pioneer in Outcome-Based Education and a strategic advisor for NAAC, NBA and Autonomous frameworks, Dr.G.P.Ramesh continues to shape future-ready engineers and scalable, tech-driven solutions for India and beyond.

Committee Members

Organizing Committee Members

Conference Chair

Dr. Shilpa Bade-Gite

Director

Dr. D.Y. Patil School of Science & Technology
Pune, India

Conference Co-Chair

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Professor & Head

Department of Electronics and Communication Engineering
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Blast-Induced Damage Zone Prediction in Hard Rock Using Vibration Thresholds

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Abstract

Drilling and blasting are widely used for hard rock excavation, despite associated with blast-induced damages. This study investigates the extent of damage zones caused by production blasting and examines their impact on the design of support systems. The critical peak particle velocity (PPV) and the maximum PPV were estimated using the vibration-based damage criterion. The estimation of the damage zone was carried out by using McKenzie approach where rock tensile strength, P-wave velocity, and density parameters of the rock were used. These models were used to establish the link between vibration intensity and the extent of blast-induced damage to the rock mass. Ground vibration data and blast design parameters were utilized to measure the thickness of the damage zone as a function of the maximum explosive charge per delay. The analysis showed a strong relationship between the thickness of the damage zone (D) and the maximum charge per delay (Q), expressed as $D = 0.1106 Q^{0.5}$. The estimated thickness of the damage zone varied from 0.31 m to 0.82 m, with an average of 0.57 m. The results indicate that vibration-based damage assessment is a reliable method for evaluating blast-induced rock mass degradation and optimizing blast design to ensure the stability of permanently exposed excavated surfaces.

Keywords

Blast-induced damage, Peak particle velocity, Damage zone, Maximum Charge per delay.

Development and Evaluation of Machine Learning-Based Techniques for Detecting Reverse Engineering and Tampering in Executable Applications

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Abstract

The increasing economic and strategic worth of software systems in financial, medically and industrial sectors has led to greater need of resistance against unauthorized reverse engineering as well as binary distortion. The classic security systems, including checksums and static obfuscation, are becoming less effective against contemporary and automated attack methods. The paper presents a machine learning-based detection model which is adaptive and uses structural, statistical, and semantic features to make a distinction between an original and a modified executable. To train and test four binomial classification models, we created a rich set of binaries that were original and tampered to create: Random Forest, Support Vector Machine, XGBoost, and Feedforward Neural Networks. The experimental evidence shows experimental tampering as causing measurable changes to executable code that can be accurately identified. XGBoost model was the best performing and had a total accuracy of 96.3, precision of 96.5 and F1-score of 96.2. As it was found, SHAP value analysis indicated that structural metrics, and especially Control Flow Graph (CFG) node counts and function counts are the most important indicators of unauthorized modification. This study validates that AI-based models can be used to offer a scalable and automated protection mechanism to current software programs.

Keywords

Software security, executable code tampering, reverse engineering detection, machine learning, binary analysis, control flow graph (CFG), structural features, XGBoost, binary classification, malware integrity.

Top-Load Washing Machine Microplastic Control Mechanism

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Abstract

It turns out that the No. 1 source of micro plastics in the world's oceans isn't plastic bags, drinking straws or discarded fishing gear, but rather fiber from synthetic clothing and textiles. Now let us see other examples using washing synthetic clothing household. Top-loading washing machines, the washer of choice for most people in India have more front-loaders than top-loaders release staggering amounts of little plastic fibers [1] from clothes into wastewater every time you do a load of laundry. This paper presents the design, development and testing of a prototype practical external two-stage filtration system for retrofitting is described in this research designed specifically to accommodate existing top-load washing machines. The system uses an easily portable coarse lint pre-filter to trap large fibers, and a finer mesh filter for small micro plastics, in a compact external housing with minimal flow resistance.

CFD modelling, with the aid of hands-on experimental measurements, was employed to optimize the tapered manifold such that water flow was distributed uniformly across filter faces. Testing with various fabrics and washing protocols showed that the system effectively captured about 85% of free FP fibers and kept pressure drop significantly lower than any limit existing for operation. The low-cost and ease to maintain design are ideal for wide acceptance, especially in developing countries. In general, the outcome of this study indicates that on-site treatment of micro plastics at washing machine (Top Load) outlets is a feasible approach in inhibiting household micro plastic pollution at the source.

Keywords

Micro plastics, top-load washing machine, filtration system, textile fibers, wastewater.

Design and Implementation of Dual Input Bridge Type DC-DC Converter

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Abstract

Hybrid energy sources combine multiple power sources to utilize their individual strengths. Instead of using multiple traditional single-input DC-DC converters which increase design complexity, cost and reduced efficiency, a dual input bridge type DC-DC converter is designed, simulated and a hardware model is developed for hybrid power management systems. The designed system utilizes a SMPS and a supercapacitor as dual-input energy sources, thereby combining the high energy density of batteries and high-power density of supercapacitors for efficient power management and reduced battery stress. The DC-DC converter topology is designed to operate in buck, boost, and buck-boost modes, utilizing proper switching control techniques. Initially, open-loop simulations are performed to verify the converter's functionality under different mode of operations. A scaled down hardware setup is designed in open loop using an Arduino microcontroller, MOSFETs, voltage sensing circuits, and a lamp load to check the workability of the converter in all three modes. Thus, the designed converter system confirms the stable operation, voltage regulation, and smooth mode transitions and offers a viable cost-effective solution for hybrid energy storage and also for DC power applications.

Keywords

Dual-input DC-DC converter, Hybrid energy sources, Buck, Boost & Buck-Boost mode, Open loop, Scaled down prototype.

A Proofreader for Kazakh Texts Based on Morphological and Syntactic Analysis

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Abstract

The Kazakh language, as an agglutinative Turkic language with SOV word order, presents unique challenges for automated text processing due to its rich morphological structure and complex syntactic patterns. This paper presents the design and implementation of a proofreader for Kazakh texts that integrates morphological and syntactic analysis to detect and correct grammatical errors. The proposed system employs a finite-state transducer for morphological parsing and a constraint grammar formalism for syntactic validation. We evaluate the system on a manually annotated corpus of 500 sentences drawn from news articles, student essays, and administrative documents. The combined system achieves an F1 score of 86.8% for error detection, substantially outperforming morphology-only (F1 = 74.3%) and n-gram language model baselines (F1 = 68.9%). The proofreader addresses a critical gap in Kazakh NLP resources and provides a practical tool for writers, educators, and automated document processing pipelines.

Keywords

Kazakh language, morphological analysis, syntactic analysis, proofreader, agglutinative language, grammar checking, finite-state transducer, constraint grammar, NLP, low-resource language.

GNN-MedSub: Graph Neural Network based Medication Substitution Engine

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Abstract

A major part of any healthcare is having effective and proper medicines available for the proper treatment. It is very common for the doctors to not find the prescribed medicines for that treatment in hospitals. Sometimes the drug is too expensive or not suitable for the patient. Finding the correct substitute isn't easy. Most of the systems still rely on drug similarity and ignore local availability or safety. In other words, most alternatives turn out to be unsafe or unavailable in the patient's area.

We developed a new framework, GNN-MedSub, to address these issues. It combines graph neural networks, safety filters, and regional availability checks in a single framework. GNN-MedSub builds a large heterogeneous graph that links drugs, proteins, and side effects using data from DrugBank, SIDER, BioSNAP, FAERS, MedDRA, and PubChem. First, we use Node2Vec and a GNN model to identify structurally and functionally similar drugs. Next, a clinical safety layer checks each drug's safety and possible contraindications. Finally, the system filters results by local availability so that the recommendations are both safe and practical.

The system outputs a set of substitute drugs with reasoning paths showing how they're connected in the graph (Drug → Protein → Effect). It also runs in real time (<100 ms) and achieves 78.4% similarity accuracy, 61.4% safety coverage, and complete regional mapping. Overall, the project uses a three-phase architecture that merges similarity learning, safety, and accessibility. It serves as a practical example of a real-world, interpretable, and scalable drug recommendation system.

Keywords

Graph Neural Networks, Drug Substitution, Contraindications, Regional Availability, Node2Vec, Biomedical Graph, Drug Recommendation, Explainable AI.

Quantification of Indirect Embodied Energy and Cost Optimization in Sustainable Concrete using Industrial By-Products GGBS and Silica Fume

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Abstract

This research evaluates the indirect embodied energy, fossil fuel consumption, compressive strength, and material cost of high-performance concrete incorporating Ground Granulated Blast Furnace Slag (GGBS) and Silica Fume as supplementary cementitious materials. M60 grade concrete mixes were designed in accordance with IS 10262:2019 and experimentally tested as per IS 516:2021. Cement replacement levels of 25–40% GGBS combined with silica fume contents up to 11% were investigated to determine their influence on mechanical performance and sustainability indicators. Indirect embodied energy was quantified using a cradle-to-gate system boundary based on standardized coefficients from the Inventory of Carbon and Energy (ICE v3.0) and BIS Life Cycle Assessment guidelines. The embodied energy values considered were approximately 4.6 MJ/kg for Ordinary Portland Cement, 1.2 MJ/kg for GGBS, and 0.8 MJ/kg for silica fume. Experimental results showed that compressive strength increased with GGBS content up to 35% due to enhanced pozzolanic and latent hydraulic reactions, leading to denser microstructure and improved C–S–H gel formation. Beyond this level, a slight reduction in strength was observed due to reduced clinker content. The optimum mix containing 35% GGBS and 9% silica fume achieved compressive strength comparable to or exceeding the control mix at 28 days. This optimized blend resulted in approximately 22% reduction in total embodied energy and nearly 40% reduction in fossil fuel demand compared to conventional concrete. A detailed cost analysis based on local material rates indicated an overall reduction of 9.9% in material cost per cubic meter. The study demonstrates that partial substitution of cement with GGBS and silica fume significantly improves energy efficiency and economic performance without compromising structural requirements, confirming the suitability of blended cement systems for sustainable high-performance concrete.

Keywords

Embodied Energy, GGBS, Silica Fume, High-Performance Concrete, Fossil Fuel Reduction, Sustainable Construction, Cost Optimization.

Comparative Life Cycle Environmental and Energy Performance Analysis of Grid-Powered versus Solar-Powered Stone Crushing Systems in Construction Operations

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Abstract

Crushing of stones is an energy consuming activity that makes significant contributions to greenhouse gas emission in the construction industry. The relevance of renewable energy has increased its importance for aggregate production systems as the importance of industrial decarbonization and sustainable building continues to rise. The life cycle assessment of the performance of solar-powered and grid-powered stone crushing machines for the building sector is given in the paper presented below. The life cycle assessment (LCA) is conducted, as per the ISO 14040 and 14044 standards, considering a functional unit of a ton of crushed aggregate material, considering the energy and environmental impacts at various stages: the manufacturing stage, the operational stage, and the end-of-life stage. A medium-sized stone crushing plant's operational data is used to make sure the two systems are comparable. According to the findings, the grid-based system's use of carbon-intensive grid electricity results in noticeably greater operational and life-cycle carbon emissions. The solar-powered system achieves much reduced total life-cycle emissions and cumulative energy demand over its operating life, while having higher embodied emissions related to photovoltaic modules and battery storage.

Altogether, the research proves that solar-powered stone crushing systems are a promising way of minimizing energy usage and environmental impacts in construction aggregate production. The findings are decision-relevant to policymakers, construction companies, and developers of infrastructures that are interested in switching to low-carbon and energy-efficient construction methods.

Investigation of Concrete Block Using Crumb Rubber Properties with Partial Replacement of Fine Aggregate

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Abstract

Society needed to find places where tire rubber could be employed on a large scale and with little financial outlay. It has been suggested that using leftover tire rubber to make concrete is an environmentally friendly way to get rid of such garbage. In this study, crumb tire rubber has been used in place of aggregates in an effort to determine the different characteristics required for the construction of concrete mix. The reference concrete specimen is M25 grade concrete. Conventional fine aggregate has been replaced with scrap tire rubber powder. In addition to enabling the sustainable use of the aggregates at our disposal, this will enable efficient mass management of rubber tire waste. rubber crumbs typically consist of particles that range in size from 4.75 mm to smaller than 0.075 mm. Tire recycling is a creative solution to stop the environmental issue. After the rubber tire waste is ground into a fine crumb, 5%, 10%, and 15% of the crumb tire aggregate is added to replace the fine aggregate. In order to determine the best way to employ crumb rubber as fine aggregate in concrete, this study assesses the workability, compressive strength of rubberized concrete.

Keywords

Concrete, Compressive Strength, Crumb rubber, Toughness, Properties.

Deep Multimodal Framework for Detecting External AI Usage in Candidate Interviews through Speech and Facial Behavior

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Abstract

Remote interviews make hiring simpler, but present the downside of authenticity, since with live AI support being used what is human responses versus AI-created action is difficult to discern. A multimodal deep framework which the researchers developed detects remote interviews with external AI support through its analysis of two domains (speech and facial expressions) and an AI-like linguistic pattern which it extracts from speech-to-text output and NLP methods. The input from facial cues & attentives is analyzed with speech features using multimodal deep learning to derive an AI-reliance confidence score. The system functions as a Chrome extension which developers built using JavaScript and TypeScript and React.

Keywords

Multimodal Deep Learning, AI-Assisted Interview Detection, Speech and Facial Behaviour Analysis, Remote Interview Integrity.

Hybrid Autoencoder and Deep Learning Approach for MRI Based ASD Detection

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Abstract

The early and accurate diagnosis of autism spectrum disorder (ASD) remains a critical challenge in neurodevelopmental healthcare. ASD is characterized by impairments in social interaction, communication, and repetitive behaviour patterns, with detection further complicated by age and gender-specific variations. Magnetic Resonance Imaging (MRI), including structural (sMRI) and functional (fMRI) modalities, offers valuable insights into neurobiological abnormalities. However, the interpretation of brain images is hindered by high-dimensional data complexity and the lack of integrated automated solutions. This study proposes a deep learning-based hybrid framework to enhance ASD classification performance across age groups.

The methodology involves preprocessing axial T1 weighted sMRI and fMRI images obtained from the Autism Brain Imaging Data Exchange (ABIDE), followed by classification using both deep learning architectures and hybrid models incorporating autoencoders with traditional classifiers. The study categorizes subjects into three age groups: children (2–10 years), adolescents (11–16 years), and adults (>16 years). Deep learning models such as CNN, LeNet 5, VGG16, Inception V3, and EfficientNet were evaluated. VGG16 achieved the highest validation accuracy, with 73.82% for children and 72.82% for adolescents using sMRI, and 69.82% and 70.82% respectively using fMRI. For adults, Inception V3 yielded the best performance, achieving 63.69% (sMRI) and 55.36% (fMRI).

In parallel, hybrid autoencoder-based demonstrated lower accuracy but significantly reduced training and inference times. The autoencoder + KNN model achieved a maximum of 55.63% accuracy for child sMRI, while autoencoder + SVM attained 55.11% for adolescent fMRI. Results indicate that while deep learning models offer superior classification accuracy, hybrid techniques may be beneficial in resource-constrained scenarios. The proposed approach contributes to enhancing diagnostic precision and paves the way for real-time ASD classification systems.

Keywords

Autism Spectrum Disorder Diagnosis, Hybrid Machine Learning, Brain Imaging Analysis, Autoencoder, Machine Learning, Deep Learning.

Decentralizing the EVM: Integrating Blockchain Voting Technologies and Hardware-Level Security for Next-Generation Elections

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Abstract

As democratic processes continue to evolve in the digital era, the need for secure, transparent, and tamper-proof voting systems becomes increasingly critical. In this context, India— the world’s largest democracy— faces significant challenges in ensuring the integrity of its elections. The country currently relies on Electronic Voting Machines (EVMs) paired with Voter Verified Paper Audit Trails (VVPATs) to facilitate the voting process. While these systems have significantly improved the efficiency and accessibility of elections, concerns over transparency, potential vulnerabilities, and security have remained points of contention. Focusing specifically on India’s electoral challenges, this paper assesses the feasibility of integrating blockchain with existing voting infrastructure. It evaluates how such a framework, could offer a scalable, secure, and inclusive voting system. The proposed system aims to address the limitations of current methods by reducing the possibility of tampering, improving voter accessibility, and ensuring full transparency of the voting process. In addition, the paper outlines a roadmap for implementing secure digital voting, taking into account India’s unique demographic, geographic, and technological landscape. This roadmap proposes solutions for overcoming potential barriers such as internet access, digital literacy, and the integration of decentralized technologies with existing electoral laws and institutions. Ultimately, this paper argues that a blockchain-based hybrid system, integrated with PUFs, for security at the hardware level, and biometric authentication, could significantly enhance the security, transparency, and inclusivity of India’s electoral processes— paving the way for a future-proof, reliable, and trustworthy digital voting system.

Keywords

Electronic Voting System, Blockchain, Biometric, PUF, Cryptography, Security.

Energy Performance Assessment of Residential Building Using Different Materials Using BIM

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Abstract

Residential buildings in India demonstrate diverse energy consumption patterns, influenced by the nation's varied climatic zones, including the hot-dry climate of Beed, warm-humid conditions in Panaji, composite climate in Pune, and cold climate in Manali. These regional differences impose distinct thermal performance requirements on building envelopes, particularly walls and roofs. However, design professionals often lack a climate-specific framework for selecting optimal materials during initial stages, avoiding the need for expensive prototypes or retrofits. This study addresses this challenge through an integrated Building Information Modelling (BIM) and building energy modelling methodology. A standardized residential building model was developed in AutoCAD and Revit, with energy performance simulated across the identified climates using Autodesk Insight 360. The analysis followed a two-stage process: Stage 1 evaluated wall systems, including fly ash brick, autoclaved aerated concrete (AAC) blocks, and red clay brick; Stage 2 independently assessed roof systems, such as reinforced cement concrete (RCC) slabs, aerogel insulation, geomembranes, vermiculite screed, and cool roof tiles. The research's novelty stems from this isolated, parametric comparison of envelope materials in a controlled digital environment, eliminating confounding variables. The results provide architects and builders with evidence-based recommendations for climate-responsive, sustainable material selection, supporting India's goals for energy-efficient residential construction.

Impact of Geopathic Stress Zones on Geotechnical Soil Parameters: A Comprehensive Review

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Abstract

Geopathic stress, generated due to subsurface geological hazards such as fault lines, underground water flow, and mineral veins. It has recently attracted attention for its potential influence on geotechnical soil properties. Differences in soil properties often lead to poor performance issues in foundations and pavement construction, which normal site exploration may not fully illustrate. This review paper investigates existing literature to measure the effect of geopathic stress zones on key engineering properties of soil. A comprehensive review of published experimental and on-field-based studies was conducted, considering parameters such as moisture content, specific gravity, liquid limit, plastic limit, shrinkage limit, and California Bearing Ratio (CBR). The reviewed studies consistently demonstrate higher moisture retention, increased plasticity characteristics, and a reduction in strength-related parameters, especially CBR, in soils located within geopathic stress zones when compared to non-stress zones. These changes have direct effects on bearing capacity, settlement behavior, and pavement performance. The review also discloses the lack of standardized testing methods and not much of geopathic stress considerations in the geotechnical design process. Based on the findings, this paper focuses attention on the need for further long-term field investigations, advanced geophysical correlation studies, and the involvement of geopathic stress analysis in regular geotechnical site investigations to increase infrastructure safety and performance.

Keywords

Geopathic Stress, Soil Properties, Atterberg Limits, CBR, Geotechnical Engineering, Review.

CareerLaunchPad: Integrated Platform for Student Freelancing, Intelligent Job Aggregation and Peer Interview Insights

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Abstract

Students often face difficulties in accessing real-world opportunities due to limited verified experience and the fragmented nature of existing career platforms. Most professional networking and freelancing systems are optimized for experienced users, which restricts visibility and growth opportunities for students and fresh graduates. This paper presents CareerLaunchPad, a MERN-based, student-centric career development platform that integrates a freelancing marketplace, an intelligent job aggregation module, and a peer-driven Interview Vault. The system implements a skill-based recommendation mechanism to analyze student profiles and provide ranked job opportunities based on relevance, while final hiring decisions remain manual to maintain transparency. The platform emphasizes real-time synchronization, scalability, and community-driven learning, demonstrating improved opportunity discovery and structured interview preparation under controlled evaluation scenarios.

Keywords

Student Freelancing, Skill-Based Job Recommendation, Intelligent Job Aggregation, Peer Interview Insights, Web-Based Career Systems.

AI-Based Number Plate Detection System

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Abstract

The work proposes an AI-driven system to recognize and read a car number plate with the help of advanced computer vision approaches. With the provision of quick detection by YOLOv5 transformer-based character detection, the system provides class-leading performance. Appropriate experiments with real-world data sets confirm high accuracy and efficacy. The paper illustrates implementation phases, training strategies, and utilization of the proposed model in a variety of traffic control applications. A next generation AI-powered number plate recognizer and detector has been proposed in the present paper to address some of the traffic management problems faced by automated methods. YOLOv5 is employed by the system as its fast plate detector, while a Transformer architecture is used as its character recognizer. The proposed system is augmented with state-of-the-art 99.4% recognition capability after employing higher-level image processing techniques and augmentation. Field testing demonstrates it to be durable enough to withstand fluctuating environmental conditions, including low-light and high-speed vehicle travel. The solution is scalable, efficient, and perfectly adaptable for installation in smart cities, law enforcement, and autonomous tolling. License Plate Recognition (LPR) technologies form a critical component of modern intelligent transportation systems. The current study introduces a strong AI powered LPR system with YOLOv5 as the plate detection module and a Transformer-based optical character recognition (OCR) module. The developed system possesses extremely high accuracy and performance under real-time conditions and is ideal for use in urban traffic management-related applications, parking, and border control.

Keywords

License plate recognition, Artificial Intelligence, YOLOv5, Transformer, Traffic management, Computer vision.

Predictive Analytics for Kidney Stone Recurrence Using Machine Learning Techniques

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Abstract

Kidney stone recurrence remains a significant clinical challenge, with nearly half of patients experiencing a second episode within five years of their initial stone event. Traditional risk stratification tools, like the ROKS nomogram, rely heavily on demographic and clinical factors but overlook critical data from 24-hour urine profiles and electronic health records (EHR), leading to suboptimal prediction accuracy. This research explores a machine learning-driven approach to more accurately forecast recurrence risk using an integrated dataset that includes urine chemistry, clinical history, and perioperative details. We used a publicly available dataset of kidney stone formers who underwent comprehensive metabolic evaluations. Multiple machine learning models—including Random Forest, XGBoost, and TabNet—were developed and compared using cross-validation. Our best-performing model, TabNet, achieved an AUC close to 0.89 for 2-year recurrence prediction, significantly outperforming traditional logistic regression baselines. SHAP analysis was applied for post-hoc interpretability, revealing urinary oxalate, urine volume, and hemoglobin change as key contributors to recurrence risk. These findings underscore the value of incorporating metabolic and clinical data into predictive modeling and point toward a more personalized approach to stone prevention. Beyond predictive performance, this study contributes new insights into early biochemical markers of recurrence and highlights the potential for data-driven tools to inform real-time clinical decision-making. This work lays a foundation for future deployment of AI-powered risk calculators in urological care settings.

Keywords

Kidney stone recurrence, machine learning, predictive analytics, 24-hour urine analysis, clinical decision support, TabNet model.

A Survey of Critical Success Factors For Enterprise Resource Planning Implementation in the Maritime Industry Using Analytic Hierarchy Process (AHP)

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Abstract

Enterprise Resource Planning (ERP) systems represent a significant paradigm shift in information and communication technology (ICT), enabling organizations to integrate and manage all aspects of their operations, including decision-making, procurement, finance, sales, and human resources within a centralized platform. Despite their potential, ERP systems also present risks, as system failures can disrupt critical business operations. This study highlights the need to identify the Critical Success Factors (CSFs) that influence the success of ERP implementation in the Nigerian maritime industry. A quantitative research approach was employed, involving a survey of 150 ERP system users within the Nigerian Maritime Administration and Safety Agency (NIMASA). Preliminary CSFs were identified from the literature, and the survey results were further analyzed using the Analytic Hierarchy Process (AHP), developed by Saaty, to determine the relative criticality and prioritization of the identified factors. The use of AHP was deemed appropriate, as human judgment, even from experienced ERP users, may not always be entirely consistent. The findings identified 18 critical success factors that significantly influence the successful implementation of ERP systems in the Nigerian maritime industry, providing both theoretical insights and practical guidance for policymakers, practitioners, and ERP project managers.

Keywords

Analytical Process, Critical Success Factors, Enterprise Resource Planning, Maritime Industry.

Artificial Intelligence and Machine Learning Integration in Mechatronic Control Systems: A Comprehensive Review

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Abstract

The integration of artificial intelligence (AI) and machine learning (ML) in mechatronic control systems is a paradigm shift, as against the traditional model-based approaches for the adaptive and data-driven intelligent models. The review assesses the application of AI and ML in the manufacturing, robotics, automotive, aerospace, and biomedical industries. Analysis includes neural networks, reinforcement learning, and deep learning architectures as well as hybrid approaches, and are focused on the reporting of performance results. The main contributions of the work include: (1) a taxonomic framework of the methods of AI-ML integration in detail; (2) a cross-domain comparative analysis that has determined transferable techniques; (3) systematic evaluation of the implementation constraints, including real-time constraints, computational constraints, and safety requirements; (4) delineating the gaps of certification and the requirements of standardization. Research opportunities include explainable AI architectures in safety-critical systems, sample-efficient learning models, and verification of neural network controllers in the future. Taken together, this research provides an evidence-based basis of the implementation of AI-ML in intelligent automation systems in the framework of Industry 4.0/5.0 paradigms.

Keywords

Artificial Intelligence, Deep Learning, Intelligent Control, Industry 4.0, Machine Learning, Mechatronic Systems, Predictive Maintenance, Reinforcement Learning.

Role Based Intelligent Content Management System using Spring Boot with Integrated Chatbot

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Abstract

The proposed project is a Role-Based Intelligent Content Management System designed to manage and publish blog content securely while ensuring streamlined access control. The system is developed using Spring Boot for backend services, offering a modular, scalable, and high-performance architecture. The frontend is implemented in React.js to deliver an interactive, responsive, and user-friendly interface. A robust Role-Based Access Control (RBAC) mechanism governs user privileges, ensuring that only authorized roles can perform specific operations. The application defines three primary user roles—Admin, Author, and Reader—each assigned with distinct capabilities. Admins are responsible for user management, role assignment, and monitoring platform activity. Authors are empowered to create, edit, and publish blog content, while Readers are allowed to view and interact with published posts.

To enhance usability, the system integrates an AI-powered chatbot using the Gemini API, enabling real-time assistance, navigation guidance, and context-aware content recommendations. The chatbot uses natural language understanding to interpret user queries and provide accurate responses. A secure authentication system based on JWT (JSON Web Tokens) ensures data confidentiality and integrity during user interactions. MySQL is employed as the database to store user profiles, content data, and access logs in a structured manner for quick retrieval. The architecture emphasizes security, performance, and adaptability to future requirements such as multimedia integration or multilingual support.

By combining RBAC principles with AI-driven conversational assistance, this system addresses critical challenges in content security, user engagement, and administrative efficiency. The solution not only improves the management and delivery of digital content but also introduces intelligent, user-centric features to elevate the overall experience for all stakeholders. This project serves as a practical demonstration of how modern web technologies and AI can be integrated to create a secure, scalable, and intelligent blog application.

Character-Level Language Modeling on enwik8 with Token-Adaptive Mixture of Depths Transformer

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Abstract

Even while recent transformer models do a great job at language modeling tasks, they give each token the same amount of work to do, no matter how hard it is. In character-level modeling, uniform handling appears unnecessary, as certain bytes, such as spaces, common letters, or repeated markup, are rather predictable, whereas others, such as the commencement of XML tags, rare symbols, or numerals, are significantly context-dependent. We developed and assessed a simplified version of the Mixture of Depths (MoD) model specifically designed for character-level prediction on the enwik8 dataset. A lightweight per-token router that learns to bypass the computationally expensive MLP block while maintaining full causal self-attention is part of the core methodology. The adaptive model cut the validation bit-per-character (BPC) from 2.97 to 2.65 after a lot of work on routing collapse debugging, careful balancing of auxiliary objectives, and tuning the temperature annealing schedule. This was a relative improvement of about 10.6%. Both models were trained with only 1000 iterations of a simple 13M parameter architecture. The persistent gap unequivocally demonstrates that adaptive per-token depth allocation is a viable strategy for enhancing efficiency in highly repetitive, granular domains such as raw byte/character-level modeling, despite the absolute statistics on enwik8 being far from state-of-the-art.

Keywords

Character-Level Language Modeling, enwik8, Transformer Modifications, Attention Mechanisms, Adaptive Computation, Mixture of Depths.

Various Types of Image Features in Object Detection: A Comprehensive Review

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Abstract

Object recognition has seen significant advancements across the last twenty years, shifting from manually crafted feature-based techniques to full deep learning frameworks able to learn layered representations traditional from input. Visual characteristics function as the essential components that permit machines to sense, precisely locate, and categorize objects inside visual settings. This paper offers a thorough survey of the diverse categories of visual characteristics utilized in object detection, sorting them into basic, intermediate, and advanced features. The survey commences with classic manually engineered features like outlines, points of interest, surface qualities, and forms, preceding sophisticated descriptors such as SIFT, SURF, and HOG. Following this, deep learning-derived feature extraction avenues, encompassing convolutional attributes, feature pyramids, and transformer-based attention depictions, are examined closely. The paper further emphasizes combined feature merging strategies and contextual attribute modelling in contemporary detectors. Conclusively, a comparative assessment of differing characteristic types is provided, charting their merits, drawbacks, and appropriateness for diverse recognition assignments.

Keywords

Object Detection, Image Features, Feature Extraction, CNN, Transformer, HOG, Deep Learning, Feature Pyramid Network (FPN).

Sustainable Intelligent Rehabilitation and Health Monitoring Framework for Next-Generation Digital Healthcare using Explainable AI with Reinforcement Learning

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Abstract

The rapid evolution of digital healthcare demands intelligent, personalized, and sustainable solutions for rehabilitation and continuous health monitoring. This study proposes a sustainable intelligent rehabilitation and health monitoring framework that integrates Explainable AI (XAI) with Reinforcement Learning (RL) to deliver adaptive, data-driven interventions. Multi-modal patient data including wearable sensors, biometric signals, and activity logs are processed to provide real-time monitoring and predictive analytics, enabling early detection of anomalies and dynamic adjustment of rehabilitation protocols. The reinforcement learning module optimizes therapy strategies by learning from individual patient responses, while the XAI component ensures transparency and interpretability, fostering trust among clinicians and patients. The framework emphasizes sustainability through efficient resource utilization and scalable deployment in next-generation digital healthcare ecosystems. Experimental results demonstrate that the proposed approach enhances personalized rehabilitation, improves health outcomes, and supports informed clinical decision-making, offering a robust, explainable, and intelligent solution for future healthcare applications.

Keywords

Sustainable Healthcare, Intelligent Rehabilitation, Health Monitoring, Explainable AI, Reinforcement Learning, Digital Healthcare, Personalized Therapy, Predictive Analytics, Wearable Sensors, Adaptive Interventions.

Smart Career Guidance System using Generative AI: Bridging the Digital Skills Gap through Resume Analysis and Personalized Roadmaps

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Abstract

The rapid growth of advanced technologies widens the gap in digital skills, a point beyond which a majority of learners and job seekers cannot fill due to the specialized requirements of modern technical roles. This paper proposes the Smart Career Guidance System using Generative AI that can offer customized career guidance along with structured upskilling plans through its intelligent, multi-layer framework. The system develops a holistic user profile by integrating PDF-based resume parsing, transformer-driven NLP for extracting skills, technical proficiency assessments, and personality evaluation modules. Further, the inputs are combined by the Generative AI reasoning layer to develop recommendations for suitable technology career paths along with skill gaps in those fields. The system offers a personalized learning roadmap through missing competencies and targeted upskilling strategies for AI, Data Science, Cybersecurity, and Cloud Engineering. By offering data-driven insights and adaptable recommendations, the proposed solution empowers users to make informed career decisions and helps the workforce be ready for an evolving digital economy.

Keywords

Artificial Intelligence (AI), Generative AI, Career Counseling, Resume Analysis, Natural Language Processing (NLP), Personality Assessment, Skill Gap Analysis, Machine Learning (ML), Hugging Face Transformers, Open-Router API, Chatbot System, Predictive Analytics, Educational Technology (EdTech), and Intelligent Decision Support System.

AI-Based Food Nutrition Detection and Diet Suggestion System

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Abstract

This work develops an artificial-intelligence frame- work for detecting food nutrition and recommending diets by combining visual analysis with an enhanced Food Nutrition Knowledge Base (FoodnKB). Instead of text queries, this ap- proach relies on food images captured by users. Large language models identify visually distinct, ready-to-eat foods and expand their synonym lists to improve data collection. To address misla- beled web images, the framework employs two complementary noise-filtering methods—Accuracy Gap (AccGap) and Cyclic Area Under the Margin (cAUM). A refined dataset is then used to fine-tune a ResNet-101 classifier pre-trained on ImageNet. The resulting system recognizes food items accurately and retrieves nutritional profiles to produce personalized dietary suggestions, providing a practical and scalable tool for everyday nutrition monitoring.

Keywords

AI-powered food nutrition detection, image- based food recognition, Food Nutrition Knowledge Base (FoodnKB), deep learning, computer vision, diet recommenda- tion system, and nutritional analysis.

Smart Military Helmet

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Abstract

Soldier protection and awareness have become important issues in present-day battlefield conditions. In this paper, a Smart Military Helmet is described that aims to improve military operation efficiency with real-time health observation, motion notify threat alarm, and location tracking capability. The device is built on an ESP32 microcontroller with a MAX30102 pulse oximeter for the real-time observation of heart rate and blood oxygen, and the MPU6050 accelerometer and gyro sensor for the detection of falling and irregular motions. The real-time location tracking function is achieved with a GPS module, and alarm notification is provided with a buzzer and display device. When critical health issues and impact happen, the helmet will send the alarm information to a monitoring unit through wireless communication with the initial triggering of these health and impact issues. The Smart Helmet is designed to be non-obtrusive and inexpensive, with a compact structure, high efficiency, and strong military and rescue value with shorter emergency response times, higher soldier survivability, and rich applications in the military and rescue sector.

Keywords

Smart Military Helmet, Soldier Safety, Embedded Systems, Wearable Sensors, Motion Detection, GPS Tracking.

Educational Game Design Using Data Structures: A Time Travel Adventure Through Modern and Future Eras

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Abstract

In computer science, especially while studying Data Structures it is a bit difficult to visualise the underlying mechanism of the concepts [1], [4]. Games, however, offer a fascinating means of making the intangible (abstract) become tangible, and a Java-based text-based multi-era puzzle game is designed and constructed with a logically sequenced series of jobs for each stage, anchored in the fundamental building blocks of arrays, linked lists, stacks and queues [3], [9]. The game's modern and future eras are the primary stages of the game, coming fast through the Modern Era encryption, decoding, and generating secure passwords are the key challenges that we confronted [6], [10]. Here, text data was encoded by means of a queue-based rotational encoding strategy and a password was created out of the refined character information through a stack-based reversal technique [6], [14]. In the Future Era, the Fibonacci sequence puzzle and a maze navigation game are featured, and expand upon the logical hints from the earlier levels. The user's move history is recorded in a stack in the maze challenge, enabling an undo feature to reverse the last move [7].

Keywords

Data Structures, Stack, Queue, Java Puzzle Games, Encryption, Fibonacci Series, Maze Navigation, Undo Operation.

AI-ML Enabled Face Liveness Detection for Aadhaar Authentication

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Abstract

As Aadhar is a national programme in India, there are various presentation attacks such as photos, videos, and masks. Aadhar has faced presentation attacks previously other biometric systems have suffered attacks. Most face authentication systems in Aadhar do not use anti-spoofing and, as a result, become vulnerable to such attacks. Most face recognition systems are easily vulnerable to presentation attacks and crash. To solve the problems, we designed a two prong face recognition and anti-spoofing systems for the Aadhar system.

The anti-spoofing systems uses a MiniFASNet model labels Fourier spectrums and uses descriptors like LBPs and HOG for training. For verification, we use ArcFace recognition models and RetinaFace aligned sets. If the images are poor quality, we fall back to classical features. We also introduced a system to process videos in order to detect head movements and other natural movements to mitigate replay and mask attacks.

ONNX Runtime-enabled model inference occurs in real time (~20 ms latency) on handheld CPUs. It runs as a lightweight Flask-SQLite web service. We carried out the evaluation on standard PAD datasets (CASIA-FASD, Replay Attack, OULU-NPU, CASIA-SURF, CelebA-Spoof) and attained a 97.8% true positive rate while keeping the false positive rate at 10^{-5} with a display of weak generalization and robustness. Thus, hybrid multi-scale architecture is likely to deliver Aadhaar authentication multi-skilling on-the-go.

Keywords

Face anti-spoofing, aadhaar verification, biometric authentication, liveness detection, arcface, retinaface, minifasnet, fourier spectrum, mediapipe, pad, multi-scale features, cnn, onnx runtime.

CareerWave: AI-Powered Career Counsellor for Schools

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Abstract

CareerWave is an artificial intelligence (AI)-based career guidance software developed to guide students to make relevant choices about their future. Unlike traditional systems that focus only on academic scores or basic aptitude tests, CareerWave includes psychometric assessments, educational games, and behavioral analysis in order to create a holistic learner profile. The platform makes use of a microservice architecture with specific modules for authentication, student profile, assessments, recommendation and a conversational chatbot named Scout. Machine learning algorithms like XGBoost and Random Forest algorithm are used to provide individual career recommendations using student data. The system offers an accessible, simple interface and an organizational system for students, teachers, and parents.

Keywords

Artificial intelligence career guidance, xg boost, random forest, educational technology.

Omni-Learn XR: A Unified AR/VR Ecosystem for Interdisciplinary Education

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Abstract

Advances in immersive technologies are transforming education by enabling interactive and engaging learning experiences beyond traditional classroom methods. The research presents the design and development of an AR/VR-based interactive learning framework that integrates augmented reality, virtual reality simulations, miniature game mechanics to support experiential learning and examine how immersive AR/VR environments can enhance learner engagement, conceptual understanding, motivation, and knowledge retention across various educational domains. The proposed system consists of four key modules: In Unity Game Engine, AR-based educational application developed for real-time visualization of learning content, miniature game to reinforce mechanics and mathematical concepts through gamification, Historical Monuments allows users to explore culturally significant landmarks in an interactive 3D environment and Virtual Zoo developed with Unreal Engine to simulate realistic animal behaviors and natural habitats. The methodology involves optimized 3D model development, interactive user interface design, integration of animations and audio feedback, and usability evaluation through user interaction testing. Results indicate that learners using the AR/VR framework demonstrated increased engagement, improved conceptual clarity, and greater interest compared to conventional learning approaches. In conclusion, research offers a scalable and effective solution for modern education, aligning with the ICASET 2026 theme of advancement in science, engineering and technology.

IoT-Enabled Smart Fuel Authorization and Tracking System

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Abstract

The rapid growth of fleet-based services has increased the demand for secure, transparent fuel management. Traditional methods rely on manual intervention, leading to unauthorized access and lack of real-time monitoring. While digital payments exist, they lack physical enforcement over dispensing. This paper proposes an IoT-Enabled Smart Fuel Authorization and Tracking System designed for vehicle-specific, accountable dispensing. The system integrates FASTag-simulated RFID authentication with a cloud-based database to verify vehicle identity before permitting access. An ESP32 microcontroller acts as the central hub, controlling a relay-based pump mechanism to physically enforce authorization based on predefined quantities. Users can input requirements via a keypad or dashboard. All transaction data—including vehicle ID and timestamps—are logged to a Firebase cloud platform for real-time monitoring via a web dashboard. By removing human intervention and adding a physical enforcement layer, this system significantly reduces fuel theft and operational fraud. The solution is cost-effective and scalable for fleet depots, institutional campuses, and industrial facilities. Future enhancements may include predictive analytics and integrated contactless payments.

Keywords

IoT Fuel Management, FASTag Simulated Authentication, ESP32 Automation, Cloud-Based Monitoring.

Governance of Generative Artificial Intelligence in Management Education: Insights from Student Perspectives

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Abstract

Management education is being transformed by the rise of generative AI tools like ChatGPT and Gemini, reshaping how students learn, analyze, and complete academic work. These tools enhance efficiency, creativity, and decision-making but also raise concerns about ethics, integrity, privacy, and overreliance. Current AI governance in higher education often overlooks management students' perspectives, despite them being primary users of these technologies in academic contexts.

The purpose of this research is to understand how management students view governance of generative AI with a mixed-methods, explanatory sequential approach. Quantitative data were obtained from surveys to explore awareness, patterns of usage, any perceived benefits, and any ethical concerns about using generative AI. This quantitative component was then followed by qualitative semi-structured interviews to get a better idea of what students are looking for with respect to adding generative AI to their curricula, having training on ethics, having ways to detect misuse, and having academic penalties for misuse. Results showed that students strongly support the integration of generative AI into their management education and that there is a desire for formalized governance mechanisms focusing on ethical literacy, competency in working with AI, safeguarding confidentiality, and utilizing transparent evaluation processes.

RoBERTa-SHAP: An Explainable Fake News Detection Framework

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Abstract

The dissemination of false information with an aim to mislead threatens the democratic processes and citizen confidence. Traditional machine-learning methods of fake-news detection are suffering in computational efficiency while lacking of features to capture deep lexical characteristics and the contextual meaning. Although transformer-based language models provide better representation of context, these models have not gained popularity in real-world verification systems because they are black-box models that rely on simplistic models with a binary choice of true and false. In order to overcome these challenges, this research suggests an explainable fake news detection system, which includes a fine-tuned RoBERTa model and SHAP (SHapley Additive Explanations). The system performs fine-grained, six-class trustworthiness classification using the LIAR and LIAR2 datasets which enables for more nuanced assessment of claims made in the political domain other than a yes-or-no notion. Experimental results show that RoBERTa has better accuracy and macro-averaged F1-score compared to DistilBERT and mBERT. The SHAP module gives us access to token-level attribution scores, which point to linguistic evidence that is used to make each prediction; making the machine learning model more transparent and understandable. The inference through the framework is deployed through a web-based interface to support real-time inference and visualizations for explanations. Overall, the proposed RoBERTa-SHAP system offers better predictive performance, explainability, and usability, which provides a scalable and socially responsible solution for trustworthy fake news detection.

Keywords

Fake news detection, Explainable artificial intelligence, Transformer-based language models, SHAP (Shapley additive explanations), Trustfulness classification, Misinformation analysis, RoBERTa fine-tuning, Token-level attribution, LIAR benchmark dataset, Interpretable NLP models.

Fetal Intracranial Abnormality Detection Using Deep Learning Techniques

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Abstract

This project introduces a deep learning-based system of abnormality detection and disease-specific classification of fetal intracranial abnormalities on ultrasound images. Noise removal, contrast enhancement, Region of Interest (ROI) cropping, and normalization are used as preprocesses of the input 2D fetal brain ultrasound images. Class imbalance is addressed by data augmentation to enhance generalization. The ventricles and cerebellum are key brain regions extracted with the help of a U-Net- based segmentation model. Segmented regions are then assigned with CNN and transfer learning models into normal and distinct abnormal conditions which include ventriculomegaly and posterior fossa abnormalities. The system will be assessed on the basis of accuracy, precision, recall, F1-score, sensitivity and specificity and aimed at aiding in the early and reliable clinical diagnosis.

Keywords

Deep learning, Fetal ultrasound, Intracranial abnormalities, Medical image classification, Abnormality detection.

DYSLEXAI: An Assistive Chatbot for Dyslexia Typing Support

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Abstract

DyslexAI is a web-based assistive learning platform designed to support individuals with dyslexia in strengthening reading, spelling, and pattern recognition skills. The system combines interactive games, a responsive chatbot, and adaptive learning paths to deliver a personalized experience. DyslexAI addresses common challenges such as spelling errors and slow reading speed through targeted exercises, real-time feedback, and accessible UI features like dyslexia mode and colour overlays. Learners interact via text-based chat and game modules, with progress and performance tracked in a parent dashboard that provides actionable tips and focus areas. A reward system motivates users through badges, streaks, and milestone notifications. The platform is optimized for children and parents, offering clear guidance and gamified practice. DyslexAI leverages modern web technologies to make dyslexia support engaging, accessible, and effective.

Keywords

Dyslexia, Assistive Learning, Gamification, Adaptive Path, Parent Dashboard, Accessibility, Web App.

Fail-Secure Edge Computing Architecture for Tamper-Resistant Protection of VLSI Intellectual Property Using AES Cryptography

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Abstract

The protection of VLSI Intellectual Property is a problem in the semiconductor industry. This is because there is a risk of people copying, sharing or changing VLSI Intellectual Property without permission when it is shared or used. The usual ways to protect VLSI Intellectual Property are not very good. They depend on agreements. Who has access but they do not do a good job of stopping bad things from happening when VLSI Intellectual Property is being used. This paper is about a way to protect VLSI Intellectual Property. It uses a kind of computer system and Advanced Encryption Standard cryptography to keep VLSI Intellectual Property safe, from people who want to hurt it. The new system uses a Raspberry Pi computer to store important VLSI hard IPs in a secret code. This way only people who are supposed to can get to the VLSI IPs. The system checks the secret code keys every time someone wants to use the VLSI IPs and it only keeps these keys for as long as the person is actually using the VLSI hard IPs. The system also watches out for people trying to cheat or break the rules like stopping the process or messing with the system. If someone tries to do something they are not supposed to the system will stop them from getting to the VLSI IPs and will get rid of the secret VLSI hard IPs in a safe way. The fail-secure design ensures that any interruption or attack leads to sudden loss of IP accessibility rather than data leakage. Experimental evaluation demonstrates that the proposed design provides effective IP protection with minimal processing, making it suitable for secure, low-cost, and portable VLSI IP management in edge computing environments.

Keywords

Edge Computing, AES Cryptography, Fail-Secure Architecture, Tamper-Resistant Systems, Secure IP Storage, Access Control Enforcement, Raspberry Pi Edge Server, Runtime Security Monitoring, Data Protection.

Real-Time Skin Cancer Detection Using YOLOv8 and CNN with Webcam Feed

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Abstract

This system performs real-time skin-health monitoring by analyzing live webcam video to detect and classify skin lesions. This model observes skin surface layer-by-layer and identifies irregularity like moles, spots or any pigmented lesions. The system first implements a YOLO-based detector to identify the suspicious lesion area and then applies a Convolutional Neural Network (CNN) classifier to distinguish whether the lesion is normal, suspicious or cancerous(melanoma). The entire system runs using a standard webcam, it makes advanced skin-health accessible to all the users by reducing the dependency on the equipments. Privacy and data protection are the key elements of this system. The combination of YOLO for lesion identification and CNN for classification will make the system more precise than earlier approaches. Its design provides a reliable, real-time, and confidential screening technique that can identify high-risk skin abnormalities early on.

Keywords

Skin cancer detection, AI analysis, melanoma, YOLOv8.

Identification of Signature Molecular Biomarkers for Therapeutic Targeting for Cardiovascular Diseases by Network-Based Analysis

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Abstract

The Cardiovascular diseases are the age-related diseases and their genesis is not only affiliated with the accumulation of lipids in the cardiac vessels but more to the inflammatory process. In this paper, while focusing on the therapeutic significance, a systems and computational biology strategy was utilized to examine biomarkers central to myocardial inflammation and analyze various regulatory networks monitoring the process. In tissue-specific gene co-expression assessment, CCL2, IL6 and IL8 were revealed as the central hub genes in atrial appendage and CCL2 was shown to be the major hub gene in left ventricle. Consequently, CCL2 was the master gene since it was expressed by both of the cardiac tissues. Moreover, in gene-miRNA interaction analysis, the post-transcriptional regulator hsa-miR-155-5p was identified as the primary regulator, furthermore, in gene-transcription factor (TF) interaction examination, NFKB1 was found to be the key regulator. Together, all these molecular markers, can be aimed for targeted-therapeutics to obstruct the inflammation procedure in cardiac tissues.

Integrating Lean Construction with Digital Technology for Smart Construction

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Abstract

In this study, opportunities and challenges of using lean construction techniques in building construction are discussed. It mainly focuses on educational initiatives, which may help in the smooth incorporation of Lean principles and sustain them in the long run using technology.

It identifies some of the key hurdles to be cleared, such as the need for different industries to have different meanings for the word 'lean,' the need for greater cooperation between professionals and academia in terms of implementing lean manufacturing concepts, and the need for learning as a means to assure that lean construction does not become another fad.

The framework put forward in the study to address these challenges has been able to merge lean construction with the use of digital technologies. The core motivation behind such an initiative is the intent to improve quality standards, reduce wastes, and enhance smoothness in project flow.

Jailbreak Firewall: A Semantic Analysis Framework for Detecting and Mitigating AI Prompt Injection Attacks

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Abstract

In the changing world of generative AI, it's important to protect large language models from harmful or tricky prompts that try to bypass safety rules—these are called jailbreak attacks. This paper presents Jailbreak Firewall v1.0, a system that checks and evaluates these attacks in real time by using Natural Language Processing and Machine Learning. Unlike old systems that look for specific words, this new method uses Sentence Transformers and cosine similarity to understand the meaning of user inputs and compare them to a database of known harmful patterns and restricted topics. The system has a clear structure with a frontend built using JavaScript and a backend powered by Python, allowing for analysis in pieces, scoring from two different sources, and classifying risks based on how serious they are. The results are shown through an easy-to-use dashboard that gives real-time risk alerts and helpful security advice. The tool works with many languages, provides answers quickly—under 2 seconds—and can be used in different ways depending on the needs of businesses and research teams. Tests show that it detects most jailbreak attempts accurately (>92%) with few false alarms, setting up a strong base for future AI security tools that can spot new threats by understanding context.

Keywords

Jailbreak Detection, Prompt Injection, Large Language Models, Natural Language Processing, Semantic Analysis, AI Security, Sentence Transformers, Cosine Similarity.

Human Recognition Framework based on Gait Characteristics

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Abstract

Traditional biometric systems like face, fingerprint, and iris recognition falter in low-light conditions, require physical contact, or face spoofing risks, limiting their real-world use. To address this, we developed a touchless, privacy-preserving gait recognition system for robust person identification in surveillance and access control. Our approach uses MediaPipe for real-time skeletal keypoint extraction from video, combined with CNNs for spatial features, LSTMs for temporal patterns, and a Siamese Neural Network for accurate gait matching. A user-friendly Streamlit interface enables video uploads, live webcam feeds, and dynamic user management.

Tested on diverse datasets, the system achieves 90% average accuracy in near-real-time processing, adapting to variations in clothing, surfaces, and environments. While challenges like low-resolution inputs persist, it outperforms baselines in non-cooperative scenarios. Future work includes 3D CNN/LSTM enhancements, expanded datasets, and batch processing for scalable deployment in smart cities.

Keywords

Biometric Authentication, Contactless Authentication, Deep Learning, Gait Recognition, Pose Estimation, Siamese Neural Network, Video Surveillance.

A Machine Learning–Driven Framework for Phishing Attack Detection and Mitigation Strategies

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Abstract

Phishing attacks leveraging deceptive URLs are evolving rapidly, posing significant threats to individuals and organizations by tricking them into disclosing sensitive information. These URL-based phishing tactics, alongside traditional schemes, represent an escalating risk to global cyber security. However, existing detection methods often fail to adapt to these new challenges, underscoring the urgent need for more advanced solutions. This paper presents the development of an advanced, high-precision scanner system that utilizes machine learning to detect phishing URLs at scale. The system enhances detection accuracy by employing five distinct algorithms: decision trees, random forest, support vector machine, and a neural network trained on software-mined data. Implemented in Python, the models leverage the Scikit-learn and Tensor Flow libraries. Feature data is sourced from reputable databases such as PhishTank and OpenPhish, with attributes including URL length, special characters, and domain information being analyzed. The core of the system is engineered for real-time phishing detection, enabling rapid identification and mitigation of malicious activity. Performance is rigorously evaluated using metrics such as accuracy, precision, recall, F1 score, and ROC AUC. The proposed machine learning models demonstrate superior performance compared to traditional detection mechanisms, offering a robust solution for combating sophisticated phishing attacks.

Keywords

Phishing Attacks, URL Analysis, Machine Learning Algorithms, Scikit-learn, Tensor Flow.

Secure and Explainable Arrhythmia Detection Using Quantum Blockchain and HQCNN

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Abstract

ECG analysis is critical for early stage arrhythmia detection; however, reliable diagnosis is often hampered by noisy signals, the interpretability limits of deep learning models, and security issues in medical data handling. Quantum-based works, such as QADS, enhance the accuracy of detection with hybrid quantum neural networks and ensure data security with the help of quantum blockchain. However, they do not guarantee the reliability of the ECG signal or provide transparent explanations of the classification results. In light of this limitation, this study describes a conceptual framework for a secure and explainable arrhythmia detection system using quantum blockchain and hybrid quantum convolutional neural networks (HQCNN). It assures the quality of the ECG signal by implementing an ECG signal quality assessment layer that allows only quality and accurate signals to proceed for processing. The HQCNN acts as the main classifier for detecting abnormal heartbeats using the MIT-BIH Arrhythmia Dataset. An explainable classification module also highlights clinically meaningful ECG features, such as variations in the R-R interval and QRS duration. The proposed system enhances the reliability of the entire process through improved security and transparency features, making it suitable for trustworthy analysis in smart healthcare applications.

Design and Experimental Implementation of an Intelligent Controller for Wind Power Management and Storage Using Battery and Converter Systems

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Abstract

In wind energy power management, the difference between the amount of power generated and the load demand may vary based on the wind energy which leads to energy loss or insufficient supply. This paper presents the design and experimental implementation of an intelligent control system developed to improve the usage of wind power using energy storage system and converters. In this system, the power is managed among wind source, battery storage and the grid, for the better usage of available energy based on the demand conditions. When the load demand is low, excess wind energy is stored in the battery instead of being wasted. During the high demand period, the stored energy supplied along with the wind power to support the demand. The real time operating parameters are frequently observed using an IOT based monitoring platform. Additionally, a load demand prediction model is used to study demand patterns and helps in energy management system. Experimental results from the hardware prototype shows effective power flow management, improved wind energy usage and reliable system operation under changing generation and demand conditions.

Keywords

Wind Energy Management, Battery Energy Storage System, Intelligent Controller, IoT-Based Monitoring, Power Demand Prediction.

Fetal Anomaly Detection Using EfficientNetB0

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Abstract

Timely identification of fetal anomalies is important for improving pregnancy outcomes. This study examines an approach for the classification of fetal ultrasound images into normal and abnormal types. A dataset including more than 1,500 fetal ultrasound images sourced from various fields was used for experimentation. Data augmentation methods, such as rotating images, flipping images, and adding noise, were employed.

Evaluation on the test set yielded a classification accuracy of 96% for abnormal frame identification.

Keywords

Fetal anomaly detection, prenatal ultrasound imaging, deep learning, EfficientNetB0, region of interest, medical image classification.

Awareness, Willingness, and Barriers to Digital Health Adoption in Rural Haryana: Evidence from a Village-Level Survey

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Abstract

Digital health technologies are increasingly promoted as a means to enhance healthcare accessibility in rural India; however, their adoption remains uneven. This study examines levels of awareness, willingness, and barriers to digital health utilization among rural populations in selected villages of the Sonapat district, Haryana. A cross-sectional survey was administered to 90 respondents using a structured questionnaire that captured socio-demographic characteristics, healthcare-seeking behaviour, and perceived challenges associated with digital health services. Data were analyzed using descriptive statistics and inferential methods in SPSS. The findings reveal a substantial disparity between respondents' willingness to use digital health services and their actual awareness of available digital health platforms. Key barriers identified include limited digital literacy, lack of access to smartphones or reliable internet connectivity, language constraints, a strong preference for face-to-face consultations, and distrust toward online healthcare services. Chi-square analysis demonstrated statistically significant associations between education level and awareness of digital health services ($p < 0.05$), as well as between age group and willingness to adopt digital health technologies ($p < 0.05$). These results underscore the urgent need for targeted digital literacy initiatives, culturally and linguistically adapted mobile health (mHealth) solutions, and hybrid healthcare delivery models that integrate digital and in-person services. Such interventions are essential to promote equitable access and sustainable adoption of digital health technologies in rural communities.

Converging Native Microbial Consortia and Bioelectrochemical Systems : Toward Integrated Platforms for Eutrophic Water Remediation and Renewable Energy Recovery

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Abstract

Eutrophication of aquatic systems poses a major environmental challenge due to excessive nutrient loading, leading to ecosystem degradation and water quality deterioration. At the same time, eutrophic waters contain significant untapped chemical energy stored in organic matter. This paper presents an integrated perspective on the use of native microbial consortia coupled with bioelectrochemical systems (BESs) for simultaneous eutrophic water remediation and renewable energy recovery. The role of indigenous microbial communities in driving nutrient transformation, organic matter oxidation, and extracellular electron transfer is discussed, highlighting their ecological adaptability and functional resilience under natural conditions. Key bioelectrochemical configurations, including microbial fuel cells and microbial electrolysis cells, are outlined with emphasis on electron transfer pathways, reactor design, and system performance. Recent experimental and pilot-scale studies, particularly from eutrophic and wastewater-impacted environments, are summarized to demonstrate the dual benefits of pollutant removal and bioelectricity generation. A simplified bench-scale framework is proposed to support reproducible system development and translation toward field deployment. The study highlights the potential of native microbiome-driven BESs as low-energy, nature-based solutions that align with circular bioeconomy principles and sustainable water management strategies.

Keywords

Native microbial consortia, Bioelectrochemical systems, Eutrophic water remediation, Waste-to-energy, Circular bioeconomy.

Phytoremediation Driven Assessment of Agrochemical Contamination in Soil and Water: A Simplified Index-Based, Analytical, and Eco-Toxicological Perspective

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Abstract

The extensive and frequent use of agrochemicals in modern agriculture has raised critical environmental and public health concerns which particularly are due to their persistence and mobility in soil and water ecosystems. Leftovers from pesticides, fertilizers, and emerging contaminants disrupt soil microbial diversity, increases eutrophication, and threaten aquatic biodiversity through bioaccumulation and food web alterations. Effective checks and remediating strategies are hence essential to reduce their long-term impacts. Analytical tools such as High-Performance Liquid Chromatography (HPLC) and other biosensor-based platforms have an advanced strategy for detection of agrochemicals with higher sensitivity and precision. Similar to these approaches, index-based risk assessment methods including Contamination Index, Pollution Load Index, and eco-toxicological benchmarks provide a comprehensive evaluation of contaminant levels and ecological risks. Phytoremediation has been emerged as a sustainable and eco-friendly alternative, in manipulating plant uptake, rhizodegradation, and microbe assisted processes to degrade or immobilize agrochemicals. Case studies also demonstrates its promise in pesticide and nitrate removal, though there are challenges which remain in biomass management, remediation rate, and field-scale application. Integrating phytoremediation with advanced analytical and index-based assessment offers a withstanding and strong framework for sustainable contaminant management. Future perspectives highlights the role of genetically engineered plants, plant microbe consortia, and supportive policy interventions in increasing phytoremediation to real world contexts.

Keywords

Agrochemical residues, Phytoremediation, Analytical detection, Risk assessment indices, Environmental sustainability.

AI-Driven Design of Personalized mRNA Vaccines for Neuro-Oncology and Autoimmune Neurological Diseases: Precision Immunomodulation in Multiple Sclerosis and Beyond

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Abstract

The mRNA vaccines are developed as a flexible therapeutic option with increasing clinical application in neuro-oncology as well as autoimmune neurological conditions. High throughput sequencing, immunogenomics and AI support the development of a patient-specific mRNA vaccine by studying an individual's patient profile in relation to disease conditions. To this end, tumor-specific antigens or neoantigens are targeted by tumor vaccines to enhance the recognition of brain tumor antigens by the patient's immune system with minimal normal brain tissue injury. This is achieved if there is proper epitope-HLA association in relation to binding of epitopes with patient specific HLA molecules to generate cytotoxic T cells. Autoimmune neurological diseases such as MS actually need the stimulation of tolerance instead of the immune system. The strategy to tackle the designing of tolerizing or reverse vaccines lies in the careful selection of epitopes. These epitopes, i.e., the antigen contained in the RNA vaccine, followed by the specific application of anti-inflammatory lipid nanoparticles for the delivery mechanism, would allow the antigen-bearing cells to present the vaccine in a manner where regulatory T cells would be preferred over effector T cells. Furthermore, it would prevent epitope spread from happening in the central nervous system. Indeed, the epitope contained in the vaccine has been specifically optimized to prevent overwhelming the innate immune system. One of the challenges in neuro-related applications is that patients can be diverse in terms of antigens and HLA. AI levels for screening and validation can solve this with comprehensive information on genomics, transcriptomics, and immune systems integrated for predictions related to optimal epitopes, refined sequences of epitopes, improved mRNA stability, and improved translation efficiency. Modeling by AI will help modulate immune systems accurately, promoting safe and effective personal mRNA vaccines for neuro-oncologic and autoimmune neurologic disorders.

Keywords

Personalized mRNA Vaccines, Artificial Intelligence (AI), Neuro-Oncology Immunotherapy, Multiple Sclerosis (MS), Tolerogenic (Inverse) Vaccination, Precision Immunomodulation.

A Survey on Machine Learning Based Intrusion Detection System for Intelligent Transportation System

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Abstract

As the autonomous vehicles such as vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications are becoming common place, the normal signature-based intrusion detection system (IDS) cannot be relied upon to recognize new and malicious cyberattacks. The paper is an intrusion detection system (HIDS) based on anomaly detection and machine learning (ML) applied at the onboard unit (OBU) to detect cyber threats in realtime. The suggested HIDS will gather such as CAN (Controller Area Network) bus traffic, process execution, network socket traffic, and message timing of embedded automotive systems. It uses the ML models to categorize the actions as normal and malicious. When tested on simulated and benchmarked V2X, the system demonstrates a state-of-the-art performance with a high F1-score of 96.2, high precision of 97.1, high recall of 95.3 and accuracy of 96.8 with low inference latency that is compatible with ultra-reliable low-latency communication (URLLC) constraints. In contrast to network-based solutions, our HIDS is not dependent on encryption of network traffic or protocol visibility, which ensures that it is resistant to spoofing, replay, and denial-of-service attacks on V2X stacks. It has a lightweight and edge-deployable architecture with 5G-supporting autonomous vehicle platforms. This study proves the practicality of ML-based HIDS as an imperative level of defense in the future intelligent transportation systems.

Keywords

Autonomous Vehicles (AVs), Host-Based Intrusion Detection System (HIDS), Isolation Forest (IF), CAN Bus, Security, Machine Learning, Anomaly Detection, V2V, V2I, Ultra-Reliable Low-Latency, Cybersecurity, 5G, Autonoetic Computing, Real-Time Threat.

Internet of Things enabled Traffic Signal Control System Using YOLO Computer Vision Assisted Artificial Intelligence Technology

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Abstract

Urban intersections face inefficiencies due to fixed-time signals and complex learning-based systems that lack real-time practicality and hardware reliability. To address these limitations, this study proposes a vision-based adaptive traffic signal control system integrating YOLO-driven vehicle detection with an IoT-enabled ESP32 controller. Recorded traffic videos are processed to estimate lane-wise traffic density, which dynamically determines green signal durations within safe operational limits. The computed timings are wirelessly transmitted to the controller for real-time signal execution with failsafe mechanisms. Experiments show an improvement of approximately 18–22% in traffic flow efficiency and a 20% reduction in average waiting time compared to fixed-time control. The system is implemented using Python, YOLO, and ESP32, validated on a public traffic video dataset, demonstrating scalability and practical deployment potential for smart traffic management.

A Comprehensive Review of Supervised Machine Learning for Predicting Power Conversion Efficiency in Perovskite Solar Cells

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Abstract

Perovskite Solar Cells (PSCs) have become a revolutionary technology in the field of photovoltaics, competing with traditional silicon-based devices since they are very efficient at converting electricity (PCE) and cost very little to make. However, the intricate, multi-faceted design space, characterized by complicated interactions among material properties, device architecture, and synthesis parameters, renders their optimization a significant task. In this review, we examine the application of supervised machine learning techniques in predicting and enhancing the power conversion efficiency (PCE) of perovskite solar cells (PSCs). We investigate how these data-driven approaches, utilizing extensive datasets from both experimental and simulated origins, might efficiently circumvent the laborious and costly characteristics of conventional research. We examine the theory and implementation of several supervised learning models, such as Random Forest, XGBoost, and Artificial Neural Networks, emphasizing their effectiveness in predicting PCE and other essential performance metrics. In this review, we devote a substantial portion to the transition from "Black-Box" models to more interpretable and physically informed methodologies, including Explainable AI (X-AI) and Physically Informed Machine Learning (PIML), which offer greater insights into the fundamental physics. We also talked about the problems we have right now, including not having enough data and the need for standardized datasets right now. We also talked about some exciting future paths, like using generative models and reinforcement learning to create better devices. We hope that this review will help researchers who want to apply ML to make PSCs that are not only efficient but also stable and useful in the actual world.

Stress and Mental Health Prediction Using Machine Learning

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Abstract

Mental health is an important part of employee well-being and organizational efficiency, especially in the technology industry where job stress is high. Predictive modeling would be able to recognize persons at risk of pursuing mental health treatment to enable early intervention and resource allocation. In this research, we used machine learning methods on a workplace mental health survey database to predict the respondents' treatment-seeking behavior. Preprocessing involved dealing with missing values, normalization of categorical responses like gender, outlier correction of ages, and scaling of numerical features. Class imbalance was tackled using the Synthetic Minority Oversampling Technique (SMOTE). Three algorithms were used and compared: Random Forest, K-Nearest Neighbors (KNN), and AdaBoost. The outcome showed that Random Forest had the best accuracy at 83.33%, with slightly lower but comparable performances by KNN and AdaBoost. These results underscore the appropriateness of instance-based and ensemble approaches to mental health prediction tasks and infer that further enhancements such as hyper parameter optimization, sophisticated encoding techniques, and model ensemble can further lead to higher predictive rates above 88%.

Keywords

Mental health prediction, workplace survey, Random Forest, K-Nearest Neighbours (KNN), AdaBoost, Synthetic Minority Oversampling Technique (SMOTE), machine learning, ensemble methods, predictive modelling, treatment-seeking behaviour.

A Machine Learning-Based UPI Security and Fraud Detection

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Abstract

Unified Payments Interface (UPI) has revolutionized digital payments in India, enabling seamless, real-time money transfers between accounts. However, its growing popularity has made it increasingly susceptible to fraudulent activities such as phishing, account takeovers, and transaction manipulation. This study introduces a hybrid fraud detection system integrating Convolutional Neural Networks (CNN) with Autoencoder, Local Outlier Factor (LOF), and K-Means Clustering to detect anomalous UPI transactions efficiently. The system utilizes anonymized UPI transaction data including transaction amount, time, device identifiers, and geolocation. Preprocessing involved encoding categorical features, normalizing numerical variables, and addressing missing data. The proposed hybrid approach was evaluated using accuracy, precision, recall, F1-score, and AUC- ROC metrics, achieving higher accuracy and fewer false positives compared to traditional methods. The findings highlight that deep learning combined with unsupervised techniques offers a robust solution for ensuring secure and reliable UPI payment operations.

Keywords

UPI fraud detection, convolutional neural networks, Autoencoder, Local Outlier Factor, K-Means Clustering, machine learning, anomaly detection, financial security.

Design and Development of an AI-Powered Solar Panel Cleaning Robot for Enhanced Efficiency

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Abstract

The robot uses artificial intelligence combined with sensors and embedded control systems to detect obstacles, assess dirt levels, and adapt its cleaning process accordingly. It is designed to operate with minimal human intervention, ensuring safe, consistent, and cost-effective cleaning for both small and large-scale solar installations. The robot is powered efficiently with low energy consumption and solar-based charging support. By ensuring consistent panel cleanliness, the system helps increase power generation efficiency and reduces long-term performance losses. The robot employs artificial intelligence, sensors, and embedded control systems to detect dirt accumulation, identify obstacles, and adjust cleaning actions accordingly. Designed for minimal human intervention, the system ensures safe, reliable, and cost-effective operation for both small- and large-scale solar installations. The robot operates with low power consumption and supports solar-based charging, making it an energy-efficient solution. Regular and intelligent cleaning enhances power output and reduces long-term efficiency losses of solar panels.

IoT-Driven Solar-Powered Smart Sensing System for Environmental Monitoring

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Abstract

This work presents a solar-powered smart environmental monitoring system based on the Internet of Things (IoT), designed to continuously observe and analyze environmental conditions in a sustainable manner. The system integrates low-power environmental sensors, a solar energy harvesting unit, and a wireless IoT communication framework to ensure reliable, long-term operation without frequent maintenance. The sensing unit includes sensors for measuring temperature, humidity, air quality, and other ambient parameters. These sensors are selected for their low energy consumption and high accuracy, making them suitable for deployment in remote and urban areas. The solar panel, along with an energy storage module such as a battery, supplies renewable power to the system, enabling uninterrupted operation even in locations with limited access to the electrical grid. The collected sensor data is initially processed at the edge device to remove noise and ensure data integrity. After preprocessing, the data is transmitted wirelessly to a cloud-based IoT platform, where it is stored, visualized, and analyzed in real time. The cloud dashboard allows users to monitor environmental trends, receive alerts when abnormal conditions are detected, and support informed decision-making. Overall, this research provides an efficient, eco-friendly, and cost-effective blueprint for next-generation smart environmental monitoring systems. It contributes to increased environmental awareness, supports sustainable resource management, and demonstrates how IoT and renewable energy can work together to address modern environmental challenges.

GreenAI: Intelligent Composting for Sustainable Hostel Food Waste Management

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Abstract

Food waste in college hostels represents a significant environmental and economic concern. The improper disposal of organic waste not only increases landfill loads but also leads to greenhouse gas emissions and hygiene issues on campus. This study proposes an AI-assisted smart composting system tailored for hostel environments in educational institutions. The system integrates sensor-based IoT devices with machine learning algorithms to monitor key composting parameters such as temperature, humidity, pH, and decomposition rate. Using AI, the system predicts optimal composting conditions and automates aeration and moisture control, significantly accelerating the composting process. A mobile/web interface is provided to students and administrators to track composting progress in real-time, view waste statistics, and receive recommendations for waste segregation. The project promotes sustainability, awareness, and green practices among students while reducing institutional waste disposal costs. The system also offers a potential model for scalable adoption across multiple campuses or urban residential complexes.

Keywords

Composting, food waste management, hostel sustainability, smart bins, IoT, environmental monitoring, college campus green computing.

HostelHub: Architectural Design of a Modular Web Framework for Academic Hostel Administration

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Abstract

HostelHub is a flexible web system designed to streamline hostel management, replacing outdated paper-based methods with organized online services and secure user access controls. Traditional systems cause complaints to take 3-5 days to resolve, scatter event and meal information, and leave data vulnerable, adding over 25% extra work for staff. The setup uses Java Spring Boot to handle core functions like user accounts, complaint handling, event planning, announcements, and daily menus. It stores data in MySQL databases with structured tables for users, complaints, events, and more. Spring Security manages logins with password encryption (using BCrypt), user sessions, and permission levels based on roles. Clean REST APIs connect the backend to simple, mobile-friendly frontends built with HTML, CSS, and JavaScript, all organized through Maven for easy dependency handling.

Keywords

Spring Boot, RESTful APIs, Spring Security, role-based access control, MySQL, Apache Tomcat, hostel management, modular web framework.

AI-Assisted Early Prediction and Severity Classification of Knee Osteoarthritis Using YOLO-Enhanced CNN Models

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Abstract

Knee OsteoArthritis (KOA) is a notably common degenerative joint disease that necessitates accurate detection and severity evaluation to aid effective scientific intervention, prognosis, and disorder control. Radiographic evaluation using the Kellgren Lawrence (KL) grading gadget stays the most widely adopted method for assessing structural abnormalities in knee X-ray pictures; but, this guide grading process is inherently subjective and brand new inter- and intra-observer variability. Early identity present day KOA performs a vital position in delaying disease progression and mitigating lengthy-time period purposeful impairment. Even though numerous current techniques employ ensemble mastering strategies to enhance category accuracy, these strategies contemporary incur high computational complexity, increased memory necessities, and restricted scalability for real-time scientific deployment. to triumph over those obstacles, this take a look at proposes an AI-pushed framework centered on early prediction and correct severity type latest knee osteoarthritis whilst bridging the space between observable structural joint adjustments and scientific signs. The proposed methodology integrates You only look as soon as (YOLO)-based totally object detection models to routinely localize and locate critical structural functions in knee radiographs, inclusive of joint space narrowing (JSN) and osteophyte formation, which might be strongly correlated with KL severity grades. These localized features are subsequently analyzed the usage of convolutional neural network (CNN) architectures more desirable via switch mastering and great-tuning techniques to permit automatic KOA class. The Osteoarthritis Initiative (OAI) dataset is applied for experimental validation, and model robustness is evaluated the use of ten-fold move-validation. Experimental effects reveal that the proposed framework achieves a mean category accuracy brand new 98.43% in a five-magnificence KL grading scenario (Grade zero-Grade four), outperforming numerous methods. furthermore, the look at famous that lowering the number today's multiclass labels improves predictive overall performance, with binary category reaching an accuracy contemporary 98.2%. The findings spotlight the effectiveness cutting-edge AI-assisted picture analytics in accurately predicting joint space discount and disease severity. The proposed CNN-primarily based framework offers obvious and dependable selection support, advocating its adoption in medical settings to enhance KOA diagnosis, treatment making plans and diagnosis.

A Real-Time Android-Based Pothole Detection System Using Compressed YOLOv8

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Abstract

Potholes are a major cause of road accidents, vehicle damage, and traffic congestion, particularly in developing countries with high vehicle density. This paper introduces a real-time, camera-based pothole detection system that can be used on Android smartphones without using external sensors. The proposed system relies on the YOLOv8 convolutional neural network to detect objects, which is optimized using the TensorFlow Lite to support lightweight and on-device inference by mobile devices. The smartphone camera takes road images and the images are processed to identify potholes whereby bounding boxes and confidence scores are used to indicate the presence and locations of potholes. Potholes identified are geo-tagged with the help of GPS and displayed in OpenStreetMap. Pothole data are updated in real time using Firebase Realtime Database which enables real-time updates to all users. Moreover, pothole positions are automatically sent to the government through the Android SMS Manager and thus damaged parts of the road are easily identified and repaired. The suggested solution is scalable, cost-effective, and applicable to smart city applications, as it offers an efficient alternative to the traditional sensor-based pothole detection systems and improves the efficiency of roads and their maintenance.

Keywords

Pothole Detection, YOLOv8, TensorFlow Lite, Object Detection, Computer Vision, Android Application, Open-StreetMap, Firebase Realtime Database, Road Safety, Smart Transportation.

BuzzPaye – Your Gateway to Influencer Booking & Brand Promotions with AI Recommendation System

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Abstract

In recent years, influencer-based marketing has become one of the most effective ways for brands to reach audiences. However, brands still struggle to find suitable influencers, understand their pricing, and coordinate campaigns. On the other side, influencers do not have a structured platform to manage collaborations, negotiate deals, or track brand requests. This leads to communication gaps, delays, and a lack of transparency.

BuzzPaye is a web-based system designed to solve these issues by creating a centralized platform where brands and influencers can collaborate efficiently. The system includes an AI-powered recommendation module that analyzes campaign requirements and automatically suggests the most relevant influencers. Brands can create campaigns, keep them private, and share them only with selected influencers. The platform simplifies the entire workflow – starting from campaign creation to influencer selection, invitation, and booking.

Keywords

Influencer Marketing, Brand Promotions, Recommendation System, AI Matching, Campaign Management.

Regulatory Network-Driven Biomarker Discovery for Pancreatic Ductal Carcinoma and Pancreatic Pseudocyst

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Abstract

Pancreatic ductal carcinoma (PDAC) is one of the deadliest types of cancer, largely due to both the silent course of the cancer, and its late-stage diagnosis, which in combination produces poor survival rates. Pancreatic pseudocyst which is a benign inflammatory entity commonly shares some clinical and radiologic features of PDAC leading to diagnostic ambiguity. In the present study, we focused on the identification of shared regulatory biomarkers between PDAC and pancreatic pseudocyst using a regulatory network driven systems biology approach. Disease associated genes were collected from the database of Comparative Toxicogenomics Database (CTD) and this led to the identification of 31 genes that were found to be common to both conditions. miRNA- gene, transcription factor (TF) gene and pancreas specific interaction networks were built using the NetworkAnalyst software platform and regulatory hubs were defined by evaluating the density of interactions within these networks. The hsa-miR34a-5p, hsa-miR-16-5p, and hsa-miR-335-5p proved to be prominent miRNA hubs while MYC, CCND1, VEGFA, RELA, and CDKN1B were found to be prominent TF hubs. Functional annotation suggested that these miRNAs were mainly responsible to repress gene of cell cycle progression, apoptosis resistance, inflammation and angiogenesis. The combined network thus points out a list of mutual regulatory biomarkers that may have a diagnostic value in distinguishing PDAC and pancreatic pseudocyst.

Fetal Intracranial Abnormality Detection Using Deep Learning Techniques

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Abstract

This project introduces a deep learning-based system of abnormality detection and disease-specific classification of fetal intracranial abnormalities on ultrasound images. Noise removal, contrast enhancement, Region of Interest (ROI) cropping, and normalization are used as preprocesses of the input 2D fetal brain ultrasound images. Class imbalance is addressed by data augmentation to enhance generalization. The ventricles and cerebellum are key brain regions extracted with the help of a U-Net- based segmentation model. Segmented regions are then assigned with CNN and transfer learning models into normal and distinct abnormal conditions which include ventriculomegaly and posterior fossa abnormalities. The system will be assessed on the basis of accuracy, precision, recall, F1-score, sensitivity and specificity and aimed at aiding in the early and reliable clinical diagnosis.

Keywords

Deep learning, Fetal ultrasound, Intracranial abnormalities, Medical image classification, Abnormality detection.

Advanced Black Box for Vehicle Safety and Accountability

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Abstract

Road accidents occur mostly without any evidence to investigate the cause and assign liability. This paper proposes an Advanced Black Box System that improves safety, identifies vehicular accidents, and helps in post-accident accountability. The system combines an ultrasonic sensor for obstacle detection, an infrared sensor for proximity detection, a force sensor for impact measurement, an MQ-3 alcohol sensor for intoxication detection, and a Global Positioning System (GPS) module for real-time location tracking. An ESP32-CAM module is added for image or video capture during unusual events, serving as visual documentation of important events. A GSM module is utilized to automatically send warning messages and captured data to concerned individuals or monitoring systems. All sensor data, GPS location, and ESP32-CAM images are immediately recorded for further analysis. The extracted image features can be processed through Google Colab machine learning models for accident pattern identification, incident severity classification, or violation detection. Upon identification of dangerous events, the system triggers an engine cutoff circuit to avoid further damage.

CivicEye – Intelligent Citizen Complaint Classification and Priority System

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Abstract

The rapid growth of urban populations has resulted in a significant increase in citizen-generated civic complaints related to public infrastructure and essential services, posing serious challenges to traditional manual grievance redressal mechanisms. Existing systems rely heavily on human intervention for complaint analysis, categorization, and prioritization, which often leads to delays, inconsistencies, and the neglect of critical issues. To address these limitations, this paper presents CivicEye, an intelligent citizen complaint classification and priority prediction system that leverages Natural Language Processing (NLP) and Machine Learning (ML) techniques to automate the handling of textual civic complaints. The proposed system processes complaint narratives using text preprocessing and TF-IDF feature extraction, followed by supervised learning models to classify complaints into predefined civic categories and assign urgency levels. By enabling automated classification and priority assessment without integrating real government infrastructure, CivicEye provides a scalable, cost-effective, and ethically safe framework for improving transparency, efficiency, and responsiveness in civic governance. The system further supports data-driven decision-making through structured complaint storage and analytical visualization, contributing to sustainable urban management.

Keywords

Civic Complaint Classification, Natural Language Processing, Machine Learning, TF-IDF, Priority Prediction, Smart Governance.

Automatic Drowsiness Detection and Vehicle Safety with Real-Time Monitoring and Engine Control

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Abstract

Driver fatigue has become a major contributor to road accidents, especially during long-distance travel and night driving. To reduce such incidents, this project presents a real-time drowsiness detection and intelligent vehicle control system using computer vision and embedded electronics. A live video stream is processed with OpenCV and MediaPipe FaceMesh to monitor the driver's alertness by tracking eye behavior and head posture. The Eye Aspect Ratio (EAR) is calculated using landmark points around the eyes, and when prolonged closure or abnormal head movements are detected, the system identifies the driver as drowsy with high reliability. The drowsiness status is communicated from Python to an Arduino controller via serial communication, while vehicle parameters such as speed, brake status, engine temperature, and throttle level are monitored over a CAN bus interface for realistic conditions. If a drowsy state is identified while the vehicle is moving above a critical speed, the system triggers both a warning alert and active safety interventions. For braking, an external motor mechanism is used to pull the hydraulic brake spring so that brake fluid is pushed into the braking system and immediate deceleration is achieved. For engine acceleration control, a relay-based bypass is implemented on the throttle position sensor line, ensuring that even if the drowsy driver unintentionally presses the accelerator, the ECU will not receive the throttle signal and fuel injection is cut off. This prevents the vehicle from gaining speed and helps it slow down safely. The proposed model effectively integrates artificial intelligence, visual monitoring, CAN-based vehicle data, and automated control actions to minimize accident risks. Future advancements can include night-vision IR cameras, cloud-based emergency alerts, and improved AI classification to make the system fully suitable for commercial automotive applications.

Keywords

Drowsiness Detection, Eye Aspect Ratio, Head Posture, MediaPipe, Computer Vision, Real-time Alert, Road Safety.

Adaptive Control and Coherence Stabilization in Quantum Chaotic Systems Using Machine Learning

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Abstract

Quantum chaotic systems exhibit rapid information scrambling and decoherence, limiting coherence preservation in near-term quantum processors. Conventional quantum error correction methods incur significant hardware overhead and are challenging to deploy on noisy intermediate-scale quantum (NISQ) devices, necessitating adaptive control strategies for stabilizing coherence in strongly interacting chaotic systems. This work proposes a machine learning-based adaptive control framework that learns temporal chaos dynamics directly from physical observables. We develop a GPU-accelerated simulator based on the Sachdev-Ye-Kitaev (SYK) model capable of modeling up to 37 qubits, extracting key chaos indicators including Loschmidt echo, Lyapunov exponents, and out-of-time-ordered correlators (OTOCs). These observables train temporal neural networks (GRU/LSTM and Temporal Transformers) to predict and mitigate chaotic instability in real time. The trained models are quantized for deployment on NVIDIA Jetson Nano as embedded chaos controllers. Validation is performed using classical chaotic oscillators (Duffing, Lorenz) and quantum-inspired simulations to demonstrate proof-of-concept adaptive stabilization. This framework bridges quantum information theory, nonlinear dynamics, and edge AI, providing foundations for next-generation hybrid quantum-classical control architectures that can enhance coherence retention in NISQ devices without the prohibitive overhead of traditional error correction approaches.

Keywords

Quantum chaos, Information scrambling, Sachdev-Ye-Kitaev model, Machine learning control, Lyapunov exponents, Embedded AI, Coherence stabilization.

Transmission-Path-Based Vibro-Acoustic Health Indicator for Rotating Machinery

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Abstract

Condition monitoring of rotating machinery requires health indicators that are sensitive to early degradation while remaining robust under variable operating conditions and interpretable for industrial use. Conventional vibration-based indicators such as RMS, Crest Factor, and Kurtosis often exhibit overlapping thresholds when load conditions vary, limiting their diagnostic reliability. This paper presents a Normalized Signature Isolation Index (NSII), a vibro-acoustic health indicator that quantifies divergence between structure-borne vibration energy and air-borne acoustic energy within characteristic transmission-path frequency bands. The proposed index is formulated as a bounded (0–1) metric, enabling intuitive interpretation and consistent thresholding. Experimental validation was carried out on an industrial marine air-conditioning plant (≈ 85 TR) driven by a 300 kW induction motor under four steady-state load conditions ranging from 25% to 100%. Results indicate that the gear-mesh-dominated 800–1000 Hz band provides maximum diagnostic sensitivity. Compared with conventional statistical indicators, NSII demonstrates superior load robustness, reduced variability, and clear separation between healthy, incipient, and advanced fault states. Owing to its physical interpretability, computational simplicity, and measurement-standard compliance, the proposed NSII is well suited for real-time condition monitoring and predictive maintenance of rotating machinery in industrial environments.

Keywords

Vibro-Acoustic Measurement, Health Indicator Construction, Rotating Machinery, Transmission-Path Analysis, NSII.

Secure Image Sharing with a Visual Cryptography Model Powered by Deep Learning

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Abstract

Thanks to smartphones and other smart gadgets, it's now possible to take digital pictures and distribute them on social media at any time, from any location. Images need greater bandwidth and more levels of protection when shared than text. Due to its susceptibility to privacy breaches during data exchange, its popularity creates obstacles for secure picture forwarding. Image data has far higher quantities and redundancy, yet regular encryption techniques can protect textual data. There are significant challenges to establishing security regulations on low-computing devices due to the limited computing capacity of smart gadgets, which makes encrypted picture transmission more complicated. We provide a lightweight data forwarding approach for contexts with limited resources to tackle privacy problems related to social network picture sharing. Enhancing data security and resource usage while reducing overhead is achieved by combining large-scale data forwarding and visual cryptography. To lessen the impact of pixel expansion and shrink encrypted picture size without sacrificing decryption quality, we provide a non-expansive approach that is based on downsampling. Our technique outperforms current methods like random-grid, according to experimental data, which show that our peak signal-to noise ratio may reach 20.54 dB and that our structural similarity index can reach 0.72. By eliminating access control gaps, preventing size growth, and facilitating safe and efficient data interchange across linked systems, our solution achieves all of these goals.

Keywords

Secure Image Sharing; Visual Cryptography; Deep Learning; ResNet-50; PSNR, and SSIM.

Current Trends and Research Gaps in Robotics Curriculum in Indian Schools based on Computational Thinking and Career Readiness

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Abstract

Educational robotics (ER) is increasingly being integrated into K-12 learning environments to support the development of computational thinking (CT), STEM-related skills, and early career awareness. This review examines evidence drawn from 40 peer-reviewed journal publications and three doctoral dissertations released between 2003 and 2025, focusing on instructional designs, reported learning outcomes, and underexplored areas within robotics-supported education. Findings indicate that robotics-based instruction facilitates the acquisition of essential CT processes, including algorithm design, logical sequencing, task decomposition, error identification, and systematic problem resolution. In addition to cognitive skill development, ER initiatives are associated with improved learner creativity, collaborative practices, and sustained engagement. Although the majority of studies target middle school populations, positive educational impacts are also documented in early childhood and elementary contexts. A range of educational platforms—such as LEGO Mindstorms, LEGO WeDo, Bee-Bots, Arduino, and Thymio—are employed through inquiry-driven projects, challenge-based tasks, and competitive learning models. Despite expanding international research activity, particularly across North America, Europe, and parts of Asia, current literature reveals notable limitations, including short intervention durations, inconsistent evaluation approaches, limited demographic diversity, and minimal integration of multimodal pedagogical strategies. The review emphasizes the necessity for systematically designed, inclusive ER programs supported by reliable assessment frameworks to inform curriculum development and educational policy.

Keywords

Educational robotics, computational thinking, STEM career preparedness, K-12, curriculum development.

Development and Evaluation of an AI Software Engineer Agent for Kazakhstan

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Abstract

The software development ecosystem in Kazakhstan faces recurring challenges such as repetitive coding tasks, delayed identification of defects, and limited access to AI-assisted development platforms that reflect local programming conventions and multilingual documentation practices. This paper presents an AI Software Engineer Agent (AI-SEA), a localized and integrated assistant that supports code generation, bug detection and repair, performance optimization, and documentation generation for Python, Java, and JavaScript. AI-SEA combines a transformer-based code model fine-tuned on regionally relevant datasets with analysis modules that identify syntax, logic, performance, and security issues and propose actionable fixes and optimizations. To better align with the Kazakh context, the training and evaluation data were constructed from anonymized industrial artifacts and student-developed projects, and the agent accepts prompts and code context in Kazakh, Russian, and English. Evaluation on realistic tasks shows that AI-SEA produces correct code for approximately 81% of tested requirements and achieves around 87% correctness for suggested fixes, while optimization recommendations reduce execution time by roughly 12% and memory consumption by about 14% on average. In a controlled educational deployment with final-year and master's students, AI-SEA reduced task completion time by 29-31%, lowered recurring defect rates by 44%, and received a mean user satisfaction score of 4.2/5. These results indicate that a localized, multi-purpose AI agent can meaningfully improve software development productivity and learning outcomes in emerging markets while respecting privacy through data anonymization.

Keywords

AI software engineering, AI-assisted coding, code generation, bug detection, code optimization, localized AI, Kazakhstan, student projects, industrial software development.

Forecasting Option Pricing Using CUDA-Accelerated Monte Carlo Simulations and Deep Learning

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Abstract

Accurate and rapid pricing of financial derivatives is a cornerstone challenge in quantitative finance. This paper presents a high-performance framework combining CUDA-accelerated Monte Carlo (MC) simulation with Long Short-Term Memory (LSTM) neural networks for forecasting option prices across multiple derivative classes including European, Asian, barrier, and American-style options. By offloading the computationally intensive path-generation stage to NVIDIA GPU hardware via the CUDA parallel programming model, simulation speedups of up to 88.7× are achieved over single-threaded CPU implementations for one million simulated paths. The generated price distributions serve as feature inputs to an LSTM model trained to forecast short-horizon implied volatility surfaces and option fair values. Experimental results on S&P 500 index options demonstrate that the proposed hybrid CUDA-LSTM pipeline achieves a Root Mean Square Error (RMSE) of 0.743 and an R2 of 0.951, outperforming standalone ARIMA and CPU-LSTM baselines. The framework is validated against closed-form Black-Scholes prices for vanilla options and benchmarked on exotic instruments where analytical solutions are unavailable. GPU-accelerated stochastic simulation coupled with deep sequence modelling constitutes a practical and scalable approach for real-time derivative pricing in production trading environments.

Keywords

Option Pricing, CUDA, Monte Carlo Simulation, GPU Computing, LSTM, Derivative Forecasting, Parallel Computing, Black-Scholes, Quantitative Finance, Deep Learning.

AttendVision: A Deep Learning Driven Automated Attendance Management System & Integrated Messaging System

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Abstract

The traditional attendance systems followed by many institutions rely on manual processes such as roll calls, which are prone to errors and may even lead to impersonation and fake attendance. This paper presents a web-based automated attendance management system utilising deep learning-based face recognition to eliminate tedious manual work typically involved in attendance marking, as in traditional methods. The proposed system integrates a user-friendly frontend interface, a backend database for secure attendance storage, and a face recognition pipeline capable of identifying multiple students from group images captured under real-world conditions. Attendance records are automatically generated in both day-wise and consolidated formats, with periodic reports disseminated to faculty via email to support continuous academic monitoring. A comparative evaluation of DeepFace, FaceNet, and ArcFace models is performed, demonstrating that ArcFace provides significantly more robustness and accuracy under low-light, occlusion, and pose-variation scenarios. This indicates that embedding-based approaches can enhance system reliability, making the proposed solution suitable for practical deployment in academic institutions.

Keywords

Face Recognition, Attendance Management System, DeepFace, FaceNet, ArcFace, Deep Learning.

CashewTTS-Net: CNN-Powered Mobile App for Leaf Disease Detection with Voice Alerts

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Abstract

Cashew producers tend to deal with leaf diseases that destroy plant health and limit crop production. Most of these diseases are not detected until the harm has already been made, resulting in financial loss. For assistance with this, we created a mobile application for detecting cashew leaf disease on the spot. The application utilizes a CNN model that is trained using actual images of healthy and infected cashew leaves. The model was translated to TensorFlow Lite so it can be run on mobile phones directly, even without an internet connection. The farmer just needs to point the phone's camera at a leaf, and the application immediately informs them what disease the leaf has. It also suggests the proper pesticide and the amount needed to be applied. To make it even simpler, particularly for farmers who might not be good readers, the app reads the results out in their native language. The solution is meant to be easy, quick, and useful in the field allowing farmers to receive the assistance they require to act early and guard their crops.

Problem Statement: Cashew growers have a problem detecting leaf diseases early, resulting in crop loss. This project will deliver a quick, AI-powered solution that enables precise disease identification and intervention on time.

Keywords

Convolutional Neural Network (CNN), TensorFlow Lite, Image-based detection, Real-time camera input, Text-to-speech, Native language output.

Optimized Solar EV Charging With Efficient Energy Utilization And Grid Integration

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Abstract

This paper presents a solar photovoltaic (PV)-based hybrid electric vehicle (EV) charging system designed to provide reliable and sustainable charging. Due to the intermittent nature of solar energy, battery energy storage and grid support are incorporated to ensure continuity of EV charging operation. A common DC bus architecture is employed to integrate the solar PV source, battery, grid interface, and EV charging load through appropriate power electronic converters. The converters regulate the system voltage and manage power flow among the different sources. The proposed system is modeled and simulated using MATLAB/Simulink to evaluate its performance under varying operating conditions. Simulation results demonstrate stable voltage regulation, effective power sharing, and reliable EV charging operation, confirming the suitability of the proposed hybrid charging system for practical EV charging applications

Keywords

Electric vehicle charging, Solar photovoltaic system, Hybrid EV charging system, Battery energy storage, DC bus architecture, Power electronic converters.

India Eu Maritime Corridor Resilience Index

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Abstract

This paper offers a dynamic, multi-dimensional framework for measuring maritime corridor resilience under prolonged disruptions. Existing studies treat resilience in silos or as some uniformly distributed property, ignoring varying stress trajectories across different dimensions – political, operational and environmental. To take up this issue, we develop a composite resilience index, wherein, we incorporate entropy-AHP hybrid weighing scheme along with normalized indicator scores. The data is tracked on monthly basis across three phases of disruption: shock, adaptation, and prolonged stress.

For each pillar, the resilience is calculated separately, then using phase-specific α -weights, they are aggregated. These α -weights shift depending upon the prevailing risk in each phase. The time span of this study is 21 months (November 2023 – July 2025), with the help of real-world indicators/and their proxies. Findings disclose an asymmetric behaviour – operational pillar showed early signs of capacity, but then it degraded rapidly; environmental pillar also collapsed but with a delay; and the legal/political pillar showed signs of recovery in the initial months but plateaued before it could reach sustainable thresholds.

When it comes to the corridor-level resilience, it never collapses completely, however it goes stagnant at a reduced level – incompetent to recoup the pre-crisis strength. In addition, a sensitivity analysis using multiple α -weights is undertaken which further confirms that resilience is critically sensitive to legal/political strain and environmental delay, even with temporarily robust operational systems.

The index so developed is able to capture evolving systemic stress whilst proposing a scalable tool for the measurement of resilience in multi-factor risk corridors. This model offers a more targeted and responsive approach towards infrastructure planning. The findings of this paper are relevant for maritime corridors that are highly susceptible to geopolitical instability, volatile environments, or persistent governance constraints.

Agentic AI System for Autonomous, Ethical, and Context-Aware HR Communication

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Abstract

Human Resources (HR) departments face increasing demands for efficient, personalized, and ethical communication at scale. This paper presents a novel agentic AI system designed to autonomously manage HR communications while maintaining ethical standards and context awareness. The proposed system integrates natural language processing, multi-agent architectures, and ethical decision-making frameworks to deliver personalized responses across various HR scenarios including recruitment, employee relations, and policy queries. We introduce a hierarchical agent architecture comprising specialized sub-agents for intent classification, context analysis, ethical compliance checking, and response generation. Our evaluation demonstrates significant improvements in response accuracy (94.3%), ethical compliance (98.7%), and employee satisfaction scores (4.6/5.0) compared to traditional automated systems. The system successfully balances automation efficiency with human oversight requirements, providing a scalable solution for modern HR communication challenges.

Keywords

Agentic AI, Human Resources, Natural Language Processing, Ethical AI, Context-Aware Systems, MultiAgent Systems.

Design and Analysis of Low-Power Consumption Linear Feedback Shift Register using a Combined Sleepy and Keeper Technique

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Abstract

Power reduction in digital systems has become a critical design priority, especially for portable devices and energy-constrained embedded applications. Conventional Linear Feedback Shift Registers (LFSRs), widely used in communication systems, cryptographic hardware, and Built-In Self-Test (BIST), consume significant leakage and dynamic power at advanced technology nodes. This work presents a low-power LFSR architecture based on an integrated Sleepy and Keeper transistor technique. The proposed hybrid method suppresses leakage during idle periods through sleep transistors while retaining logic state with keeper circuits to avoid performance degradation. A 16-bit LFSR was implemented and simulated using a CMOS process. Experimental results demonstrate a Leakage reduction in leakage power, 18% dynamic power savings, and minimal delay overhead compared to the conventional LFSR. The design therefore offers an efficient and stable solution for low-power applications requiring continuous state retention and high reliability.

Keywords

LFSR, low-power design, sleepy technique, keeper transistor, leakage reduction, CMOS VLSI, BIST, state retention, power gating, subthreshold leakage.

BC Registered Communicating Nodes in Secure Transport Layer

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Abstract

In this article, a secure Block-Chain (BC) Technology enabled transport layer protocol in communication networks has been explored. It is known that the mechanisms involved in this layer are connection establishment, congestion control and its management. In traditional, transport layer protocols like TCP and UDP suffer security issues in trust-related aspects like spoofing attacks, a non-existence of built-in authentication in UDP, acknowledgement tampering, congestion behaviour, susceptibility to SYN flooding attacks and absence of transparent auditability. Even the very existence of solutions are limited to centralized security mechanisms or higher layer protections which present single points of failure and finite accountability. Therefore, a blockchain ledger is proposed with communicating nodes enabling registered cryptographic identities, where, the cross check with authentication is established in the transport layer framework.

Significance of Training in Data Life Cycle

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Abstract

Data which is prevalent in all the aspects of our life has brought up the concepts of data breach and theft. To prevent the same, data protection laws have been framed. These laws have suggested the different stages of managing the data. These stages collectively called as Data life cycle. These data need to go through from different stages to get protected. It is also essential for the personnel/team who are managing this data should get updated and upgraded with new technology and processes. The team who takes care of the well-being of the data are the cyber/data security team. Thus, for the maintenance and management of this data life cycle, the cyber security team or data security team must be updated with the current technology. This raises the need of training to these teams. The objective of writing this paper is to understand the significance of training and its impact on the revenue of the organization. This study uses a quantitative research methodology, where the sources of primary data has been used which helps in understanding and analyzing the importance of maintaining the data life cycle by the organization.

Keywords

Data, training, cyber security team, expenditure, life cycle.

Performance of Pervious Concrete with Inclusion of Wheat Husk Ash and Pumice Aggregate

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Abstract

In recent era Pervious concrete is widely used in storm water management practices. Wheat straw burnt in open adds to air pollution and generates ash termed as Wheat husk ash. Pumice aggregate possess porous structure that can help in increasing the void content of concrete. To promote the use of agriculture waste wheat husk ash as partial replacement to cement in sustainable construction practices and for efficient draining ability of pervious concrete this study focuses on the suitability of use of wheat husk ash and pumice aggregate in pervious concrete. Compressive strength, Split tensile strength and permeability of pervious concrete were determined. Wheat husk ash and pumice aggregate were replaced by 0%, 2%, 5%, 8%, 10%, 12%, 15%, 18%, 20% by weight of cement and coarse aggregate respectively. The results indicated for replacement of 5% cement with wheat husk ash and 5% coarse aggregate with pumice aggregate compressive strength, split tensile strength increases. With replacement of wheat husk ash and pumice more than 5% the compressive strength decreases. The permeability of pervious concrete with replacement of 8% wheat husk ash and pumice aggregate increases. For replacement of wheat husk ash and pumice aggregate more than 8% the permeability decreases. The experiment findings indicate the suitability of using wheat husk ash and pumice aggregate in application of sustainable pavements and efficient drainage.

Design of Multi-Stage Fractional-Order controller for Load Frequency Control of Islanded Multi-Microgrid System

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Abstract

With the increasing penetration of renewable energy sources, smart grids and microgrids have emerged as key enablers of sustainable and flexible power systems. Smart grids employ bidirectional communication and advanced control strategies to manage power flow under dynamic operating conditions. The interconnection of multiple microgrids at the distribution level forms a multi-microgrid system, improving reliability, resilience, and operational efficiency. However, when operating in islanded mode, multi-microgrids are highly vulnerable to frequency deviations due to the stochastic nature of renewable generation and rapid load variations. To ensure stable and reliable operation, an effective Load Frequency Control (LFC) strategy is essential. This paper focuses on the application of a TD(1+PI) controller for frequency regulation in an islanded multi-microgrid environment. The TD(1+PI) structure combines tracking differentiator dynamics with proportional-integral control, enabling fast disturbance rejection, improved transient response, and reduced steady-state frequency deviation. The controller dynamically adjusts power generation to maintain supply-demand balance under varying load conditions. Simulation-based analysis demonstrates that the proposed TD(1+PI)-based LFC significantly enhances frequency stability and robustness compared to conventional control approaches. The results confirm the effectiveness of the proposed strategy in improving the operational resilience of renewable-dominated islanded multi-microgrid systems, contributing to the development of reliable and efficient smart grid infrastructures.

Development of Prediction Model for Delay and Cost Overruns in the Bridge Construction Project by using Artificial Neural Network

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Abstract

Bridge construction projects frequently faces delays and cost overruns due to various uncertain factors. Traditional risk assessment methods are limited in their ability to analyse complex data and make precise predictions. There is necessity of advanced techniques such as Artificial Neural Network to increase the efficiency in the risk forecasting. This study focuses on to develop an Artificial Neural Network model for predicting delay and cost overruns in bridge construction project. The model was developed by using 123 historical dataset of completed bridges from the Western Maharashtra (India) region, from this 70% dataset utilize for training and 30% dataset kept for testing purpose. The Cascade Forward Backpropagation model shows higher accuracy for predicting delays and cost overrun with an R value of 0.96673, MSE of 0.0012624 and RMSE of 0.035530, as compared to Feedforward Backpropagation model. This research utilizes dual model comparative approach implemented exclusively in bridge infrastructure project, along with real-world dataset from Maharashtra Public Work Department, which is rarely used in previous research work. It offers practitioners for taking decision and detecting the risk in the early stage, as well as to optimize the financial losses.

Educational Game Design Using Data Structures: A Time Travel Adventure Through Ancient and Medieval Eras

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Abstract

Undergraduate students frequently find it difficult to understand data structures because concepts are typically taught in an abstract and theoretical way. We developed an educational game called Time Travel Adventure to give students a more practical understanding of data structures. As part of our coursework, the paper was created using Java and Swing and focuses on the Ancient and Medieval eras. Instead of utilizing Java's built-in libraries, we implemented a particular data structure for each of the game's four small games. In the past, we used a binary tree to simulate the various routes taken during the hunting game and a linked-list-based queue to regulate the order of memory rounds. We were interested in going beyond theoretical descriptions of data structures and really getting down to how they work, when creating this project. We made the game to require interaction with operations such as FIFO in queues, LIFO in stacks, tree traversal through left and right turns, and basic graph optimization. All of which are experienced by the player as they navigate the game. We tested the game with a group of computer engineering students from our department and, although it wasn't a controlled experiment, their feedback suggested that they found the game a lot more manageable than traditional classroom explanations.[1] They found that visual interaction and breaking down the problems into steps was a huge help in understanding how data structures behave during execution.

Keywords

Educational game design, Data structures, Queue implementation, Binary tree traversal, Graph algorithms, Stack operations, Kruskal's algorithm, Interactive learning.

RespireTech: Intelligent Inhaler for Chronic Care Management

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Abstract

Poor medication adherence and incorrect inhalation techniques remain major challenges in asthma management due to the absence of real-time monitoring in conventional inhalers. The proposed system presents an IoT-enabled smart inhaler integrated with cloud computing and deep learning for accurate inhalation monitoring and personalized usage analysis. The system employs MQ-2 and DHT-22 sensors to capture inhalation dynamics and environmental parameters during medication delivery, interfaced with an ESP-32 microcontroller. Sensor data are securely transmitted to a cloud platform for real-time processing, where a Long Short-Term Memory (LSTM) model analyzes temporal breathing patterns to detect inhaler usage and classify correct and incorrect inhalation events. Experimental evaluation demonstrates an inhaler usage detection accuracy of 96.8%, with a precision of 95.9%, recall of 96.4%, and F1-score of 96.1%. Inhalation technique classification achieves an accuracy of 93.2%, indicating reliable identification of improper usage. A mobile application provides real-time alerts, medication reminders, and detailed usage analytics for both patients and clinicians. The proposed solution significantly improves medication adherence, enabling continuous remote monitoring and data-driven decision-making for enhanced asthma management.

Keywords

Internet of things (IoT), Arduino, Smart asthma management, Smart Inhalers, Smart Healthcare.

Detection and Prediction AI Chatbot for Viral Diseases

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Abstract

The rapid transmission of viral diseases represents an ongoing threat to public health systems, especially in areas where reliable access to accurate medical information and early warning about outbreaks is scarce. In response to this gap, we developed an AI-based disease detection and warning solution named Health Guard, which is based on the combination of symptom-driven assessment, real-time disease reporting on a centralized console, and semi-automation-controlled notification exchange. Unlike traditional health chatbots that limit themselves to the analysis of individual symptoms, the presented tool combines a multi-user reporting system with an administrator-powered validation workflow to guarantee information accuracy. Health Guard supports three kinds of users: contributors who report disease occurrences in their area, subscribers who get alerted when a disease outbreak is reported, and general users who can access health-related information. Contributor disease reports are confirmed by an administrator before they are updated into the system database and disseminated via SMS and email notifications using the Twilio communication service. In addition, the platform offers an AI-powered virtual health chatbot that decodes user-submitted symptoms in natural language and provides advice on potential viral scenarios and recommendations for prevention without updating outbreak statistics.

The system is based on Node.js- and Express.js-based backend services, MySQL for structured data management, and a modular API architecture with secure authentication, notification services, and third-party integrations. Experimental results show that the system is able to provide fast response times and secure alert propagation while allowing administrator oversight. The proposed system demonstrates the promise of integrated conversational AI with crowd-sourced, verified data to facilitate early situational awareness and decision-making during a viral disease outbreak.

Keywords

AI-Assisted Healthcare System, Viral Disease Detection, Symptom-Based assessment, Real-Time Disease Reporting, Conversational AI, Public Health Alert System, Administrator-Verified Notifications, Natural Language Processing, Outbreak Monitoring, Web-Based Health Platform.

AI Career Coach: SENSAI

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Abstract

This paper describes a Human-Centered Career Coaching Platform Using Artificial Intelligence for Students and Early-Career Professionals to make informed career decisions, utilizing an innovative combination of full-stack web development and Generative Artificial Intelligence (AI) to create Personalized Insights, Suggested Career Paths, and Skill Development Strategies. The application utilizes modern web technologies such as Next.js, Prisma ORM, and Neon PostgreSQL, creating an optimized architecture for managing Data and a smooth User Experience. Workflow Automation Tools are used to automate all background processing tasks that allow the system to Process User Input Information, Generate Contextual Recommendations, and Deliver Structured Guidance without interrupting Real-Time Performance. Additionally, the use of Generative AI Models within this application allows it to Interpret the Goals of Users, Identify Gaps in User's Knowledge, and Provide Tailored Suggestions aligned with Current Industry Demands. This Research will examine the Architectural Design, Internal Workflow, and Core Functional Components of the System, and evaluate the Systems Ability to Provide Meaningful, Reliable, and Actionable Support to Individuals Developing Their Career Growth Plans. Findings indicate the potential of AI-Driven Tools to Enhance Accessibility, Personalization, and Overall Effectiveness of Modern Career Counseling.

Smart Band Based Fall Detection for Parkinson's Patients

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Abstract

Parkinson is a neurodegenerative disorder which is progressive in nature and has serious effects on motor control causing symptoms like tremors, rigidity and postural instability. As the disease progresses, the patients have trouble with their daily activities and one of the disabling symptoms is the Freezing of Gait (FoG) when the patient momentarily loses his or her ability to start or resume walking. Such abrupt incapacity frequently leads to falls, injuries and poor quality of life. Even with the medical treatment progress, affordable, portable and real-time assistive technologies are required that can aid the detection and reduction of the symptoms of Parkinson especially in falls. The proposed Parkinson Smart Belt is a wearable device, which is an IoT device, to track and identify abnormal gait patterns and sudden falls in Parkinson patients. The system will consist of several sensors including 3-axis accelerator, gyroscope and pulse sensor to monitor the movement and physiological conditions of the patient in a continuous manner. The data is processed by a microcontroller (NodeMCU based on the ESP8266 Wi-Fi) and sent wirelessly to a special mobile app that the caregivers or other healthcare professionals could use to monitor the patient in real-time. The system can also alert instantly in cases of abnormal movement or falls with a vibrational feedback system that has ensured the system responds quickly to emergencies. The main characteristics of the system consist of real-time fall detection, tremor control, and physiological monitoring (heart rate). The gadget is also equipped with location tracking by means of GPS module that is to make sure the patients are assisted as quick as possible. The Parkinson Smart Belt, through incorporation of a feedback system and proper continuation of data transmission, would improve patient safety and equip caregivers with useful information on patient management.

C-Collar: IoT Based Cattle Health Monitoring System

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Abstract

The need for dairy products has increased dramatically in the modern world due to the growing global population. Also, the traditional cattle health monitoring system is very much inefficient due to the expansion of dairy farms. To protect animal welfare and avoid financial losses, an automated, continuous monitoring system that can identify physiological distress and environmental heat stress in real time is desperately needed. The C-Collar project uses an ESP32 microcontroller to connect animal physiological data and remote cloud analytics in order to provide an integrated IoT-based solution for real-time livestock health monitoring. The system offers a comprehensive picture of animal health by utilizing a specialized sensor suite, which includes the MAX30102 for heart rate and SpO2, the DS18B20 for accurate body temperature, a DHT sensor for environmental heat stress tracking, and an ADXL accelerometer for behavioral and movement analysis. Early illness or distress detection is made possible by this automated framework, which offers continuous data acquisition for manual observation. In the end, the C-Collar system provides a non-invasive, scalable method of precision livestock farming that greatly improves animal welfare and operational effectiveness.

Keywords

C-Collar, ESP32, Remote Cloud Analytics, IoT Systems, Sensor suit, Behavioral and Movement Analysis, Animal Welfare.

A Facial Based Emotion Recognition System and Interactive AI

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Abstract

Facial emotion recognition systems have become increasingly important in the fields of human-computer interaction, security, and mental health monitoring. This presents a comprehensive study on the development of a state-of-the-art facial emotion recognition system that employs advanced machine learning techniques to accurately identify human emotions from facial expressions. The system utilizes convolutional neural networks (CNNs) to process facial images and extract relevant features that correspond to various emotional states. A pre-processing pipeline is designed to enhance image quality and normalize facial data, ensuring consistency across different lighting conditions and facial orientations. The emotion recognition model is trained on diverse and annotated datasets, covering a wide range of demographic variations to improve its generalizability and robustness. Experimental evaluations demonstrate the system's high accuracy in detecting and classifying emotions such as happiness, sadness, anger, surprise, fear, and disgust. The proposed model outperforms existing approaches in terms of precision, recall, and overall recognition rate.

Effect of Geosynthetic Reinforcement in Unpaved Road Using Static Cone Penetration Test

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Abstract

Unpaved roads are largely constructed in rural, mining, and forest areas. They are economic and less labour extensive as compared to paved roads. However, they often under-perform when subjected to heavy loads and high traffic volume. The major challenges related to unpaved roads are excessive rutting, surface deformation, and reduced serviceability, when built on soft subgrade soils. This leads to higher maintenance cost and compromises overall road safety. A comparative investigation was done using static cone penetration test (SCPT) on soft subgrade with and without geosynthetic reinforcement. The geosynthetics compared in this study were geogrid and geotextile. These reinforcements were placed at 50 mm and 100 mm depths in the test section to determine their effects on the load distribution and strength improvement. The results of the reinforced sections showed increased cone resistance value, decreased penetration depth, and increased stiffness compared to the unreinforced soil. The geogrid reinforced subgrade shows an increase of 225 % cone resistance while 144 % resistance is achieved using geotextile when compared to unreinforced section. These improvements may contribute to durability of the road, lower maintenance costs, and better road safety. The study will help the field practitioners to efficiently place these reinforcements for suitable applications.

Rehab360: The AI-Powered Chat-Based Healing with Emotions to Full-Care Advice

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Abstract

Rehab360 is a new AI-based holistic recovery service that is intended to assist those with addictive and mental health issues with intelligent and individualized assistance. The project will reinvent classic rehabilitation through applying artificial intelligence, emotional intelligence, and predictive analytics to a single system of digital support. Rehab360 aims to offer around-the-clock emotional and behavioral support through the use of cutting-edge technologies, including emotion-sensitive chatbots, craving forecasting applications, nutrition apps, and real-time crisis forecast. The system has Natural Language Processing (NLP) and sentiment analysis to interpret the emotions of the user and support him in conducting conversations, empathizing with the user and guiding him through difficult times. The patterns of craving are predicted with the help of machine learning methods like ARIMA and SARIMAX and help to detect the situations under the threat of relapse and intervene in time. Moreover, the platform provides individual nutritional information and inspirational guidance to enhance physical and mental health to guarantee a complete healing process. Another feature of Rehab360 is a crisis detection which gives attention to emotional and behavioral patterns in order to detect possible emergencies and offer immediate assistance or warnings. The system brings about a supportive and adaptive atmosphere to the users by integrating emotional awareness, predictive analytics, and holistic care guidance. The end vision of Rehab360 will be to improve the recovery rates, decrease the levels of relapses, and support people with a caring mobile friend during a longterm recovery and sustainable health.

Keywords

AI, Addiction Recovery, Aware of my emotions chatbot, Natural Language Processing, Machine Learning, Craving Prediction, Crisis Detection, Predictive Analytics, Holistic Healthcare, Personalized Care Discovery, Mental Health Monitoring, Smart Rehabilitation System.

Smart AI Wildlife Detection and Warning System

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The Smart AI Wildlife Detection and Warning System is created to help prevent accidents in areas where wild animals and people live close to each other. The system continuously watches the surroundings using cameras and identifies the presence of animals at an early stage. When an animal is noticed, the system sends warning messages or alerts so that people can take safe actions in time.

This project is mainly useful for forest roads, village borders near forests, and wildlife-sensitive areas. It helps reduce unexpected animal encounters and supports safer movement for humans while also protecting animals from harm. The system proves that intelligent technology can play an important role in improving safety and supporting wildlife conservation.

Keywords

Smart AI, Wildlife Detection, Warning System, Animal Monitoring, Accident Prevention, Camera Based Detection, Human–Wildlife Safety, Real-Time Alerts.

Machine Learning Framework for the Industrial Machine Sound Classification in Predictive Maintenance

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Abstract

The "Machine Learning Framework for Industrial Machine Sound Classification in Predictive Maintenance" project aims to develop an advanced system for the classification of industrial machine sounds. The system analyzes audio data from industrial pumps to detect anomalies that may indicate mechanical issues or failures. By leveraging machine learning algorithms such as CNN+LSTM, AST, CRNN, Inception and AE, the framework efficiently processes and classifies sound data into normal and faulty categories. The framework supports predictive maintenance by identifying potential problems before they become critical, thus reducing downtime and improving the longevity of industrial machinery. The project employs a dataset of audio recordings representing different machine states and uses various feature extraction and classification techniques to ensure accurate predictions. The backend of the system is built using Python and Flask, while the frontend is developed using HTML, CSS, and JavaScript. The system also includes modules for user registration, login, sound classification, and model comparison.

Keywords

Industrial machines, sound classification, machine learning, predictive maintenance, CNN+LSTM, AST, CRNN, AE.

Ship Localization in SAR Imagery using YOLOv1 and Customized MobileNet V2

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Abstract

Ship detection method for single class object detection task is proposed on custom SAR data using a YOLO-inspired approach with MobileNet V2 as a backbone pretrained on ImageNet. The objective of this work is to highlight the applicability of CNN model having higher speed and accuracy while having low computational burden for SAR ship detection. We evaluate the model performance based on Training loss, Validation loss, mAP (mean Average Precision), Recall, mAP50, mAP50-90 and Intersection over Union (IoU).

Keywords

SAR Ship Detection, CNN, YOLOv1, MobileNet V2.

AI - Powered Allergy Aware Medicine Dispenser

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Abstract

This study introduces an AI-driven Allergy-Aware Medicine Dispensing System to ensure secure administration of medicines and prevent adverse drug reactions. The system combines IoT, AI, and technology for automation by using an ESP32 microcontroller to control an RFID device for patient identification and motors with servos for drug delivery. Patient data stored in a database, including allergy information, makes it possible to verify each dispensing process in a unique way. When a patient scans their RFID card, the technology checks to see if the medicine they are about consuming is in their allergy group. An artificial intelligence system based on a Decision Tree classification system suggests a safe alternative medication if an allergy is found in a patient database. The ESP32 is powered by a steady 5V supply module, which then turns on the right servo motor to deliver the right medicine. This smart system makes drug management more accurate, secure, and effective, which makes it a reliable way to deliver smart and personalized healthcare. For hospitals, clinics, and medical services at home systems, it is a good chance to improve patient health by making it less likely that they will have to take allergy medications. This product will be very helpful for giving medicine to older people.

Keywords

ALLERGY, MEDICINE DISPENSER, AI, 5V supply module, ESP32, RFID card, Decision Tree Classifier.

Vision Transformers-Enhanced Signal Denoising System for Robust 6G Communication

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Abstract

The evolution of 6G communication networks demands highly reliable and low-latency signal transmission under extremely noisy and dynamic environments. Traditional signal denoising techniques often struggle to handle complex interference patterns and rapidly changing channel conditions. To address these challenges, this paper presents a Vision Transformers (ViTs)-enhanced signal denoising system designed to improve the robustness of 6G communication. In the proposed approach, received communication signals are transformed into structured visual representations, enabling Vision Transformers to effectively capture long-range dependencies and global contextual features. Unlike convolution-based models, Vision Transformers utilize self-attention mechanisms that allow the system to focus on important signal components while suppressing noise and interference. This results in more accurate noise reduction and improved signal reconstruction. Experimental evaluations demonstrate that the proposed model achieves superior denoising performance compared to traditional filtering and deep learning-based methods, especially in high-noise and non-stationary environments. The enhanced denoising capability leads to improved signal-to-noise ratio (SNR), lower bit error rate (BER), and increased communication reliability. Overall, this Vision Transformers-based denoising framework shows strong potential for enabling robust, intelligent, and efficient signal processing in future 6G communication systems.

MultiSow: An AI-Enhanced Multi-Tier Crop Management System for Sustainable Intercropping

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Abstract

The global agricultural sector faces critical challenges including declining arable land and resource scarcity necessitates the shift in the current mode of mono-cropping to intensive and resource-efficient agricultural systems. This study presents MultiSow, an AI-based multi-tier crop management system that will support and streamline Multi-Tier Intercropping (MTI). MultiSow allows designing and analysing the layered cropping models that maximize the space and nutrient use by relying on a multi-tier management framework. This incorporates a Strata System Designer which offers real-time compatibility analysis on four different vertical qualified layers namely; Overstory, Middle Tier, Understory, and Vertical Layers. Also, a Soil Compatibility Analysis module has been included in the system to fit the major Indian soil types, including Alluvial, Black, Red and Laterite etc., to provide a localized accuracy in the choice of crop.

MultiSow was created with a FastAPI back-end, SQLite database, and Vanilla JavaScript front-end, and is a scalable and lightweight data-driven agriculture tool. The experimental modelling and field simulations show that the platform has the capability to reduce water consumption by 40-70 percent and increase productivity per unit area by 3.5x to 4.2x over traditional farming. MultiSow provides a sustainable agricultural intensification solution with the help of the introduction of an AI-based compatibility advisor and a multi-factor yield prediction model. The study uncovers the conclusion that MultiSow can help in narrowing the digital innovation-to-real land-use optimization gap and provides a critical approach to streamline agricultural production in resource-restricted settings.

Keywords

Multi-tier intercropping, precision agriculture, ai advisor, sustainable farming, fastapi, stratification optimization.

A Comprehensive Survey of Deep Learning Approaches for Diabetic Retinopathy Detection and Grading from Fundus Images

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Abstract

Diabetic Retinopathy (DR) is a leading cause of vision impairment among working-age adults worldwide. Early detection and accurate grading of DR are essential for preventing irreversible vision loss. In recent years, artificial intelligence (AI) and deep learning (DL) have demonstrated remarkable performance in automated DR screening using retinal fundus images. This paper presents a comprehensive review of deep learning- based approaches for DR detection, classification, and grading. We systematically analyse convolutional neural networks, attention mechanisms, ensemble learning, transfer learning, vision transformers, and uncertainty-aware models proposed between 2021 and 2024. Additionally, explainable AI techniques and uncertainty estimation methods are discussed to highlight their role in enhancing clinical trust and reliability. Public datasets, evaluation metrics, challenges, and future research directions are also examined. This survey aims to provide researchers and clinicians with a structured understanding of current advancements and open problems in automated DR analysis.

Keywords

Diabetic Retinopathy, Deep Learning, Retinal Fundus Images, Convolutional Neural Networks (CNN), Transfer Learning, Image Classification, Medical Image Analysis, Disease Grading, Automated Diagnosis, Explainable AI.

ML-Driven Hybrid Framework for Mental Health Screening in Adolescents and Person with Disabilities

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Abstract

This review combines and reviews the latest trends in ML-based mental health screening systems for children and persons with disabilities (PWDs). Although PHQ-9A and ASQ, the common identification tools, are clinically validated, their dependency on subjectivity and limited scalability remain major concerns. The application of cutting-edge ML and DL models has opened up new possibilities for automated, multi-faceted, and very precise screening through text, voice, face and bodily functions data. In this context, the paper presents a multi-method research design and a hybrid CNN-LSTM-Random Forest framework that synergizes the strengths of CNN's feature extraction, LSTM's pattern learning in sequences, as well as the interpretability of Random Forest. The combined model has the ability to outshine the separate algorithms and has reported 99.3% as the accuracy throughout. The system described not only promotes but also provides the important dimensions of inclusivity, interpretability, and real-time prediction as major infrastructures for the future ubiquitous mental health solution.

Keywords

Machine Learning, Deep Learning, CNN, LSTM, Random Forest, Hybrid Model, Mental Health, Adolescents, PWDs.

DAPE: Decentralized Autonomous Programming Environment for Tamil NLG Code Generation

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Abstract

The democratization of software engineering is fundamentally hindered by the English-centric paradigm of traditional programming languages, creating cognitive barriers for developers whose primary language is morphologically rich like Tamil. Current reliance on cloud-based Large Language Models for code generation introduces critical vulnerabilities regarding data sovereignty, intellectual property leakage, and network latency. This paper introduces the Decentralized Autonomous Programming Environment (DAPE), a novel peer-to-peer framework enabling developers to construct complex software systems using natural Tamil prompts. DAPE's core innovation comprises a Direct Bytecode Synthesis engine performing semantic mapping from Tamil tokens directly to machine-executable opcodes, bypassing high-level source code generation, and a P2P mesh network that distributes computational tasks across local devices. The system formally models Tamil's agglutinative morphology, treating logical operators as suffixes to root lemmas. Evaluation via a simulated heterogeneous network of 15 nodes demonstrates 95% logical accuracy measured via Jaccard Coefficient and 85% reduction in end-to-end latency compared to cloud baselines, with 0% False Matching Rate for authorized prompts.

Advances in Explainable CNN-Based Models for Reliable Plant Disease Detection

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Abstract

Spotting sick plants matters a lot when farming - waiting too long can wipe out whole crops. Lately, smart computer systems, particularly those using deep learning, help find these illnesses just by looking at pictures of leaves. A useful trick here is borrowing already-trained models, say ones built on ImageNet, then tweaking them for smaller collections like PlantVillage. That speeds things up, needs fewer photos, yet still spots problems better most times. Models people pick again and again include ResNet, VGG, along with Inception. Still, big problems pop up once these systems leave the lab. Even if they work great on tidy, organized data, their performance drops with actual field photos. Out there, pictures come with messy light, cluttered surroundings, or leaves piled on top of each other. That mismatch - what's seen during training versus what shows up outdoors - is called the lab-to-field gap, sometimes just domain shift. To show how tough real-life crop disease spotting really is, collections like PlantDoc came into play; since then, researchers tried closing the divide through methods including unsupervised domain adaptation. On top of that, new studies looked into different supporting ideas. Instead of real ones, fake pictures are made using GANs when there's not enough data. Some systems can now spot plant issues they haven't seen before - this helps a lot out in fields. Smaller AI models were built so phones and similar gadgets can detect problems even offline. Lately, tools that show what parts of a leaf image the system focuses on have come up, making it easier to see how decisions are made. This review looks at how transfer learning is used for spotting plant diseases, while also tackling problems faced in actual use. Through checking older and newer research, it points out what's still missing and suggests where work should go next to build AI tools that really work on farms.

Integrating AI and Climate Science: A Scenario Simulator for Predictive and Adaptive Climate Modeling

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Abstract

Climate change is characterized by complex, non-linear and uncertain dynamics that are difficult for traditional physics, based climate models to scale, adapt and provide real, time decision support. In this paper, we describe an AI, Climate Scenario Simulator (AI, CSS) that uses AI to create, study, and assess the influence of future climate scenarios by utilizing multi, source environmental and socio, economic data. Our model utilizes the theory of advanced machine and deep learning and incorporates it into a unified framework for the modeling of spatio, temporal climate patterns, simulation of emission and policy alternatives, and assessment of environmental impacts. The simulator can produce climate scenarios dynamically under different levels of uncertainties, thus being useful for both long, term climate change projections and short, term extreme event analyses. Besides, the paper describes the integration of explain able AI components, which reveal the reasons of model predic tions and identify influential climate drivers, thereby increasing model transparency and reliability. We compare our approach with traditional statistical methods and numerical simulations and evaluate it by forecasting historical climate data, from which results it appears that our approach has better predictive performance, is more robust and efficient computationally. AI, CSS framework serves as a scalable, flexible decision, support tool for both climate scientists and policymakers, which facilitates assessing climate risks, evaluating mitigation strategies, and planning for sustainable development.

Keywords

Artificial Intelligence, Climate Scenario Sim ulation, Machine Learning, Deep Learning, Climate Change Modeling, Predictive Analytics, Sustainability, Decision Support Systems.

Bacterial Consortia for Biodegradation of Aquaculture Effluents: A Systematic Review of Isolation Strategies and Optimization Approaches

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Abstract

The above trend of rising global aquaculture industry brought about the need to satisfy protein needs of an increasing human population that has set the stage of a critical environmental issue, which is the handling of high-strength effluents with high nitrogenous compounds, organic strain, and the emergence of micropollutants. With the upgrading of the industry to Recirculating Aquaculture Systems (RAS) and extreme-intensive pond cultures, the release of untreated or insufficiently treated wastewater presents dire threats of eutrophication, hyper-nitrification of the receiving water bodies, as well as the growth of antibiotic-resistant pathogens. Traditional physical and chemical treatment options are not economically viable and environmentally friendly to large scales. It was a systematic review systematized in line with IEEE and meets the PRISMA requirements, which thoroughly discusses the effectiveness of bacterial consortia in biodegradation of aquaculture wastewater. Isolation strategies are critically analyzed and the emphasis has shifted to high-throughput microfluidic screens and metagenomic-guided selection which enable the reconstruction of synthetic microbiomes by abandoning old methods of enrichment culture that are limited by capturability bias. Moreover, the review outlines optimization strategies, the classical One-Factor-at-a-Time (OFAT) models vs. the advanced statistical tools like Plackett-Burman Design (PBD), Response Surface Methodology (RSM), and emerging artificial intelligence (AI) models like Artificial Neural Networks (ANN). A particular focus is made on the mechanistic foundations of synergistic interactions, namely quorum sensing, metabolic cross-feeding, and algal-bacterial symbiosis, which makes the consortia better than single-strain applications. The report ends by the techno-economic analysis of immobilization technology (biochar, alginate encapsulation) and bioaugmentation plans and finds scalability, biosafety, and regulatory compliance to be the most obvious limitations in adopting such technologies in industry.

Keywords

Aquaculture wastewater, bacterial consortia, recirculating aquaculture systems (RAS), microfluidic screening, response surface methodology, quorum sensing, techno-economic analysis.

Educational Phishing Detection: A Machine Learning Approach with Feature Selection and DL Models

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Abstract

Digitization of academic qualifications has instilled a quicker process of checking certificates but has also resulted in a tremendous increase of fake certificates which is a major challenge to the employers, schools, and even to the government agencies. I am suggesting a self-driving, intelligent system, which in this project will take place, and proposal is to apply the recent machine-learning tricks, as both traditional machine-learnings and deep neural nets, to substantially check educational materials with hardly any human effort. The system negotiates with the issuers in real time and in a safe manner, extracts significant details such as the ID characteristics of the institution, certs design, the text, and concealed metadata. It uses CNNs to identify such visual features as logos, seals, signatures, layout and RNNs or LSTMs, line by line, to read the text in question without excising any suspicious mysteries that are a clue of a fake. The pattern of combining these visual and textual suggestions makes the model more apposite at detecting abnormalities. And, there is an encrypted web portal that either has good authentication and is restricted to ensure that data is secured across the entire process. During testing, the system performs better than the older systems on the accuracy, reduces the time required to check, and has a lesser dependence on manual verification. All in all, it provides a greater degree of transparency and trust, facilitates scale, combats paper fraud and promotes institution credibility. This study advances to the extreme of science, engineering and tech by providing a stable tool of validating the academic qualifications in a digital era, in a safe and smart manner.

Keywords

Educational Phishing, Machine Learning, Deep Learning, Educational certificates, Legitimacy.

Research on Intelligent Wafer Sensor Fault Detection using Machine Learning

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Abstract

For electrical equipment to function properly, semiconductor wafer quality and dependability are essential. Traditional fault detection techniques frequently miss small flaws that could cause serious product failures. This paper presents an intelligent wafer sensor fault detection system using machine learning to improve reliability in semiconductor manufacturing. Wafer sensor datasets are collected from Kaggle and preprocessed for noise removal, normalization, and feature extraction. A Random Forest/XGBoost algorithm is applied to train the model, ensuring high accuracy and robustness in detecting faulty wafers. To enhance transparency and reliability, multiple datasets are utilized during training and evaluation. The finalized model is integrated into a Flask-based web application with Python backend, enabling users to upload wafer sensor data and receive real-time fault predictions. This system aims to reduce manual inspection, minimize production downtime, and provide a scalable solution for efficient fault detection in wafer processing.

Keywords

Machine Learning, Kaggle, Random Forest, XGBoost Algorithm, Flask, Python.

Machine Learning–Based Predictive System for Early Detection of Pancreatic Cancer

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Abstract

Pancreatic cancer has the highest global rate of mortality from all cancer types due to its rapid development, lack of early warning signs, and usually presenting with advanced stages; therefore, historically, less than 10% of patients treated for pancreatic cancer survive five years post-diagnosis. In this work, we created a machine learning model that helps clinical practitioners calculate how long individuals with pancreatic cancer are expected to live based on their demographic, clinical, symptom and lifestyle data. The dataset used to create our model included over 50,000 de-identified patient records from 23 countries with 23 features that could predict survival. Then, we trained and evaluated the four supervised learning models of Logistic Regression, Gradient Boosting, XGBoost, and Random Forest on their overall accuracy, interpretability, and computation efficiency. Random Forest outperformed all other models with an accuracy of 87.15% and a high level of generalizability. The final machine-learning model is accessible via a personalized Streamlit Web Application that generates real-time survival predictions, probability scores, visual analytics, guidelines, and interpretable outputs of the model. This web application empowers clinicians and researchers to utilize machine learning results through an easily accessible, interpretable user interface.

Keywords

Pancreatic cancer, machine learning, Random Forest classifier, survival prediction, clinical decision support system, Streamlit, healthcare analytics.

Design of a 106:1 Hybrid Planetary-Cycloidal Actuator for Purpose of High-Torque Applications

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Abstract

In the domain of electromechanical actuation, achieving high torque density within a limited volume is a persistent engineering challenge. High-torque rotary actuators are fundamental components in industrial automation, robotic manipulators, and heavy-duty positioning systems. While conventional multi-stage planetary gearboxes provide necessary reduction and often suffer from excessive length and backlash. This paper presents the analytical design of a compact hybrid actuator that integrates a planetary pre-stage with a cycloidal output stage. It proposes a hybrid architecture: a “Two-Stage” concentric reducer. Stage-1 utilizes a planetary gear set (4.235:1) to reduce input speed, while Stage-2 employs a cycloidal mechanism (25:1) for massive torque multiplication. The system delivers a total reduction ratio of 105.88:1 in a unified module. The design leverages the high-speed efficiency of planetary gears and the shock-load capacity of cycloidal discs. This study details the geometric parametrization of the cycloidal profile and analyzes the inherent mechanical benefits of hybrid architecture. Furthermore, the adaptability of the mechanism is evaluated across various prime movers, including Stepper motors and BLDC drives, demonstrating its versatility for diverse high torque applications.

Keywords

Cycloidal Mechanism, Gear Transmission, Hybrid Actuator, Planetary Gear, Torque Multiplication.

Solar Based Water Purification: A Sustainable Approach for Clean Water Access

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Abstract

Purification of water is essential for removing harmful contaminants like bacteria, viruses, heavy metals, and chemicals from drinking water to prevent waterborne diseases such as cholera, typhoid, and diarrhea. Various physical, chemical and biological methods are used for it. In this study solar energy is used for purification of water.

Access to safe drinking water remains a critical global challenge, exacerbated by population growth, industrialization, and climate change. Traditional water treatment methods are often energy intensive, costly, and dependent on centralized infrastructure. Solar based water cleaning technologies present a sustainable alternative by harnessing abundant solar energy for pollutant removal and microbial disinfection. This paper reviews major solar driven water purification methods, analyzes system efficiencies, discusses key design parameters, and evaluates both laboratory and field performance. Results demonstrate that solar technologies, particularly solar disinfection (SODIS), solar distillation, and photo catalytic degradation, can effectively improve water quality with low operational cost and minimal environmental impact. Challenges related to scalability, weather dependence, and material durability is addressed, concluding with recommendations for future research and policy integration. It ensures long term health, improves taste and odor, supports better digestion, and protects against toxins that can lead to serious, chronic health issues.

Assessing Lake Encroachment in Urban Sprawl of Chennai Metropolitan Area using Remote Sensing and GIS

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Abstract

Rapid urban expansion in the Chennai Metropolitan Area (CMA) has significantly altered the spatial structure and ecological integrity of urban lakes. This study evaluates the impact of built-up growth and encroachment within a 250 m buffer around three strategically selected lakes—Rettai Eri (North Chennai), Perungudi (Central Chennai), and Perumbakkam (South Chennai)—using Remote Sensing and GIS techniques. Multi-temporal satellite imagery (2006, 2016, and 2025) was processed to generate Land Use Land Cover (LULC) maps and NDWI for water spread assessment and NDBI for built-up intensity analysis. Change detection techniques were applied to quantify spatial transformation patterns and identify land-use transitions within lake buffers. Built-up intensity mapping was used to delineate encroachment pressure zones, while Land Surface Temperature (LST) analysis examined the influence of urban growth on micro-climatic conditions. Results indicate a consistent increase in impervious surfaces and a parallel decline in water spread and vegetation cover across all three lakes. Spatial correlation between high NDBI and elevated LST confirms the intensification of localized urban heat effects. The study demonstrates that continued unregulated development within statutory buffers threatens lake storage capacity, ecological resilience, and climate-regulating functions, underscoring the need for spatially informed lake buffer protection and sustainable urban planning interventions.

Bio Nexus: A Centralized Platform for Matching Multi-Biological Samples and ML Based Predictive Healthcare

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Abstract

Accurate donor-recipient compatibility evaluation, especially Human Leukocyte Antigen (HLA) matching, is crucial for hematopoietic stem cell transplantation and associated biological therapies. Existing systems are still restricted to registry-centric models and single biological sample types, even with advances in machine learning-based donor selection. The centralized biomedical platform Bio Nexus, which combines automated compatibility matching, predictive disease risk analysis, clinician-in-the-loop validation, and multi-biological sample sharing, is proposed in this paper. The system uses machine learning models like XG Boost and K-Nearest Neighbours (KNN) for risk assessment and compatibility prediction. Bio Nexus supports a variety of biological inputs, including stem cells, blood cells, bone marrow, tissue biopsy samples, and saliva-based genetic markers, in contrast to conventional methods. In comparison with conventional manual methods, it has demonstrated enhanced predictive accuracy and matching workflow efficiency through experimental evaluation. The proposed framework aims to improve transplantation decision-making processes and facilitate technologically driven biomedical collaboration.

Keywords

Stem Cell Matching, HLA Compatibility, Machine Learning, Biomedical Data Integration, Predictive Healthcare, XG Boost, KNN.

Vision Based Realtime Vehicle Theft Detection Using YOLOv12

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Abstract

Urban vehicle theft remains a persistent problem because manual monitoring and response systems are limited. Typical surveillance systems often fail to distinguish between normal and suspicious actions, leading to missed events or frequent false alarms. This work introduces a vision-based prototype for detecting and responding to vehicle theft. It aims to assist law enforcement through an automated alert system. The setup uses YOLOv12, an advanced object detection algorithm, to spot individuals showing unusual behavior near parked vehicles. This includes actions like lingering too long, tampering with locks, trying to force entry, or interacting with sensitive vehicle parts. When such behavior is detected, the system captures real-time images, uses EasyOCR to extract the vehicle's license plate number, and sends visual proof to the registered owner for verification. If the owner confirms the action as theft, the system automatically alerts nearby law enforcement with the suspect's image, location coordinates, and timestamp. If the owner does not respond within a set time, the system marks the event for manual police review. This confirmation-based method greatly cuts down on false positives while enhancing the link between real-time monitoring and effective policing. The proposed solution shows great promise for preventing urban crime, providing a scalable and practical model for smart city security systems.

Keywords

YOLOv12 Algorithm. Smart Surveillance Systems. Urban Vehicle Security. AI-Powered Crime Prevention. EasyOCR Plate Recognition. Vision-Based Law Enforcement Support. Next-Gen Surveillance Automation.

Sustainable Heliport Infrastructure Development: Integrating Electric Vertical Take-Off and Landing (eVTOL) Technologies for Urban Air Mobility in Emerging Economies

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Abstract

The rapid urbanization of emerging economies necessitates innovative approaches to transportation infrastructure that balance connectivity requirements with environmental sustainability objectives. This paper examines the integration of electric vertical take-off and landing (eVTOL) technologies within heliport infrastructure frameworks, proposing a comprehensive model for sustainable urban air mobility development. Drawing from three decades of helicopter operations experience and heliport infrastructure implementation across India, this research analyzes technical requirements, regulatory considerations, and sustainability parameters essential for next-generation vertical flight infrastructure. A mixed-methods approach incorporating site assessments, stakeholder consultations, and technology readiness evaluations reveals critical success factors for eVTOL-compatible heliport development. The findings indicate that strategic infrastructure positioning, renewable energy integration, noise mitigation technologies, and modular design principles significantly enhance operational sustainability while maintaining economic viability. The proposed Sustainable Heliport Development Framework addresses United Nations Sustainable Development Goals 9 (Industry, Innovation and Infrastructure), 11 (Sustainable Cities and Communities), and 13 (Climate Action). This research contributes actionable guidance for policymakers, aviation authorities, and infrastructure developers seeking to establish future-ready vertical flight facilities that support sustainable urban transportation ecosystems.

Keywords

eVTOL, Sustainable Aviation, Heliport Infrastructure, Urban Air Mobility, Green Aviation Technology, Advanced Air Mobility, Emerging Economies.

The Evolution of WiFi-Based HAR: A Review of Learning Paradigms and Sensing Modalities

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Abstract

WiFi-based Human Activity Recognition (HAR) is a promising device-free sensing paradigm that makes use of the current wireless infrastructure to identify human activity without requiring users to wear sensors [1], [2]. Researchers have shown the scope of successful activity recognition in smart homes, healthcare, and human-computer interaction by taking advantage of variations in WiFi signals, such as Channel State Information (CSI), Received Signal Strength Indicator (RSSI), and Doppler frequency shifts. With an emphasis on Internet of Things (IoT) environments, this paper aims to provide an extensive review of WiFi-based HAR. We summarized representative datasets, examined the shift from conventional machine learning to deep learning techniques, and offered an organized taxonomy based on sensing modalities and learning paradigms. We also go over deployment, security, and robustness issues that have been brought to light by recent critical studies.

Keywords

WiFi (Wireless Fidelity) sensing, Human Activity Recognition (HAR), Channel State Information (CSI), RSSI (Received Signal Strength Indicator), IoT (Internet of Things), Deep Learning, Federated Learning, Device-free sensing.

Extensive Study of Challenges in Concentrated Solar Power Plant using Heliostats

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Abstract

This study presents a simplified and efficient design for a Concentrated Solar Power (CSP) plant utilizing conventional molten salt storage systems. The proposed configuration minimizes operational complexity and reduces maintenance costs by employing an automated heliostat field equipped with high-precision, self-aligning mirrors that continuously track the sun in real time. These mirrors focus solar radiation directly onto central receiver silos containing water, thereby eliminating the need for intermediate heat transfer fluids. Under concentrated solar flux, the water undergoes a direct phase transformation from liquid to high-pressure steam within the receiver container. This steam is subsequently fed into a steam turbine, where its kinetic energy is converted into mechanical work to drive a generator, producing electricity. By removing salt-handling components, the system reduces thermal losses across multiple heat exchange layers and mitigates corrosion risks inherent to molten salts. Overall, the proposed model introduces a cost-effective and direct solar-to-electric conversion process emphasizing optical accuracy, high-temperature steam cycles, and structural simplicity—factors that collectively enhance the efficiency and sustainability of CSP technology.

Smart Respi Track for Contactless Respiratory Monitoring

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Abstract

In critical health care situations, especially in rural or remote areas or unattended environments, timely diagnosis of respiratory distress or apnea are very significant in the prevention of life threatening complications. Smart Respi Track is a contact free, real time Internet of Things based respiratory monitoring system for hassle free continuous monitoring of breathing work without any physical contact or wearable sensors. The solution benefits from milli meter wave radar technology that can track micro motions of the chest wall with precision and hygiene, to accurately track the patient's breath. Compared to conventional methods based on wearables or heavy equipment, Respi Track provides a non-invasive, scalable and low-cost technology that can be implemented in a wide variety of medical locations. At its heart, a low-power ESP 32 (Espressif Systems Platform 32 bit) microcontroller is used to process signals from the radar and communicate via secure cloud connectivity. Easy-to-use web-based dashboard lets caregivers and medical professionals view real-time respiratory rate, rate trends, respiratory rate anomalies, and respiratory rate trend. To ensure the highest level of patient safety, an intelligent alert mechanism is integrated into the system and will generate notification alerts through either buzzer, SMS (Short Message Service), mobile app notification, or automated voice calls for abnormal respiratory patterns or apnea events detected.

UAV Deployment Strategies in FANETs: A Review

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Abstract

The use of FANETs has been essential in facilitating groups of UAVs to collaborate in such a task as disaster management, establishing temporary wireless connections, surveillance, or intelligent traffic management. The FANETs are not like conventional ground ad-hoc networks. They include speed, 3-dimensional mobility, ever-changing network topology and energy constraints. As a result of these reasons, the method of deployment of UAVs is of critical importance. The decisions to deploy are made to have an adequate coverage, good connections, reliable communications and to prevent untimely battery drainage. This paper is a review of 20 years of literature on the presence of optimal deployment of UAVs in FANETs. Discussed are the methods of static deployments, dynamic methods using one mobile UAV, and more advanced methods using multiple UAVs cooperating in their deployment. The different models of deployments such as optimization-based, learning-based, and hybrid models were studied to compare their effectiveness. The article identifies key trends, assesses the effectiveness of various strategies, and indicates outstanding open areas of concern. This research paper will aim at providing a well-structured, broad guide to the researchers and engineers when determining future FANET solutions.

Keywords

FANETs, UAV deployment, aerial networks, coverage optimization, swarm UAVs.

Hybrid CNN and EfficientNet-Based Facial Emotion Recognition System

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Abstract

Facial Emotion Recognition (FER) is a key research area in affective computing and human-computer interaction. This paper presents a deep learning-based FER framework that integrates a hybrid Convolutional Neural Network (CNN) with EfficientNet to achieve accurate and robust facial emotion classification. The CNN layers are used to extract low-level spatial facial features, while EfficientNet provides efficient high-level feature representation through compound scaling. The system is implemented in Python using Google Colab for backend processing and Streamlit for frontend deployment. Experimental evaluation conducted on the **RAF-DB benchmark dataset** demonstrates that the proposed hybrid CNN-EfficientNet model achieves improved performance in terms of accuracy, robustness, and generalization when compared to a conventional CNN-based approach. Specifically, the proposed method attains an **F1-score of 0.71**, outperforming the baseline CNN model which achieves an **F1-score of 0.67**, thereby validating the effectiveness of the hybrid architecture for reliable facial emotion recognition.

A Hybrid CNN Framework for Robust Detection of AI Generated Imagery

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Abstract

As the generative technology has improved so much, specifically via two key types of generative models, Generative Adversarial Networks (GANs) and Diffusion-Based Frameworks, it is nearly impossible to visually identify or distinguish between real and synthetic images. While this shift has opened many creative opportunities, it has also raised grave concerns, including issues related to deepfakes, fake news, identity theft, etc. Therefore, in response to these new and significant concerns regarding the authenticity of images and who created them, this paper will assess the possibility of a Hybrid Image Classification approach using both traditional forensic techniques and deep learning methods. More specifically, we employed a dataset consisting of both GAN generated samples and Diffusion generated samples that had been balanced for number and quality of samples. We will compare both methods using a number of different forensic feature types (including intensity characteristics, edge density, sharpness metrics, and RGB Color histograms) that we have created manually using Computer Vision techniques, as well as, MobileNetV2 Embedding Features in order to improve the ability of any of these forensic features alone to classify the type of image as real or generated. Based upon our findings, it has been shown that incorporating/using the data obtained from the different types of forensic features provides additional meaningful information and value to identify and detect subtle patterns that Identification and Classification Models can identify as having been left behind either during the Image Generation Process or as a result of the Image Generation Process. This provides a more complete and improved understanding of the differences between real and AI-generated images, which would not have been possible using deep learning models without the inclusion of the traditional methods of forensic analysis of digital images.

Keywords

Analysis, Deep Learning, MobileNetv2, GAN, Diffusion-based Models, Synthetic Image Detection, Computer Vision.

Performance Analysis of RSMA-Based Network Slicing for eMBB, URLLC, and mMTC Services

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Abstract

Network slicing is an important 5G key technology for providing heterogeneous services such as eMBB, URLLC, and mMTC communications. Recently, a novel multiple access technique called Rate Splitting Multiple Access (RSMA) has received considerable attention due to its superior flexibility in handling interference for multi-service communications. In this paper, an in-depth performance analysis of an uplink RSMA-based network slicing transmission scenario is conducted to explore the effects of Power-Splitting Factor values on various services. The simulation results of RSMA are compared with those of Orthogonal Multiple Access (OMA) and Non-Orthogonal Multiple Access (NOMA) in three aspects of eMBB sum rate, URLLC outage probability, and mMTC maximum stable user arrival rate in Rayleigh fading channels. Monte Carlo simulations have shown that RSMA performs better than OMA and NOMA for almost all values of Power-Splitting Factor. In addition, it has been shown that Power-Splitting Factor (β) values can form an optimal region to provide an excellent balance between sum rate, outage probability, and maximum connectivity. The results have further illustrated that RSMA has potential for being an efficient multiple access technique for future wireless networks by providing an optimal balance between sum rate, outage probability, and connectivity.

Keywords

Rate-Splitting Multiple Access, Network Slicing, eMBB, URLLC, mMTC, Power-Splitting Factor, Rayleigh Fading.

A Deep Learning-Based Approach for Automated Blood Cancer Detection using Convolutional Neural Network: A Comprehensive Review

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Abstract

Blood cancer is a life-threatening disease that needs timely and accurate diagnosis for effective treatment. The use of computer-aided diagnosis tools is driven by the subjective and time-consuming nature of traditional microscopic evaluation of blood cell images. This paper presents a comprehensive review of recent advancements in deep learning methods applied to blood cancer detection and classification, summarising its key architectures, methods, and trends reported in the literature review. The study explores how CNN-based models have improved from traditional feature extraction methods to advanced transfer learning and lightweight architectures, improving efficiency and accuracy. It also analyses approaches to model training, feature representation, and performance evaluation across studies. The review explores existing work, including model performance, current research trends, and open challenges.

Keywords

Blood cancer, leukemia detection, Acute Lymphoblastic Leukemia (ALL), Deep Learning (DL), Convolutional Neural Networks (CNN).

DEEPVERIFY: Confidence-Based Audio-Video Fusion for Robust Deepfake Detection

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Abstract

As deepfake generation techniques become more realistic, checking the authenticity of multimedia has become a major problem in digital forensics, fighting misinformation, and safely sharing media. Current methods for detecting deepfakes mostly use unimodal analysis or fixed-weight multimodal fusion. This means they are not very good at spotting partial forgeries where only audio or video content is changed. To overcome these constraints, this paper introduces DEEPVERIFY, a reliability-aware audio-video confidence fusion framework designed for effective deepfake detection. The proposed approach analyzes visual and auditory modalities at the same time. To check if a video is real, a convolutional neural network (CNN) is used to find facial artifacts and spatial inconsistencies. To check if an audio file is real, recurrent neural network architectures like SimpleRNN and Long Short-Term Memory (LSTM) are used to find spectral and temporal speech features taken from Librosa. DEEPVERIFY doesn't use independent or fixed-weight decisions. Instead, it uses an adaptive confidence fusion strategy that changes the contributions of each modality based on how reliable they are thought to be, like the quality of the video or the integrity of the audio signal. A security-first decision policy is also used to find partial forgeries by marking content as fake when strong evidence of manipulation is found in any modality. This design makes it easy to find cross-modal inconsistencies, such as real video and fake audio or fake video and real audio, which are often missed by other methods. Experimental evaluation shows that the proposed reliability-aware fusion method always works better than audio-only and video-only detection models on their own, making them more reliable and confident in their decisions. The framework is also made to work in real time, which shows how useful it would be for real-world media authentication systems. In general, this work shows that reliability-driven multimodal confidence fusion makes it much easier to find deepfakes in real-world attack situations.

Keywords

Deepfake Detection, Multimodal Neural Networks, Adaptive Fusion, Confidence Estimation, CNN-Based Face Analysis, RNN-Based Speech Analysis.

RESPIRACCLASS: An Audio Classification System to Identify Respiratory Diseases

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Abstract

Some of the respiratory diseases e.g. asthma, chronic obstructive pulmonary disease (COPD), pneumonia, and bronchitis can be treated effectively only when they are properly and timely diagnosed. Conventional auscultation with the use of a stethoscope is highly clinical experience reliant and tends to be subjective. To fill this gap, the proposed project will introduce an audio classification system named RESPIRACCLASS, which will help to classify the sounds of a breathing process with the use of artificial intelligence and support the automation of the identification of respiratory sounds. The system will examine the sound recordings of the lungs and categorize the recordings into various respiratory sounds which include normal, wheeze, crackle, and abnormal mixed sounds. The framework proposed involves the audio acquisition, preprocessing, and extracting features based on methods like MFCC and Mel-spectrograms followed by classification based on the deep learning models. The application will take the form of a web-based application where clinicians, researchers, and students will have separate access to the application where they can upload sound and visual analysis as well as prediction. The purpose of RESPIRACCLASS is to aid in clinical decision-making process, advance medical education learning and research in analysis of respiratory sound. The given system is centered on the aspects of accessibility, automation, and enhanced credibility of respiratory sound interpretation, particularly where the area lacks access to qualified pulmonologists.

Keywords

Lung Auscultation, Deep Learning, Respiratory Sound Classification, Deep Learning, Wheeze Detection, Crackle Detection, Deep Learning, MFCC, Healthcare AI.

Sign Language Interpreter Using the Novel HastaFlow Algorithm for Real-Time Hand Gesture Recognition

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Abstract

Sign Language Interpreter Using the Novel HastaFlow Algorithm focuses on the issue of the interpretation of the sign language in real-time, with restricted publicly available data, excessive within-class variability of hand gestures, and extremely high latency demands to be met in order to deploy it in practice. In order to overcome these limitations, a new hand gesture recognition system is presented, which is called HastaFlow, to interpret sign language continuously. To achieve the proposed system, the MobileNetV2 transfer learning was used as the feature extractor, which is capable of obtaining compact but discriminative spatio-temporal hand movement representations that allow implementing the proposed system on the resource-constrained platforms. HastaFlow uses preprocessing optimization, temporal smoothing, and a lightweight classification pipeline that is optimized to make inferences in real-time. Experimental assessments on a edited sign language corpus show both a general classification accuracy of 82% and a macro average of 0.83, and reliably performs at real-time. This work has brought about the HastaFlow algorithm design, the transfer learning using MobileNetV2 to be the most efficient in gesture recognition, and the deployment-oriented architecture concerning the interpretation of the sign language in real-time. Its findings imply that the suggested solution can increase accessibility through promoting reliable, real-time communication between sign language users and non-signers, which will add to the human-computer interaction being more inclusive.

Keywords

Sign Language Recognition, Real-Time Gesture Interpretation, HastaFlow, MobileNetV2, Spatio-Temporal Features, Low-Latency Inference, Lightweight Gesture Classification.

Effect of Alkali Activator and Dosage on Mechanical Properties of One-Part Fly Ash-Based Geopolymer Concrete

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Abstract

The growing demand for sustainable construction materials has accelerated the development of geopolymer concrete as a low-carbon alternative to ordinary Portland cement. Among various geopolymer systems, one-part geopolymer concrete has gained attention due to its improved practicality and ease of field application compared to conventional two-part systems. However, the mechanical performance of one-part geopolymer concrete is highly dependent on the type and dosage of alkali activators, and systematic optimisation across different binder contents remains limited.

This study investigates the effect of alkali activator dosage on the mechanical properties of one-part fly ash-based geopolymer concrete. Sodium silicate was used as a sole activator and their performance was evaluated over a range of binder contents. Compressive strength and workability were determined to assess both strength development and stiffness characteristics.

The results indicate that activator chemistry significantly influences strength and stiffness development. An optimum activator dosage was identified for each activator system, beyond which mechanical performance declined due to over-alkalisation effects. The findings provide practical guidance for activator optimisation in one-part geopolymer concrete and support its potential application in structural construction.

Keywords

One-part geopolymer concrete, alkali activators, two-part system, sodium silicate.

Autonomous Drone Swarm Coordination Using Multi-Agent Reinforcement Learning

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Abstract

Independent interaction of masses of drone is a strenuous issue because of the decentralization of decisions, dynamic environments, and communication limitations. In this paper, an amulti-agent frame of literacy (Shingle) is introduced based on a centralized training and decentralized prosecution paradigm. Every drone is represented as a learning intelligent agent that acquires collaborative programs based on original compliances and little information on neighbors. The suggested system incorporates a scaled armature, simulation-based training, and decentralized prosecution of the policies so that they can be robust and collision-averse mass geste. Large-scale simulations have shown that there is a stable literacy confluence, improved area content, and lower collision rate, and is highly scalable to mass size. The results verify that Shingle offers a powerful and versatile outcome in the context of shared control in full autonomous drone masses functioning under partial observability and communication conditions. The suggested solution provides the basis of real-life implementation of unborn deployment and mass operation at scale.

Keywords

Multi-Agent Reinforcement Learning, Drone Swarms, Autonomous Coordination, Decentralized Control, Swarm Intelligence, Cooperative Robotics.

Smart Waste Monitoring System

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Abstract

Smart cities have efficient and viable waste management operational plans to accommodate the increase in civic populations and environmental limitations. The proposed paper is a Smart Waste Monitoring System that integrates IoT-enabled sensing, heterogeneous wireless communication, cloud-hosted analytics, and machine learning-based prediction and routing in municipal solid waste operations. Sensor-equipped bins constantly report fill levels and environmental conditions and predictive models are used to estimate overflow times and induce priority scores. These predictions are utilized by dynamic routing algorithms to minimize distance between trips, energy use, and response time. A pilot-scale analysis is used to show that overflow incidents, collection latency, and vehicle availability significantly reduce when using fixed-schedule and reactive methods. The findings show that a combination of predictive intelligence and real-time monitoring has the potential to primarily increase functional effectiveness and sustainability in civic waste operations.

Keywords

Smart cities, waste management, Internet of Things, predictive analytics, route optimization, sustainability, edge computing, cloud systems.

Smart Wardrobe: AI-Powered Outfit Suggestions & Organization

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Abstract

The Smart Wardrobe application introduces a revolutionary approach to wardrobe management and personal styling via the addition of artificial intelligence. It is designed to help users to better organize, access, and make use of their clothing; the app has a smooth process that also raises individual style but also supports sustainable fashion trends. At essentially, the app will allow users to catalogue their wardrobe by type, colour, season, and occasion, to develop an orderly digital inventory. This feature guarantees that users can easily monitor their clothes and make the most of their existing items. By leveraging AI algorithms, the app provides personal fashion guidance according to individual preferences, local climate, and some events. These tips help users create quick and current decisions, whether work clothes, an afternoon out in everyday clothes, or a formal occasion. The app tackles an everyday issue of the current speeded-up life—decision messy closets and fatigue. All have to contend with repetitive outfit options, unused apparel, and lack of creativity for blending and coordinating. Simplifying the decision of an outfit, the app saves time, reduces stress, and stimulates imagination. Additionally, the focus of the app on sustainability encourages users to get the best out of their existing wardrobe, cutting down on new buying and lowering fashion waste. This computer program is perfect for anyone who wants to embrace a beautifully organized way of life. The easy-to-use interface makes access to all, while the personalized recommendations empower users to share their own personal style choices easily. Additionally, the use is consistent with sustainable fashion ethics since it promotes wiser consumption and reducing clothing waste. By changing the way people speak to their wardrobes, let the Smart Wardrobe app not only make daily life but also encourages a more conscious and sustainable approach to fashion. It is a necessary entity for those who require a balance of efficiency, style, and sustainability as part of their everyday dressing routine.

Keywords

AI-based fashion, Smart Wardrobe, wardrobe management, eco-friendly fashion, outfit recommendation, clothing cataloging.

Weather Sequence Prediction Using LSTM Networks with IoT Sensor Integration

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Abstract

Accurate localized weather forecasting is essential for smart agriculture, renewable energy management, and intelligent urban infrastructure. Traditional numerical weather prediction models are computationally intensive and often fail to deliver precise short-term localized forecasts. This study proposes a deep learning-based temperature forecasting framework that integrates Long Short-Term Memory (LSTM) networks with real-time Internet of Things (IoT) sensor data. The system combines 13 years of historical weather data (2008–2022) from Pune, India, with real-time environmental measurements collected using low-cost IoT sensors including LM135 and DHT22. After preprocessing and feature normalization, a two-layer LSTM model with 64 hidden units per layer was trained using a 24-hour lookback window to predict next-hour temperature. The dataset was chronologically divided to preserve temporal dependencies. Experimental evaluation demonstrates strong predictive performance with a Mean Absolute Error (MAE) of 0.51°C, Root Mean Squared Error (RMSE) of 0.64°C, Mean Absolute Percentage Error (MAPE) of 2.08%, and an R^2 score of 98.12%, outperforming traditional machine learning models. The proposed framework offers a scalable, computationally efficient, and cost-effective solution for real-time localized temperature forecasting, contributing to advancements in intelligent environmental monitoring systems.

Multi-Dimensional Comparative Analysis of Lightweight Cryptography for IoT: Energy, Security, and Data Size Perspectives

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Abstract

The rapid expansion of the Internet of Things (IoT) demands cryptographic solutions that balance strong security with strict energy, memory, and computational constraints. This study presents a multi-dimensional comparative analysis of five representative ciphers—AES-128, ASCON-128a, PRESENT-80, SPECK-64/96, and ChaCha20—evaluated across simulated IoT platforms ranging from 8-bit microcontrollers to 32-bit edge devices. Performance metrics include execution time, CPU usage, RAM/ROM footprint, throughput, energy consumption, avalanche effect, key sensitivity, and ciphertext entropy. A unified decision matrix is constructed to interpret trade-offs across energy efficiency, security margin, and data-size performance. Results demonstrate that no single cipher is universally optimal. ASCON-128a achieves a strong balance for general-purpose IoT nodes requiring authenticated encryption. ChaCha20 and SPECK excel in high-throughput, software-centric environments, while PRESENT and SPECK are suitable for ultra-constrained devices with strict memory limits. Hardware-accelerated AES remains highly efficient where available. The proposed framework provides actionable guidance for selecting appropriate cryptographic primitives in diverse IoT deployment scenarios.

Choroid Layer Segmentation in OCT Images Using Cascade U-NET with Attention Mechanism

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Abstract

Choroid segmentation in OCT is a complex problem for retinal diagnosis. Segmenting the choroid in OCT scans is notably challenging due to low contrast, imprecise choroidal boundaries, and the need for the correct thickness measurement. In this paper, we present a new Cascade Attention U-Net (CAU-Net) which integrates dual-stage deep learning architecture with attention mechanisms to improve choroid segmentation. The proposed CAU-Net first divides the retina with a U-Net and then discriminates the choroid boundary exactly using an attention-gated U-Net, which is capable of coping with thickness change in CTV and image quality inconsistency. In this paper, we also have a comparative study where we test the performance of our proposed systems through comprehensive measurements such as mean Dice coefficients, mean IoU (intersection-over-union), sensitivity, and specificity to validate efficiency and accuracy of segmentation. The practical classification results of these heterogeneous OCT datasets demonstrate that the new proposed CAU-Net has surpassed the existing models by a large margin, with a mean Dice score of 0.92 and a mean IoU of 0.87. The framework combines the cascade learning method and attention mechanism to accomplish an automatic and dependable analysis of the choroid while being computationally efficient, which can potentially be used for clinical purposes in diagnosing and monitoring different types of ocular diseases.

Keywords

Choroid Segmentation, Optical Coherence Tomography, Deep Learning, Attention Mechanism, Cascade U-Net, Medical Image Analysis, Ocular Disease.

DigiKrushi: AI-Powered Smart Crop Recommendation and Soil Analysis Platform

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Abstract

We present DigiKrushi, a smart agriculture platform that integrates IoT-based soil sensing with AI-driven analysis and generative recommendation to enable data-driven decision-making for farmers. The system uses a Raspberry Pi connected to soil moisture, pH, temperature, and humidity sensors to collect real-time field data for precise environmental monitoring. A Convolutional Neural Network (CNN) classifies soil types from captured images, while a Support Vector Machine (SVM) predicts suitable crops based on sensor readings and historical datasets [1]. The combined AI outputs are processed by a Large Language Model (LLM) API, which generates comprehensive agricultural guidance covering crop growth stages, fertilization, irrigation, pest control, and soil health management. The advice is translated into Marathi, ensuring accessibility for regional farmers [2]. By merging deep learning, machine learning, IoT sensing, and generative AI, DigiKrushi delivers a low-cost, automated decision-support system that minimizes the need for laboratory testing and expert supervision. It provides actionable insights for sustainable crop production, reduces input waste, and improves yield efficiency. The platform's hybrid architecture, combining on-device AI processing with cloud based reasoning, ensures real-time performance even in limited connectivity settings. Overall, DigiKrushi demonstrates how AI, IoT, and language technologies can transform traditional agriculture into an intelligent system.

Keywords

Crop Recommendation, Soil Analysis, Convolutional Neural Network (CNN), Support Vector Machine (SVM), Internet of Things (IoT), Generative AI (Gemini API), Marathi Language.

FIT INIT: An AI-Based Human Pose Estimation for Automated Yoga Asana Guidance in Women's Fitness Applications

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Abstract

The FIT INIT system presented in this study is an AI-based human pose estimation application developed to provide automated yoga asana guidance and self-defense training support for women's fitness and safety. The system offers an interactive digital platform where users can perform guided exercises while receiving real-time posture analysis and corrective feedback. The application is developed using Python and Flask for server-side processing and deployment, while OpenCV and MediaPipe are integrated for structured human pose detection and landmark tracking through computer vision techniques. The front-end interface is implemented using HTML5, CSS3, JavaScript, and jQuery to ensure a responsive, accessible, and user-friendly experience. The system performs real-time video capture, pose validation, and comparison with predefined reference models to generate automated feedback for posture improvement and movement accuracy. In addition to yoga guidance, the platform can be extended to include AI-assisted self-defense training modules that help users practice defensive movements safely and effectively. By integrating artificial intelligence with digital fitness learning, the system enhances accessibility, improves posture accuracy, reduces training costs, and promotes independent wellness and safety awareness among women. The modular and scalable architecture makes it suitable for integration into mobile applications and future intelligent fitness solutions.

Keywords

Women fitness, human pose estimation, artificial intelligence, computer vision, yoga guidance, self-defense training, women safety, web application.

Data-Efficient Deep Learning for Oral Cancer Diagnosis: A Survey of Few-Shot Learning, Diffusion-Based Augmentation, Histopathology Analysis, and Explainable AI

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Abstract

Oral cancer is a prevalent public health problem, especially in areas where the normal practice of screening is not routinely performed and specialist medical attention is not accessible. While deep learning algorithms have found considerable success in most other medical image analysis tasks, they tend to rely on the availability of very large and heavily labeled image databases in most cases. When it comes to oral cancer imaging, the creation of such databases is often not possible in a normal clinical setup.

To overcome this drawback, many recent studies have begun to target approaches that can work efficiently with a limited amount of data. In parallel, the literature works targeting diffusion-based image generation for the purpose of boosting the training samples, dual-extractor networks for the aim of learning contrasting characteristics, subspace learning strategies for the purpose of enhancing the feature representation, and explainable AI for the aim of facilitating the explanation of the decision made by the models.

The current survey reviews 20 recent studies related to oral cancer diagnosis or studies on FSL. The studies surveyed include works on general few-shot learning strategies, FSL applied to medical imaging tasks, diffusion learning strategies for augmenting data, models designed specifically for clinical images, histopathological image models designed specifically for online histopathological image examination, and studies that deal with the integration of dual feature extraction and explainable AI. The studies were grouped based on their idea.

Keywords

Oral cancer, Oral squamous cell carcinoma (OSCC), Few-shot learning (FSL), Prototypical Networks, Meta-learning, Diffusion models, Histopathology, Clinical imaging, Dual-extractor networks, Explainable artificial intelligence (XAI), Medical image analysis.

Towards Sustainable Energy Projects: A Review of Generative AI in Renewable Energy Forecasting

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Abstract

Sources of renewable energy such as solar and wind are exploited on large scale and difficult to use as they are not predictable and extremely affected by weather conditions. Consequently, generation of power is hard to predict. This may influence grid operations, cost increment, and high energy systems have to be used. Over the past years, scholars have delved into how Generative Artificial Intelligence (GenAI) can be used to aid in forecasting renewable energy and in the operation of systems. This paper is based on the review of the studies carried out in the renewable energy projects. The analysed papers implement various GenAI methods, such as Generative Adversarial Networks (GANs), Diffusion Models, Large Language Models (LLM) and Transformer-based models. Conclusions usually show the improvements in forecasting accuracy. The findings also indicate that a higher utilization of AI is not always beneficial to the environment. Transformer-based models are considered to be a good option among others because of the accuracy, efficiency, and scalability. Though these positive results are achieved, there are still challenges such as unequal access to the state-of-the-art AI technologies and ambiguity over the way these models arrive at a decision. Its knowledge can be of relevance in making sure the application of GenAI in renewable energy systems is conscientious and very valuable.

Keywords

Generative AI, Energy Optimization, Renewable Energy, Solar Forecasting, Transformers, Sustainability, Smart Grids, Wind Prediction.

Analysis on Post Processing Techniques for Artifact Removal: A Systematic Review

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Abstract

High quality digital images essentially demand a large space to store and are being used for various purposes like scientific, medical, business, personal, etc. A large bandwidth is required for the transfer of these images. To counter the problem, images are compressed by using block-based DCT which results in blocking artifacts. For the elimination of blocking artifacts, various deblocking techniques have been applied. To rectify the artifacts, efficient pre and post-processing techniques are applied that focus on quantization error, ringing, blocking effects, etc. Although few review papers in the field of blocking artifacts have been published, there is still a gap like artificial boundaries as artifacts exist in the reconstructed images. 2753 studies were screened using Scopus, IEEE, and Web of Science databases from 2010 to 2025 and adaptive filtering and estimation-theoretic methods are identified as the most effective strategies for post-compression artifact reduction. This study presents a bibliometric and systematic analysis of post-processing techniques for blocking artifact removal in image compression. Co-authorship and country collaboration analyses revealed China and the United States as leading contributors.

Smart Passenger Authentication and Emergency Alert System for Indian Railways

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Abstract

Millions of passengers travel by railway transport systems every day, and the secure identification of the passengers is a serious concern, as well as the security of their lives on board, so the Conventional ticket verification processes are mostly manual or can be based on only one factor of electronic identification, which is susceptible to and inefficiency. Thus within the context of this paper, a Smart Passenger Authentication and Emergency Alert System which aims at improving access control and passenger security in booked railway compartments. The suggested system is a mix between RFID identification and biometric face recognition and thus offers dual factor authentication. Besides this, a smart emergency warning system with MEMS accelerator is also added to automatically identify accidents and abnormalities. The entire system runs on a Raspberry Pi platform, a small, inexpensive and stable system that can be used in real time railway applications.

Keywords

Railway safety, Radio Frequency Identification, Face recognition, Local Binary Pattern Histogram, MEMS accelerometer, Raspberry Pi, Emergency alert system.

An Explainable Multimodal Approach to Depression Detection on Social Media

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Abstract

The growing number of mental complications, especially depression, among urban people requires scalable and early detection mechanism for depression. There is a large amount of user-generated data on social media platforms, which makes it possible to apply technology-based mental health monitoring. However, at present, the existing solutions can be narrowed down to unimodal analysis and are not interpretable, which reduces their applicability.

In this work, we develop an explainable multimodal framework for depression detection by combining text, image, and behavioral data collected from social media. The approach uses MentalBERT for feature extraction through text and EfficientNet for visual information analysis, as well as a pattern of behavior with the help of temporal and psycholinguistic cues. A combination mechanism is used to create an integrated user representation, while SHAP (SHapley Additive Explanations) is used to provide interpretable information about model predictions.

The role of each modality is also emphasized by the experimental evaluation, which shows that multimodal fusion is more accurate than single-modality detection techniques. The proposed system provides a more transparent and scalable way to analyze mental health patterns, supporting tech-enabled wellbeing and contributing to the development of healthier and more resilient urban communities.

Explainable Pathway-Driven Drug Repurposing and Safety Profiling for Coronary Artery Disease

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Abstract

Cardiovascular diseases (CVDs), particularly coronary artery disease (CAD), remain the leading global cause of mortality, yet molecular mechanisms of common treatments like aspirin and atorvastatin are incompletely understood. Drug repurposing offers a cost-effective alternative to ground-work up development, but existing transcriptomic and machine learning approaches suffer from inconsistent preprocessing, black-box predictions, and siloed similarity/toxicity analyses. Thus an explainable pipeline is presented that integrates LINCS L1000 Level 5 Signatures (filtered: `pert_type=tr_cp`, `inference_score > 1.5`) with CTD/DrugBank annotations (803: 395 CVD, 408 Non-CVD) and SIDER Side-effects. Consensus signatures are transformed into pathway activation matrices (KEGG/GO/Reactome), embedded via UMAP for clustering/ network analysis (Louvain), revealing CVD Drugs form heterogenous mechanistic neighborhoods with non-CVD overlaps for repurposing. A master feature matrix combines the pathway features, embeddings, and safety metrics to train an XGBoost toxicity regression model, to capture the relative side-effect burdens (evaluated via MAE/RMSE/Spearman). SHAP Explanations attribute risks to inflammation, apoptosis, and immune pathways, enabling transparent prioritization. A weighted repurposing score ($0.55 \times \text{CVD Similarity} + 0.45 \times \text{Safety}$) ranks candidates balancing efficacy potential and low toxicity. Results highlight the top non-CVD Candidates with potential repurposing capability. Thus this framework uses the repurposing candidates together with CVD Profiles to analyze and the side-effect toxicity prediction by linking the perturbations to clinically actionable insights. This framework thus lays a solid foundation to make room for enhancements with multi-omics data, GNNs, and lab validation.

Level Up Learning: Accessible Game – Based Skill Development for Primary and Secondary Students

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Abstract

Students with mild Autism Spectrum Disorder (ASD) face challenges with foundational language skills such as listening, speaking, reading and writing (LSRW) and also in maintaining attention during learning activities. However, existing solutions depend on hardware solutions and lack to monitor attentiveness of students during learning. This paper proposes a web-based learning system designed for primary and secondary students with mild ASD, accessibility, user engagement, learner comfort, attention monitoring are focused. The system integrates game-based learning and targets to enhance LSRW skill development with an attention monitoring mechanism which is enabled using webcams. When the user is found inattentive for a long time, inattentiveness is detected, the system triggers alert sounds and in addition it notifies registered parents or mentors through mail. Additionally, the system gives priority to ensure the learner's comfort, with the presence of calm moment and learning is resumed when ready. Evaluation is done with five students and improvement is shown. The initial evaluation is done with five neurotypical students and tested the usability, engagement throughout the learning session, and attention monitoring. Reading and speaking skills are improved higher ($\approx 19\%$) than listening and writing skills ($\approx 15\%$). This may vary depending upon the learner.

Keywords

Mild Autism Spectrum Disorder (ASD), LSRW skills, Web- Based Learning, Attention monitoring, Skill Development, Multimodal Learning Approach.

Hack Blocker: A Real-Time Phishing Website Detection System using TabNet and Browser Extension

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Abstract

The current online world is facing a growing trust deficit, mainly fueled by the rise of phishing attacks. These types of attacks, which aim to obtain login credentials by masquerading as trusted entities, have matured from crude, homemade-style emails to sophisticated, automated attacks that easily bypass traditional security measures. Conventional security tools—static blacklists—are inherently reactive and cannot protect against a novel, never-before-seen attack. To fill this gap, we developed Hack Blocker, a real-time detection system. Hack Blocker combines a browser extension with TabNet, a deep learning model carefully optimized for efficient tabular data processing. Unlike conventional models, which rely on external resources, Hack Blocker focuses on the URL's intrinsic structural signals to assess legitimacy in milliseconds. Our findings demonstrate a 95.

Keywords

Phishing Detection, TabNet, Deep Learning, Browser Extension, Cyber Security, URL Analysis, Explainable AI.

Life-Cycle Cost and Carbon Footprint Analysis of Cable Sizing Methods: A Comparative Study of Oversized and Optimized Approaches

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Abstract

The study uses life-cycle cost (LCC) and carbon footprint (CF) to compare the optimum versus oversized cable sizing options for low-voltage industrial power distribution systems. While large sizing uses the next higher standard size to lower electrical losses, optimized sizing chooses the smallest conductor cross section that satisfies current-carrying and voltage drop restrictions. To quantify the trade-offs between the two ways throughout a 25-year service life, an integrated methodology incorporating electrical performance modelling, economic evaluation, and life cycle carbon assessment is established. The findings indicate that while optimized cables have lower initial costs and emissions, bigger cables have lower cumulative life-cycle costs and lower total carbon emissions because of lower operational energy losses. Oversized cars become economically favourable after a break-even period of roughly six to seven years. The study shows that careful cable oversizing can enhance energy efficiency, dependability, and long-term sustainability in electrical system design when assessed using life-cycle performance criteria.

Keywords

Life cycle cost, Cable sizing, Optimized design, Oversized design, Sustainability, Electrical system design, Environmental impact, Reliability.

Influence of Granite Waste and Steel Fiber Reinforcement on the Properties of Fly Ash-Based Self-Compacting Concrete

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Abstract

The growing demand for sustainable construction materials has encouraged the utilization of industrial by-products and waste materials in concrete production. This study investigates the fresh, mechanical, and durability performance of fly ash-based self-compacting concrete (SCC) incorporating granite waste as partial fine aggregate replacement and steel fibers as reinforcement. Ordinary Portland Cement (OPC) of 53 grade was used with 30% Class F fly ash replacement, and the total binder content was maintained at 450 kg/m³ with a water-to-binder ratio of 0.36. Granite waste was incorporated at varying replacement levels of 20% and 40%, while steel fibers were added at 0.5% and 1.0% volume fractions. Fresh properties were evaluated using slump flow, T₅₀ time, V-funnel, and L-box tests. Mechanical performance was assessed through compressive, split tensile, and flexural strength tests, while durability was examined using water absorption and sorptivity tests. The results indicate that incorporation of granite waste and steel fibers slightly reduced flowability but remained within acceptable SCC limits. Mechanical properties, particularly tensile and flexural strengths, showed significant improvement due to fiber reinforcement, with optimum performance observed at 20% granite waste and 1.0% steel fiber content. Durability characteristics improved due to reduced water absorption and sorptivity, indicating a denser microstructure. The study demonstrates that sustainable SCC with enhanced performance can be developed through the combined use of fly ash, granite waste, and steel fibers.

Keywords

Self-compacting concrete, Fly ash, Granite waste, Steel fibers, Fresh properties, Compressive strength, Flexural strength, Water absorption, Sorptivity.

ElectViz: A Global Election Analytics Platform for Digital Media

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Abstract

Today, reporting election results quickly and accurately is very important to maintain public understanding easily. As elections are now closely followed through digital media, people expect fast and reliable updates. However, during voting, media organizations receive huge amounts of live data from many sources. Understanding this information using manual entry, static tables, and repeated updates consume lot of time and can easily lead to mistakes or delays. So, there is a clear need for a smarter system that can quickly convert raw election data into simple and meaningful information. ElectViz is developed as a centralized, real-time election analytics and visualization platform specially created for digital media and newsrooms. It uses modern technologies like React.js to build responsive user interfaces and D3.js and Leaflet.js to create interactive maps. The backend, supported by Spring Boot and FastAPI, ensures fast and smooth data processing. The system collects data from APIs and JSON/CSV files and processes it with very little delay. The platform shows the results through interactive dashboards using live maps, vote-share details, swing analysis, winning margins, and majority tracking. Hence news reporters can present clear data to public. In simple terms, ElectViz makes election reporting faster, clearer, and easier for journalists and students to understand.

Keywords

Real-Time Data Visualization, Election Analytics, Digital Media Reporting, Choropleth Mapping, WebSocket's, Swing Analysis, Electoral Intelligence System.

Investigation on Wear Behaviour of Nano Boron Carbide Reinforcement with Zn Based Metal Matrix Composite

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Abstract

Particle-reinforced zinc-based metal matrix composites are replacing monolithic zinc matrices due to their lower cost, superior strength-to-weight ratio, and nearer isotropy. In this study, the sliding wear behavior of Zn-Sn alloys reinforced with boron carbide (B_4C) nanoparticles was investigated. Composites containing 0–8 wt.% B_4C were fabricated using a two-step fusion process. Wear resistance was evaluated on a pin-on-disc testing machine under the following conditions: a sliding distance of 2000 m, a track diameter of 90 mm, and applied loads of 10, 20, 30, and 40 N at sliding speeds of 1.4, 1.8, 2.3, and 2.8 m/s. In 80 studies, 16 wear tests were performed on each sample. Higher sliding velocities do, in fact, help to lower the wear rate, according to research, but the volumetric wear rate keeps rising as the load increases. EDS, wear debris analysis, and worn surface analysis are the techniques used to characterise the surface. Therein, these are in complete agreement with the fact that nano B_4C reinforcement is a possible approach to improve the mechanical and wear properties of the Zn-Sn take place; especially because both surface hardness and roughness show an increase with increasing sliding speeds.

Keywords

Zn85-Sn15composites, B_4C particulates, stir casting, Wear mechanism, SEM and EDS.

Design and Evaluation of a Python-Based IoT Simulation Framework

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Abstract

The growing use of the Internet of Things (IoT) in smart home settings has increased the need for efficient tools to build, test, and assess these systems. However, expensive hardware, poor scalability, and complex maintenance often limit the real-world experimentation with IoT devices. While there are a number of IoT simulation frameworks available, many of them are less appropriate for application-level experimentation and use because they mainly concentrate on network-level or rely on predefined scenarios. In order to provide a realistic simulation of IoT devices without the requirement for physical hardware, this research discusses the design and implementation of a Python-based IoT device simulator for smart home systems. The suggested simulator uses components that are modular and extendable to simulate sensors and actuators, and at the same time also focuses on device-level modelling, automation logic and user interaction. A centralized controller uses rule-based automation to control device interactions, and synthetic yet realistic data is generated to simulate real-world data. The simulator has data logging features for the assessment and analysis of simulation, as well as interactive device control. The framework has been created to assist students and research scholars by offering a lightweight and affordable IoT environment for testing without complex hardware.

Personalized Medicine Recommendation System using AI

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Abstract

Personalized medicine has been a paradigm shift of the previous paradigm of treatment in that it concerns personalizing treatment to individual-patient details. The advancement of artificial intelligence and predictive analytics makes it possible to develop systems that will be able to process various data about patients and provide reasonable treatment guidance. The proposed study proposes an AI-powered recommendation system that is utilized to tailor medical treatments with the help of a combination of clinical data, genomic data, and demographic data. They predict individual patient treatment response, can optimize treatment plans, and can minimize adverse drug reactions with the use of machine learning and deep learning systems. The system is explainable- based so as to ensure transparency and clinical trust and to make clinicians know the logic behind each recommendation. It is expected that the outcomes will be higher rates of recovery, more effective treatment, and reduced risks of medication side effects. The hybrid architecture, i. e. the synthesis of multi- modal patient data (i.e. the synthesis of genomics, electronic health records (EHR) and lifestyle parameters) and explainable AI to deliver accurate, patient-centered, and trustful medical guidance is the originality of this work hence adding to the goals of precision medicine.

Keywords

Adverse Drug Reaction Prediction, Artificial Intelligence, Clinical Decision Support System, Deep Learning, Electronic Health Records, Explainable AI, Genomic Data Integration, Machine Learning, Multi-Modal Data Fusion, Patient-Centric Therapy Recommendation, Personalized Medicine, Predictive Analytics, Risk Modeling.

CivicWatch: AI-Powered Public Grievance Alert System

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Abstract

In hyper-modern civic settings, social concerns that include illegal-leaving, roadblocks, water leakages, importunity and crime are often left unresolved as an outcome of ineffective reporting processes and delayed responses. To overcome such odds this paper presents CivicWatch which is an AI- based policing service that provides a platform to allow citizens to file their grievance and alert through a multimedia-based feature (images and/or videos and/or text messages). The system supports automated issue bracket, prioritization and real time alert generation through artificial intelligence methods, allowing original authorities to respond in real time and in the most effective way. Its combination of sophisticated analytics and a transparent reporting structure enables CivicWatch to not only speed up resolution processes, but also increase community engagement and civic accountability. The suggested system is beneficial in building smarter, safer and responsive civic nations with citizen lead contribution and AI-driven governance.

Keywords

Civic engagement, public grievance system, artificial intelligence, smart cities, real-time alerts, urban governance, transparency.

ML and XAI-Driven Models for Sustainable Energy Development in Next-Generation Smart Systems

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Abstract

Sustainable energy development (SED) ensures environmental protection, energy security, and economic growth by utilizing low-carbon. Moreover, renewable technology to meet present energy needs while protecting resources for future generations. High dimensionality, inconsistent or missing data, and a large regional imbalance are some of the issues with the SEG dataset that might impact model generalization and accuracy. Furthermore, it is challenging to obtain clear and policy-relevant insights from complicated models due to their low temporal resolution and explainability. To solve this issue, the proposed model used the customized Machine Learning-based techniques with Explainable Artificial Intelligence (XAI) for energy improving the next generation technologies (EnergyMLXAI). Artificial Intelligence (AI) and Machine Learning (ML) approaches are widely used in the sustainable energy sector for demand-side energy management, smart grid operation, defect detection, and renewable energy forecasting. Machine learning models allow predictive analytics for solar and wind energy systems while deep learning techniques improve grid stability, asset monitoring, and real-time control of distributed energy resources. The development of intelligent energy infrastructures and the incorporation of renewable energy sources into contemporary power systems depend on such capabilities. The suggested approach has been tested on four sustainable energy development csv datasets. The simulation results have been examined by evaluation metrics for proper validation. The suggested approach performs State-Of-The-Arts (SOTA) model.

Keywords

Artificial Intelligence, Sustainable Development, eXplainable Artificial Intelligence, Environmental Issues.

Disaster Preparedness and Evacuation Planning Using Weather and Satellite Data

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Abstract

Natural disasters such as cyclones, floods, and extreme rainfall continue to pose serious risks to human life, infrastructure, and economic stability. In many cases, the impact of such events is amplified by inadequate resource preparedness and delayed evacuation planning. This paper presents a data-driven framework for real-time disaster preparedness and evacuation support, designed using real meteorological and spatial data sources. The proposed system integrates live weather information with satellite-based geospatial data to perform region-wise disaster intensity assessment and resource requirement estimation. Disaster intensity is estimated using time-series weather data enhanced through feature engineering, while resource demand is predicted using a feedforward neural network model. Satellite imagery and road-network data extracted using OSMnx are employed to identify real-world routes, road connectivity, and geographical constraints, enabling practical evacuation-aware planning without reliance on simulated environments. Experimental results on a real-world coastal district dataset show that the disaster intensity prediction model achieves an accuracy of 96%, while the resource estimation model attains 95% accuracy. The findings demonstrate that combining real-time data, spatial analysis, and learning-based prediction models can significantly improve disaster preparedness and decision support for emergency response authorities.

Keywords

Disaster Management, Resource Preparedness, Disaster Intensity Prediction, Satellite Imaging, Decision Support Systems.

Dynamic Web Platform for Real – Time Cryptocurrency Analytics and Market Insights

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Abstract

The rapid growth of cryptocurrency markets has created the need for interactive, real-time analysis platforms. This project, Crypto Vista, is an innovative crypto dashboard developed using Streamlit, Python, and data integration from CoinGecko, Yahoo Finance, and NewsAPI. The system provides live cryptocurrency market data, candlestick visualisations, moving averages, price forecasts, portfolio tracking, and sentiment analysis from news headlines.

The dashboard combines data analytics, machine learning (linear regression for forecasting), and visualisation tools (Plotly) to support traders and researchers in making informed decisions. It features a customizable interface with support for multiple currencies, auto-refreshing market data, and user- managed virtual portfolios. The sentiment module offers a simplified view of market psychology through keyword-based analysis. This project demonstrates how modern web technologies and open-source APIs can be integrated into a single decision-support tool, bridging the gap between data science and technology.

Keywords

Forecasting Portfolio Tracking, Sentiment Analysis, Data Visualisation, CoinGecko API, Yahoo Finance API.

Integrating Street Vending and Non – Motorized Transport for Sustainable Urban Economic Growth in Purasaiwalkam, Chennai

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Abstract

Indian cities experience great competition for street space, wherever pedestrian flow and informal street vending attend with limited law and infrastructure. In areas such as Purasaiwalkam, deficient footpath width, poor walkability, and non-regulated vending result in congestion, safety issues, and dispute in public space, despite the providing of the street vendors act.

This study aims to assess pedestrian walkability and street vending ideal and to develop an inclusive, policy-aligned urban design proposal that carry livelihoods while improving pedestrian safety and consolation.

The methodology incorporate is walkability scoring based on physical and conceptual parameters, activity and density mapping, traffic-pedestrian interactivity analysis, and a review of relevant street vending policies and urban instructions. Spatial analysis and primary surveys were used to recognize high-intensity corridors and critical dispute zones.

The findings disclose that streets with high commercial activity attract dense walking flows and street vendors, often considerable the carrying capacity of existing footway. While walkability levels range from poor to average, strong pedestrian dependence underlines the socio-economic importance of these streets. The study demonstrates that integrating vending zones, improved the pavement design, crossings, and street furniture-guided by the street vendors act-can enhance walkability, reduce conflicts, and promote equitable approach to the public space. The research complete with design recommendations that contribute to sustainable urban development by steady mobility, economic inclusions, and the public realm quality.

Keywords

Walkability, Street Vending, Public Space, Urban Policy, Sustainable Urban Development, Inclusive Streets.

Lightweight Custom CNN with Integration for Simultaneous Detection of Diabetic Retinopathy and Glaucoma

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Abstract

Diabetic retinopathy and glaucoma are among the leading causes of preventable blindness worldwide, requiring early and accurate screening for effective treatment. Traditional diagnostic procedures rely heavily on manual examination by ophthalmologists, which limits large-scale screening in resource-constrained environments. This research proposes a lightweight custom convolutional neural network (CNN) integrated with clinically interpretable biomarkers for simultaneous detection of diabetic retinopathy and glaucoma using fundus images. The proposed framework performs image preprocessing, optic disc and cup segmentation, and lesion analysis to extract clinical indicators such as cup-to-disc ratio (CDR) and rim-to-disc ratio (RDR). Unlike transfer learning approaches that require large computational resources, the designed CNN contains approximately 500,000 parameters, enabling faster inference and reduced memory usage while maintaining high diagnostic performance. Experimental evaluation demonstrates a validation accuracy of 99.75%, sensitivity of 98.65%, and specificity of 98.60%, achieving performance comparable to VGG16 while being significantly more computationally efficient. The integration of explainable clinical biomarkers improves interpretability and clinical reliability of predictions. The proposed system supports scalable and cost-effective ophthalmic screening and can assist healthcare professionals in early disease detection, especially in low-resource clinical settings.

Secure Voting System by Aadhaar Verification and Iris Detection Using Deep Learning

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Abstract

Secure and transparent voting systems are essential for maintaining the integrity of democratic processes. Traditional voting methods and existing biometric-based electronic voting systems are often vulnerable to impersonation, duplicate voting, and various security threats. This paper presents a secure electronic voting system that integrates Aadhaar-based identity verification with deep learning-based iris recognition using a pre-collected iris dataset. The proposed system adopts a multi-factor authentication approach to ensure that only legitimate and eligible voters are permitted to participate in the voting process. A convolutional neural network (CNN)-based Siamese architecture is employed for effective iris feature extraction and matching, enabling reliable biometric authentication with high accuracy. Aadhaar verification serves as an additional authentication layer, strengthening identity validation and preventing unauthorized access. To protect sensitive voter information and voting records, the system utilizes Advanced Encryption Standard (AES) encryption, and all encrypted data are securely stored in a MongoDB database. The proposed system strictly enforces a one-person-one-vote policy by continuously monitoring voter activity and rejecting duplicate voting attempts. Experimental evaluation conducted using the iris dataset demonstrates improved authentication accuracy, enhanced security, and reliable system performance when compared to conventional biometric voting approaches. The results confirm that the integration of Aadhaar verification, deep learning-based iris recognition, and secure data storage significantly enhances the robustness and trustworthiness of the electronic voting process. Overall, the proposed multi-factor authentication framework provides a secure, scalable, and practical solution for modern electronic voting systems.

Keywords

Secure voting system, Aadhaar authentication, Iris recognition, Deep learning, Biometric authentication.

Flood-Resilient Revitalization of the Buckingham Canal, Chennai Using GIS-Based Spatial Analysis

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Abstract

Rapid urbanization and unplanned land-use transformation have significantly reduced the hydraulic efficiency of the Buckingham Canal, increasing flood vulnerability in many low-lying and densely populated areas of Chennai. Encroachments along canal margins, narrowing of waterways, and the loss of natural floodplains have weakened its historic function as a primary urban drainage corridor. Rapid expansion of built-up areas and the conversion of permeable surfaces into impervious cover have further reduced natural infiltration, intensifying surface runoff during heavy rainfall events.

This study assesses flood vulnerability and develops a flood-resilient revitalization framework for the canal using GIS-based spatial analysis. Methods include land-use and land-cover change detection, built-up density mapping, and flood-risk zone identification. Spatial analysis reveals that canal constrictions, increased impervious surface coverage, and poor integration with the city's stormwater drainage network significantly aggravate localized flooding.

The findings highlight the urgent need for canal restoration, removal of encroachments, enhancement of hydraulic connectivity, and protection of residual floodplains. Integrated urban planning interventions—combining ecological restoration with sustainable drainage strategies—are essential to restore the canal's drainage capacity and improve long-term flood resilience in vulnerable neighbourhoods.

A Privacy-Preserving and Explainable AI Framework for Sustainable Healthcare Intelligence

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Abstract

Artificial intelligence (AI) has emerged as a transformative technology that facilitates automation, smart decision-making, and innovation driven by data in modern sectors. In healthcare, its growing adoption has reshaped clinical decision-making, patient monitoring, and operational efficiency. However, the rapid expansion of AI has heightened challenges related to data privacy, model transparency, and environmental sustainability, especially in large-scale interconnected healthcare systems. To address these concerns, this study introduces a unified framework that combines privacy-preserving federated learning (FL) with explainable artificial intelligence (xAI) to foster sustainable and trustworthy decision-making in smart environments. The proposed framework promotes secure collaborative model training without the need for centralized data aggregation by employing differential privacy and homomorphic encryption to reduce the risk of privacy leakage. Additionally, model-agnostic explainability modules enhance interpretability and build user confidence by clarifying the decision-making processes of complex AI models. Furthermore, the framework incorporates sustainability-oriented design considerations aimed at improving computational efficiency and encouraging environmentally aware AI model development for healthcare settings. Recent studies indicate that integrating privacy, explainability, and environmental consciousness significantly enhance model accountability, fairness and energy efficiency. The proposed approach provides a structured foundation for developing intelligent, ethical, and eco-conscious AI solutions aligned with evolving healthcare data protection and governance.

Fusion of AI with Psychology for Personality Based Social Networking

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Abstract

Traditional social networking sites are used to consider surface level traits of a person rather than semantic level. This is because traditional data mining approaches are unable to extract a high level semantic personality of a person. But now there are three different approaches that can compare the semantic level personality of a person. These approaches use Large Language Models (LLMs) which are categorised within artificial intelligence technology, 2CLSTM which is two way long short term memory combined with convolutional neural network (CNN) which is categorised within deep learning and the third is Hypergraph Neural networks.

This research paper involves studying the three different categories of model and to identify which model among them is quintessential by comparing them on different parameters which includes Predictive accuracy (R^2 score), Precision (Mean Squared Error), Computational efficiency (training time in seconds), Model efficiency (R^2 per second of training). These parameters will help us to identify the best model based on their Training efficiency, Accuracy, Training time and Relative performance. This research paper uses the dataset of BIG FIVE PERSONALITY in which the components are Extraversion, Neuroticism, Agreeableness, Conscientiousness and openness taken from kaggle.

Keywords

LLM models, 2CLSTM, Hypergraph neural network, Big five personality, Semantic level personality.

A Heterogeneous Stacked Gradient Boosting Architecture for Customer Purchase Behavior Prediction

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Abstract

Modeling customer purchasing behavior is still a major challenge in current retail analytics due to complex, non-linear interactions between demographic, transactional, and behavioral factors, as well as difficulties like feature heterogeneity and class imbalance. Conventional single-model machine learning techniques sometimes have trouble generalizing to different data distributions and client segments. In order to improve prediction accuracy and resilience, this study suggests a unique heterogeneous stacked gradient boosting framework that combines Extreme Gradient Boosting (XGBoost), Categorical Boosting (CatBoost), and Light Gradient Boosting Machine (LightGBM) within a meta-learning architecture. Using ordered boosting for efficient handling of categorical features, regularized gradient boosting with shrinkage control for better generalization, and histogram-based learning for computational efficiency, the suggested ensemble takes advantage of the structural diversity of boosting paradigms. A meta-learner integrates probabilistic outputs from base learners to improve decision boundary changes and capture higher-level interactions. To improve robustness, class-balanced training techniques and hyperparameter adjustment are applied. The proposed stacked ensemble consistently outperforms single base learners in terms of accuracy, F1-score, and AUC metrics, according to an experimental evaluation of a dataset of customer shopping behavior. By identifying important behavioral elements influencing purchasing decisions, feature significance analysis enhances comprehension.

Visual Artifact Based Deepfake Analysis Through Texture Boundary Identification

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Abstract

Recent advances in Generative Adversarial Networks (GANs), diffusion models, and neural face-swapping techniques have significantly improved the realism of synthetic media, commonly known as deepfakes. These technologies enable convincing manipulation of facial identity in videos, raising serious concerns related to misinformation, impersonation, and non-consensual content generation. As synthesis quality improves, detecting very subtle visual inconsistencies created during face manipulation and compositing becomes more challenging.

This study explores deepfake analysis using visual artifacts, focusing on granularity patterns and blending inconsistencies identified through frame-level texture identification on the FakeAVCeleb dataset. A diversity-aware cluster sampling approach has been implemented in order to reduce redundancy as well as to maintain important visual patterns during training. Three pre-trained architectures have been implemented and evaluated using standard classification measures, resulting in ResNet18 with the highest accuracy of 98.52%, followed by ViTB/16 with an accuracy of 98.35%, and EfficientNet-B3 with 97.81%. The ROC-AUC Scores were all above 0.998, indicating that the models provide near-perfect ability to discriminate between Real and Fake. Visualization using Texture Boundary Maps based on LBP and GradCAM++ also confirms that the models use blending seams and Texture Discontinuity as areas of focus while working with a controlled dataset.

Comparing Single-Agent and Multi-Agent LLaMA Based Systems on FinQA

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Abstract

Financial decision making is one of the most important applications of Artificial Intelligence; unlike general text understanding, financial decision making requires multiple-step logical reasoning over complex data. Large language models have shown strong potential in understanding general text, but they still lack the reliability to locate the correct numbers, determine the appropriate arithmetic operation, and compute the output without any error. These requirements make financial question answering fundamentally different from general domain tasks. A single LLaMA agent for financial numerical reasoning is expected to retrieve relevant numbers, plan the reasoning steps, and perform arithmetic, all within a single generation pass, so, they are lacking the capability to produce correct outputs due to arithmetic hallucination. This work investigates whether a multi-agent framework can overcome these limitations by distributing the reasoning process across multiple specialized agents, where one agent retrieves the relevant numbers, a second decides the operation, and a third executes the arithmetic using a Python interpreter, and will produce more reliable answers than a single agent handling everything at once. To test this, four configurations are evaluated on the FinQA benchmark under both zero-shot and few-shot prompting conditions, using the same base model.

TinyML Voice Automation with Thermal Hazard Detection and Recovery

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Abstract

Industrial safety management faces a critical problem: the traditional systems often lack decentralized intelligence to prevent catastrophic failures and do not ensure secure reactivation. There is a need for a solution to eliminate reliance on cloud processing for emergency shutdowns. The existing solutions often rely on simple thermal fuses or manual resets, which fail to provide a zero-trust authentication layer. The current research proposes a Hybrid Safety Interlock and Recovery System which is built on ESP32, integrating TinyML for voice-authenticated restoration. The proposed solution utilizes a DHT11 sensor to monitor thermal gradients via a Rate-of-Rise (ROR) algorithm for immediate load-shedding. For the recovery phase, a Convolutional Neural Network (CNN) is implemented to extract MFCCs (Mel-Frequency Cepstral Coefficients) and recognize the specific keyword recover. Experiments were conducted on the current research by simulating fire hazards to measure the sub - second response time of the hardware and the accuracy of the classifier. The results confirm that the system successfully latches power off during spikes and only restores the intelligence when the temperature is low and the keyword is verified. The current model is highly applicable to industrial IoT edge devices where autonomous, secure, and rapid hazard mitigation is mandatory for operational safety.

A Feature-Driven IoT Intrusion Detection Framework Using Machine Learning for Enhanced Detection of Anomalies

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Abstract

The increasing usage of smart devices that connect to the internet has increased the number of opportunities for cybercriminals to gain illegal access to network systems. Traditional intrusion detection systems (IDS) that utilize both signature-based and rule-based detection methods cannot detect zero day exploits and advanced persistent threats. The purpose of this research is to develop a lightweight, scalable, feature-driven, and machine learning ensemble based IDS framework for improved anomaly detection. The framework comprises of two classifiers. The first stage classifier is a binary classifier that establishes whether traffic is normal or malicious. The second stage classifier is a multi-class classifier that distinguishes between the types of attacks detected. The issue of class imbalance has been addressed by using a controlled oversampling method (SMOTE-ENN). The planned method of classifying multiple model predictions through the use of confidence-disagreement weighted ensemble (CDWE) provides a more reliable combination of results while reducing the amount of misclassifications that may occur. Based on empirical results, the proposed method outperformed or produced equivalent results compared to baseline methods across all performance metrics including high accuracy, improved precision-recall balance, enhanced detection rates of minority attack classes, and decreased error rates. Additionally, feature analysis provides insights into important network traffic attributes for attack detection. The framework serves as a robust and scalable method for real-world IoT intrusion detection.

Effect of Biocementation on Silty Sand Using Microbial Activity of Cow Dung

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Abstract

Various soil stabilization materials, like cement and lime, that are in use for soil stabilization pose a threat to the environment. This work utilizes cow dung (CD) as a binding material in place of conventional binding materials such as cement and lime. Environmental degradation can be reduced by replacing conventional practices with eco-friendly techniques such as biocementation. Biocementation using CD utilises microbial activity for binding soil particles. Microbial activity produces products like calcium carbonate and extracellular polysaccharides, which bind soil particles by filling the voids of the soil. This study focuses on stabilisation of soil after inducing it with CD. Direct shear test and California bearing ratio test confirms the improvement in soil. Calcium carbonate precipitates are observed between soil particles in SEM images. CD can be used as a ground improvement method on commercial basis as it is easily available in society and byproducts are not harmful for the health of soil and surrounding water bodies.

MediConnect- Intelligent Symptom Checker Doctor Recommender

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Abstract

Many people find it difficult to recognize early health signs, especially if they lack access to medical advice. Due to the present digital solutions' erratic or inflexible assistance, users usually aren't aware of how critical. What kind of treatment they require or what their condition may be. The entire digital healthcare platform MediConnect, which offers context-aware, simply accessible, and customized initial health advice, is presented in this paper. MediConnect enables users to communicate their symptoms via a variety of formats, including voice input, written descriptions, and image uploads. These inputs are analyzed by a potent engine, which then interprets the data and produces probability-based health insights. Additionally, it offers suggestions for the top medical expert. MediConnect provides a personalized evaluation that adapts to specific situations rather than adhering to rigid guidelines or general recommendations by looking at the patterns, severity, and other characteristics that are specific to each user. MediConnect's comprehensive approach is one of its main characteristics. It integrates follow up assistance, personal health record management, expert advice, and symptom evaluation into a single platform. By eliminating the need for numerous disparate technologies, this configuration simplifies the user experience and enables proactive healthcare management. The platform's user interface is conversational and intuitive. Users of various ages and skill levels can interact with the system with confidence thanks to its design. MediConnect demonstrates a user-focused, astute approach to digital health care by tying together early symptom assessment and expert care. The platform serves as an example of how a thorough, adaptable system may reduce ambiguity, enhance prompt access to the appropriate medical care, and assist people in making well-informed decisions.

Keywords

Digital healthcare, symptom assessment, personalized health insights, multimodal input, specialist recommendation, health record management, conversational interface, early symptom recognition.

An AI-Based Intelligent System for Demand-Supply Matching to Optimize Resource Utilization

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Abstract

Optimal matching of demand with existing supply is a significant issue in different business areas, leading to resource wastage and inefficiency. This paper introduces an AI-based intelligent demand-supply matching system to achieve maximum resource efficiency and enhance overall operational efficiency. The proposed system applies machine learning algorithms to analyze historical data, existing demand patterns, and supply constraints to generate accurate forecasts and optimal allocation. The proposed system reacts dynamically to changing circumstances, thus minimizing wastage, reaction time, and decision-making accuracy. The experimental outcomes clearly demonstrate that the AI-based system outperforms the traditional rule-based and manual allocation methods in terms of efficiency, scalability, and reliability. The results obtained from this research investigation clearly illustrate the potential of artificial intelligence in transforming the demand-supply management field by offering intelligent, adaptive, and data-driven operational solutions.

Keywords

Artificial Intelligence, DSM (Demand Supply Matching), RUO (Resource Utilization Optimization), ML (Machine Learning), DF (Demand Forecasting), IDS (Intelligent Decision System).

Dual Disease Prediction of Diabetes and CKD Using Deep Learning

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Abstract

Early identification of chronic illnesses significantly enhances patient outcomes and helps in minimizing overall healthcare expenditure. Among these conditions, Diabetes Mellitus and Chronic Kidney Disease (CKD) are among the most widespread health conditions globally and exhibit a strong interrelationship. This study introduces a Deep Learning based Dual Disease Prediction Framework capable of detecting both Diabetes and CKD at an early stage using clinical datasets. The proposed system utilizes Artificial Neural Networks (ANNs) developed with the TensorFlow-Keras platform to capture intricate, non-linear dependencies among medical attributes. Dedicated deep learning architectures are trained individually for each disease to enable precise feature extraction and disease-specific prediction. The optimized models are integrated into a Flask-driven web application, providing real-time prediction through an intuitive user interface. The experimental outcomes indicate that the developed system delivers robust and accurate prediction performance while ensuring scalability and ease of integration, thereby demonstrating its effectiveness for clinical decision support environments.

Keywords

Deep Learning, Artificial Neural Network, Diabetes Prediction, Chronic Kidney Disease, Healthcare Analytics, Flask Deployment.

Parkinson's Disease Prediction through Voice Analysis using Machine Learning

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Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disorder affecting motor functions and speech production. Early detection plays a crucial role in improving treatment effectiveness and patient quality of life. This paper presents a machine learning-based framework for detecting Parkinson's disease using voice signal analysis. Acoustic features such as Mel-Frequency Cepstral Coefficients (MFCC), jitter, shimmer, fundamental frequency, and Harmonics-to-Noise Ratio (HNR) are extracted from the UCI Parkinson's Telemonitoring dataset. Multiple classifiers including Support Vector Machine (SVM), Random Forest (RF), K-Nearest Neighbors (KNN), and Logistic Regression (LR) are implemented and evaluated.

Experimental results show that SVM achieves the highest accuracy of 89.2%, outperforming other models. The proposed system offers a non-invasive and cost-effective solution for early-stage screening and telemedicine applications.

Introduction: Parkinson's disease is characterized by tremors, rigidity, bradykinesia, and speech impairment.

Traditional diagnosis relies on neurological examination and imaging techniques, which may be subjective and expensive. Voice impairment is one of the earliest symptoms of PD, making speech analysis a promising non-invasive diagnostic approach. Recent advancements in artificial intelligence and machine learning enable automatic analysis of subtle acoustic variations associated with neurological disorders.

Methodology: The UCI Parkinson's Telemonitoring dataset was used for experimentation. The dataset was preprocessed to remove noise and normalize features. Acoustic feature extraction included MFCC, jitter, shimmer, pitch, and HNR. The dataset was split into 80% training and 20% testing data.

Machine learning models including SVM (RBF kernel), Random Forest (100 estimators), KNN (k=5), and Logistic Regression were trained and evaluated.

Results and Discussion: Performance evaluation was conducted using accuracy, precision, recall, and F1-score. SVM achieved the highest accuracy of 89.2%, followed by Random Forest (86.7%), KNN (83.5%), and Logistic Regression (81.9%). Confusion matrix analysis showed SVM produced the lowest false positives and false negatives, indicating better generalization performance.

Conclusion: This study demonstrates the effectiveness of machine learning techniques for detecting Parkinson's disease using voice analysis. The proposed system provides a scalable, non-invasive, and efficient screening tool suitable for telemedicine and remote monitoring. Future work includes incorporating deep learning models and expanding dataset diversity for improved generalization.

Early Detection of Mastitis in Dairy Cows Using AI- Driven Image Analysis and Advanced Data Analytics

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Abstract

This study introduces a solution to the problem by providing its implementation and design, including the development of an intelligent mastitis detection system that can be executed in Flask and a custom Deep Learning system that can be trained on the base of YOLOv11 to identify the health of the rudders in dairy cows with the help of automated means. It is a multi-modal system with support of static image, prerecorded videos and live webcam streams. The uploaded media will undergo and can be processed through the YOLO model which classifies the mastitis condition as healthy, mild, moderate, and severe and predicts the mammograms depending on the bounding box prediction and the confidence score. A metadata record of annotated visuals and their metadata is created using the forensics system and the metadata is stored in a SQLite database, in which traceability/more user-specific analyses can be performed on historical data. A systematic recommendation model provides condition-specific recommendations that provide severity interpretation, treatment recommendations and preventive recommendations. This application has the user authentication, role management, secure files handling and responsive interface that can be used by the clinician or in the field. The entire system demonstrates the feasibility of the introduction of deep learning-driven diagnostic help tools in a lightweight web infrastructure that offers a rapid mastitis detector to contribute to the prevention of early interventions and the management of the health of the herd.

Keywords

Mastitis detection, YOLOv11, deep learning, flask application, image analysis, video processing, cattle health checkup, SQLite., real-time, veterinary diagnostics.

Causal AI-Driven Diabetic Retinopathy Risk Assessment with CBN Algorithm: Web and Mobile Implementation

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Abstract

Diabetic Retinopathy (DR) is one of the top causes of blindness to persons living with diabetes so it's important that they have a way to identify early and prevent this disease. The research project created a multi-platform Diabetic Retinopathy Risk Assessment system including a web-based site and Andoid application. The Diabetic Retinopathy Risk Assessment system combines both patient-observable characteristics (age, duration of diabetes and blood sugar component) as well as lifestyle factors (e.g. activity level, nutrition, etc.) to evaluate the level of risk each person exhibits. Using a Causal Bayesian Network (CBN) based rule-driven algorithm, a weighted score (0%- 100%) is computed to determine the person's risk level (low, moderate, high) and 2-3 of the top contributing factors to that person's level of risk. This multi-platform software incorporates causal AI visualizations, vision acuity/contrast sensitivity tests, and wellness tools in order for person using the software can complete a comprehensive self assessment of his/her health and wellness. Additionally, based upon the causal analysis and the wellness score (a composite score based upon physical activity, nutritional intake, etc.) a personalized prevention plan is produced for each user. This work supports UN SDG 3; to enhance the ability of a health systems to promote prevention of disease by providing persons living with diabetes access to an AI supported self-assessment. N.Jashuva Department of Computer Science and Engineering, Kalasalingam Academy of Research and Education, Krishnankoil-626126. Tamil Nadu, India.99220040649@klu.ac.in low-cost and accessible preventive methods need to be developed that empower patients to assess their own risk and take steps to prevent progression. The primary purpose of this research is to design and implement an integrated, multi-platform solution (a web based application and an Android application) to facilitate an accurate assessment of a patient's risk for developing DR by leveraging Causal Bayesian Networks (CBN) and causal Artificial Intelligence (AI) technologies. The proposed system will utilize observable patient variables (age, duration of diabetes, blood sugar management, lifestyle choices) to provide valuable insights into a patient's health status.

Keywords

Diabetic Retinopathy, Risk Assessment, Causal Bayesian Network (CBN), Causal AI, Preventive Healthcare, Web Application, Android Application, SDG 3.

Improving Diagnostic Accuracy and Patient Outcomes through AI-Driven Early Detection of Brain Tumors

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Abstract

Brain tumors that are accurately diagnosed would actually be easier if very early detection was even made possible as a result of better patient prognoses in due course. The proliferation of AI in imaging and medical diagnostics has led to significant changes in how both technologies function by not only providing novel solutions for the early detection of brain tumors at their incipency but also by redefining the very nature of the technologies themselves. This review in part concerns the use of AI to the analysis of neuroimaging and talk about machine learning, deep learning methods, and the use of MRI and CT. We compare AI-driven systems as opposed to human experts in terms of sensitivity, specificity, and overall diagnostic efficacy. Potential implications of AI-based detection for treatment, survival, and quality of life are also discussed by us. Consequently, problems such as the scarcity of data, the interpretability of the built algorithms, and ethical considerations that are also mentioned in this manner, should be considered as a balanced view of the current state of research and the next steps of rapidly developing a field. The manuscript achieves this goal by consolidating recent research and technological advancements with the ultimate aim of identifying possible ways in which AI could be used to radically change the diagnostic process of brain tumors thus enabling better treatment of patients.

Keywords

AI, early detection, brain tumors, diagnostic accuracy, machine learning, deep learning, neuroimaging, MRI, CT scans, patient outcomes.

Antimicrobial Resistance Decontamination in Pharmaceutical Waste Water

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Abstract

Aim: This study set out to quantitatively test the efficacy of 0.1 N Sodium Hydroxide in chemically deactivating beta-lactam drugs (amoxicillin and potassium clavulanate).

Materials and Methods: In this research, there are two groups. **Group 1** refers to 1 N KOH with 16 samples and **Group 2** refers to 1N NaOH with 16 samples as the active reagent in the deactivation procedure to inactivate the worst-case materials.

Result: It was established using both Amoxicillin and Potassium Clavulanate that both levels were Below the Limit of Quantification (BLQ) by transferring the qualitative microbiology procedure to a quantitative analysis via HPLC-UV using a wavelength of 220 nm. The findings prove that both Amoxicillin and Potassium Clavulanate can be transferred to alkaline hydrolysis with a significance level of approximately **0.029**.

Conclusion: This framework provides superior meaning than the current method to avoid environmental pollution and satisfies the global requirements of the pharmaceutical Effluent management.

Keywords

Beta-lactam, Amoxicillin, Potassium Clavulanate, HPLC, Alkaline hydrolysis, NaOH, AMOX, CLAV, Decontamination.

WildLensAI: A Low-Power Edge Intelligence Framework for Autonomous Wildlife Monitoring Using Multi-Hop Mesh Communication

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Abstract

Wildlife conservation in remote and off-grid environments requires reliable monitoring systems that operate with minimal energy consumption and without dependence on communication infrastructure. Conventional surveillance solutions are often impractical due to continuous power usage, excessive data generation, and reliance on network connectivity. To address these challenges, an eco-friendly intelligent surveillance system, WildLensAI, is proposed. The system follows an event-driven architecture in which low-power motion sensing activates edge-based artificial intelligence only when relevant activity is detected. A Raspberry Pi performs on-demand object detection to distinguish between animals and humans, while environmental sensors provide additional contextual data. Efficient and infrastructure-less communication is achieved using an ESP-NOW-based multi-hop mesh network, with Protocol Buffers employed for compact and reliable alert serialization. To conserve energy, storage, and preserve privacy, only critical human-intrusion events are selectively retained. The proposed system enables scalable, low-power, and autonomous wildlife monitoring, making it suitable for long-term deployment in resource-constrained conservation environments.

Keywords

Wildlife surveillance, edge AI, solar-powered IoT, ESP32, Raspberry Pi, ESP-NOW mesh network, Protocol Buffers, low-power IoT, multi-hop communication.

A Comprehensive Review of Multimodal Deepfake Detection Using Text and Audio

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Abstract

Recent developments in artificial intelligence and deep learning have greatly increased the pace of the production of highly realistic deepfake media in both audio and textual forms. Although such technologies have some useful applications, they also present significant dangers, such as massive misinformation, impersonation of identity and voice cloning, as well as social manipulation. The current deepfake detection methods are mostly based on unimodal analysis and cannot check coordinated multimodal attacks when several content types are being manipulated at the same time. This research presents a systematic review and analysis of the state-of-the-art methods in detecting deepfakes, focusing specifically on the text-based, audio-based, and the multimodal methods of detecting deepfakes. Transformer models have been shown to work well on semantic and acoustic representations learning, including BERT, DistilBERT and Wav2Vec2.0, but issues in cross-modal consistency, resistance to real-world disturbances, multi-linguistic content, and scalability to larger computational models are still mostly open. The research classifies current multimodal deepfake detection systems based on input modality and architectural design. A comparative analysis of the advantages and drawbacks of these methods is made emphasizing the impacts of various modalities and model structures on the performance in detection. The research paper also establishes the research gaps that are critical and which are currently restricting the development of effective multimodal detection systems. Besides that, open challenges that are not yet solved are also addressed in the survey, highlighting the necessity of the reliable and explainable solutions that can be implemented to real-life situations.

Keywords

Multimodal Learning, Deepfake Detection, DistilBERT, Wav2Vec2.0, Fake News, Audio Spoofing, Fusion Networks.

Early Neurodegenerative Pattern Analysis Using Deep Learning on MRI Scans

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Abstract

Neuro-degenerative disorders like Alzheimer's disease progressively impair cognitive abilities and memory. Early diagnosis is critical for effective treatment plus patient care. Manual intervention of brain Magnetic Resonance Imaging (MRI) is time-consuming and may fail to capture slight structural variations present in early stages. Making things harder for people with Alzheimer's, because these diseases steadily erode the memory of people who have them. It is very important to catch the illness soon after the illness starts. This work is about a way of doing things using deep learning-based framework for early detection. This approach uses learning to look for issues early on which is really important and this paper presents a new way to do that using deep learning. Neuro-degenerative pattern analysis using MRI brain scans. A dataset derived from the OASIS-1 MRI. The MRI images are prepared beforehand so that they can be used for the experimentation of the dataset. The MRI images are processed and analyzed using a Convolutional Neural Network (CNN) for multi class classification based on Clinical Dementia. This new system wants to find changes in CDR (Clinical Dementia Rate) levels that are not easy to see. The proposed system aims to detect structural abnormalities in brain images at early stages. To guarantee precise and understandable predictions, the framework combines multi-plane MRI analysis, skull stripping, a ResNet50 architecture, and GradCAM visualization. Doctors can use diagnosis but it also helps them make decisions when they are treating patients. It gives doctors information so they can make better choices about patient care and treatment using automated diagnosis.

Keywords

Alzheimer's Disease, MRI, Deep Learning, CNN, Neuro-degeneration, Medical Imaging.

Proximity Based Real-Time Bus Identification Using BLE- Beacons For Visually Impaired Commuters

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Abstract

Public transportation poses a significant accessibility issue for visually impaired people, particularly when it comes to finding and boarding the right bus at busy stops. Current systems rely too much on visual information, internet access, or GPS tracking, which makes them hard to use in real-world situations. This paper introduces an AI-enabled Smart Bus Identification System that uses Bluetooth Low Energy (BLE) technology along with a mobile voice-assistance application. BLE beacons installed in buses send out unique identifiers, such as route and bus number. An Android app on the user's smartphone scans these identifiers. The app calculates how close the bus is based on the Received Signal Strength Indicator (RSSI) and delivers real-time voice alerts via a Text-to-Speech (TTS) module. The system works entirely offline, ensuring it is highly accessible, low cost, and uses minimal power. Experimental results indicate that this method offers reliable and hands-free bus identification, greatly improving mobility and independence for visually impaired commuters.

Keywords

Bluetooth Low Energy (BLE), Text-to- Speech (TTS), Accessibility, RSSI, Smart Mobility, Assistive Technology, Internet-free System, Public Transport.

Breast Cancer Contact Map Analysis Using Convolutional Neural Networks

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Abstract

Breast cancer is a leading health concern, characterized by abnormal cell growth in breast tissue driven by complex genetic, molecular, and environmental factors. Proteins play a crucial role in cancer progression through cellular processes such as signaling, repair, and replication. Understanding protein structures is essential, as they determine biological functions. This project leverages protein contact maps—2D representations of residue interactions, to analyze proteins associated with breast cancer. With the help of computational tools, contact maps are generated from structural data and consolidated via Principal Component Analysis (PCA) to identify patterns and clusters. Machine learning further highlights the unique structural features of cancer proteins. The study bridges bioinformatics and computational biology, offering insights into protein folding, stability, and function. These findings may inform therapeutic strategies by identifying key structural targets, advancing cancer research and drug discovery.

Keywords

Breast cancer, Protein Contact Maps, Principal Component Analysis, Protein Data Bank, Distance Matrix, Structural Patterns.

Inclusive Patient Support: Developing Multilingual and Low-Resource Healthcare Chatbots

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Abstract

The need to provide multilingual and low resource healthcare chatbots has been indicated by the growing demand of the accessible healthcare services among the different linguistic population groups. This paper is a discussion on the creation of smart conversational agents that can comprehend and communicate in multiple languages, especially where annotated data and computing power is limited. The proposed system is built using the opportunities of natural language processing (NLP), transfer learning, and lightweight model architectures, which can tackle the limitations of the language scarcity problem, the use of domain-specific medical terms, and context-sensitive dialogue management. The experimental assessments reveal that the chatbot is effective in delivering the correct answers, enhancing interaction between patients, and minimizing obstacles to health care access. The results highlight the ability of multilingual low- resource chatbots to improve inclusive healthcare provision in the world.

Keywords

Multilingual Chatbots, Low-Resource NLP, Healthcare AI, Patient Engagement, Transfer Learning, Conversational Agents, Inclusive Healthcare.

Unmasking Bias Detection Techniques in Pre-Trained Language Models: A Review

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Abstract

Large pre-trained language models are used in a huge number of real-world applications. It is noticed that there is a worsening effect of social biases within these models due to bias already embedded in them as a result of biased training. This paper discusses the bias detection techniques for pre-trained language models. We organize these methods into multiple levels: embedding, representation, output, decision, evaluation, and data level. We discuss common methods of bias detection, like association tests, benchmark comparisons, statistical tests, and internal probing techniques. Our survey indicates that the bias detected at the output level with benchmark comparisons is dominant. Also, the biases studied are mostly gender and racial biases, not giving much focus on other bias types and their intersection. It is observed that there is a lack of standard evaluation tests for the analysis and comparison of different models on some standard parameters. Thus, more in-depth evaluation techniques for pre-trained language models are needed.

Keywords

Bias Detection, Large Language Models, Machine Learning, Pre-Trained Models, Word Embeddings.

Designing and Implementation of Lightweight Intrusion Detection System for IoT Devices Using Rule-Based Logic and Machine Learning

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Abstract

Intrusion Detection Systems play a significant role in ensuring the security of IoT environments as they monitor and then analyze network traffic to detect malicious activities. However, IoT devices have special issues: limited computing capabilities, dynamism of network operations, and dynamism of attack patterns. In this regard, we propose L-IDS-a lightweight intrusion detection system that is a hybrid of machine learning and rule-based logic. It comprises a set of predefined rules for the fast detection of known threats and a hybrid stacked machine learning model, consisting of Random Forest, Gradient Boosting, and K-Nearest Neighbors, that could identify complex and previously unknown patterns of an attack. Light weight meta-learner dynamically sets the threshold values of detection threshold according to recent error feedback to enhance adaptability while minimizing false alarms. Some key novelties are outlier-aware and dynamic feature selection and threshold tuning mechanisms, which increase the sensitivity of rare attacks while maintaining resource efficiency. The proposed system was tested on the UNSW- NB15 dataset, which contains actual IoT traffic with different attack types: Fuzzers, Analysis, Backdoors, DoS, Exploits, Reconnaissance, and Worms. The performance metrics were measured using Accuracy, Precision Recall, F1-Score, MAE, MSE, RMSE. The results of the practicality evaluation indicated that the proposed L-IDS is capable of providing high detection accuracy under a minimal computation load. Hence, it will be a feasible and scalable solution for next-generation IoT security systems. The result of the evaluation indicates that the proposed L-IDS has an outstanding accuracy in the detection process of 93.8%, and thus very practical and efficient in its operation.

An IoT Based Environmental Monitoring Rover with Rule-Based Advisory for Greenhouses

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Abstract

Manual collecting of data, fixed sensing locations, and delayed responses to growers are typical limitations of greenhouse environmental monitoring. This paper describes the design and experimental analysis of a mobile environmental monitoring rover for greenhouse applications. The system includes cloud-based logging, wireless communication, and multi-sensor data collection into a modular architecture. An ESP32 microcontroller interfaces with sensors for temperature and humidity (DHT22), air quality (MQ135), and light intensity (BH1750) to collect timestamped measurements at a fixed sampling interval of $\Delta t = 15$ s. A cloud database receives sensor readings so they can be stored and accessed remotely. A predictable rule-based advisory module matches measured parameters with predefined environmental thresholds to generate suggestions. Wireless transmission sends sensor data to a cloud database which uses AI-driven analysis to interpret environmental measurements through rule-based and threshold-based methods and create advisory recommendations based to environmental standards. The rover allows users to choose their own navigation paths while it follows its programmed monitoring schedule. The system offers user interaction through a Telegram chatbot which enables users to see real-time updates and receive advisory feedback while a mobile web interface allows users to operate the rover manually. The research showed that the system achieved reliable data collection success rate of over 97 percent through $N > 10^4$ recorded sensor data which resulted in secure cloud data storage and active system performance during battery operation. The research demonstrates that the system provides an effective and straightforward method for monitoring greenhouse environmental conditions because it allows simple implementation and understanding of its operational functions without the need for autonomous movement or advanced artificial intelligence systems.

Keywords

Smart rover, Precision agriculture, Internet of Things (IoT), ESP32, cloud database, chatbot.

Identification of Vital Nodes in Social Networks: A Review

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Abstract

A social network is a collection of social links and relations between individuals, organizations, and groups. One of the primary areas in the realm of continuing study is social network analysis. The rise of diverse social networks has considerably enhanced our daily lives while also posing a difficult problem in identifying the vital nodes within them. In these domains, a variety of methods have been devised and implemented, but some have included centralities, as well as their flaws and limits, in their research. As a result, various centralities have been developed over time. The significance of nodes inside a social network is measured using the centrality index. This study provides a review of the research on identifying vital nodes in social networks. The purpose of this review is to describe past and current research on centralities for determining vital nodes in social networks. Finally, we present our future research plans based on measures of centrality.

Keywords

Social Networks, Centrality Measures, Vital Nodes.

Cloud-Based Encrypted File Sharing and Storing System

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Abstract

In recent years, with the rapid growth of cloud-based storage and file-sharing platforms, ensuring data privacy and user-controlled access has become a critical challenge for modern digital systems. Although existing cloud services provide high availability and scalability, they often rely on centralized control and limited encryption transparency, raising concerns about confidentiality and unauthorized data access. To address these limitations, this paper presents a secure and privacy-focused cloud-based file sharing and storage system that integrates strong cryptographic protection with lightweight embedded computing. Recognizing the importance of user autonomy and secure data handling, the proposed system employs Advanced Encryption Standard (AES)-256 encryption to protect files before storage, ensuring that data remains confidential even if the storage medium is compromised. The system leverages a Raspberry Pi as a local secure server, combined with a web-based interface that allows users to upload files, assign passwords, and receive a unique file identifier for controlled sharing. Through systematic implementation of encryption, authentication, and secure storage mechanisms, the system ensures that only authorized users with valid credentials can retrieve and decrypt stored files. Experimental evaluation demonstrates reliable encryption performance, low processing latency, and strong resistance to unauthorized access. The proposed approach provides a practical and cost-effective alternative to conventional cloud services, offering enhanced security, privacy, and user control in both online and offline environments.

Toward Secure and Privacy-Preserving Remote Examinations: A Computer Vision and Biometric Hashing Approach

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Abstract

The use of online examinations has increased but maintaining academic integrity during remote testing presents a major obstacle. The traditional web-based proctoring systems use either manual monitoring methods or independent detection systems which fail to stop identity spoofing and tab-switching cheating and unauthorized help. The research introduces a secure online examination proctoring system which combines browser-based computer vision technology with biometric verification through SHA-256 hashing and behavioral tracking systems. The system uses the FaceDetector API of the browser to perform real-time face detection which produces bounding boxes that the system uses to create cropped facial images for identity verification through hashing. The system employs cryptographic similarity metrics to compare periodic verification snapshots for the purpose of detecting impersonation attempts. The system uses behavioral monitoring modules to track eye movements and head movements and tab switching and copying and pasting activities. The secure programming assessments use a sandboxed multi-language code execution engine which enforces strict time limits for all tests. The experimental evaluation finds that the system detects 95% of faces while achieving 92% accuracy in behavioral monitoring and over 90% confidence in identity verification during normal lighting conditions. The system processes each frame with a detection latency of 50 to 200 milliseconds. The combination of client-side computer vision with cryptographic biometric validation produces strong remote examination security while maintaining user privacy according to the results.

A Quantum Generative Model for Multi-Dimensional Time-Series to Analyze Financial Data

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Abstract

Despite proposing a quantum generative model for time series that successfully learns correlated series with multiple Brownian motions, the model has not been adapted and evaluated for financial problems. In this study, a time-series generative model was applied as a quantum generative model to actual financial data. Future data for two correlated time series were generated and compared with classical methods such as long short-term memory and vector autoregression. Furthermore, numerical experiments were performed to complete missing values. Based on the results, we evaluated the practical applications of the time-series quantum generation model. It was observed that fewer parameter values were required compared with the classical method. In addition, the quantum time-series generation model was feasible for both stationary and nonstationary data. These results suggest that several parameters can be applied to various types of time-series data

Keywords

Quantum generative model, time-series generation, correlated time series, financial data modelling, Brownian motion, long short-term memory (LSTM), vector autoregression (VAR).

Comprehensive Study of Concrete Block Using Gypsum Material with Partial Replacement of Cement

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Abstract

One of the foremost problems that construction companies have to address the amount of construction and demolition waste that is generated during the construction and refurbishment of a building. This review combine the current state of the art in terms of recycling gypsum based wastes, such as flue gas desulfurization (FGD) gypsum, red gypsum, titanium gypsum, gypsum plasterboard waste (GPW) and autoclaved aerated concrete waste (AAC), into sustainable materials for construction, such as concrete, plaster, mortar and composite materials. Through the use of experimental studies on the mechanical properties of various types of gypsum wastes as well as their microstructural properties, leaching behaviour, and multi-criteria assessments of their environmental impacts, optimal substitution levels of these types of gypsum wastes into concrete bricks and other petetion are determined (typically between 5 % to 50 %), and their capability to increase compressive strength (up to 45 MPa) and improve thermal insulation or sound absorption (0.17-0.89), while coincidently reducing water absorption and CO₂ emissions by 10-20 %. In general, recycling gypsum waste is a key part of the circular economy and provides economic, high-performance substitutes for virgin materials while decreasing energy use and environmental impact, thus fostering more sustainable methods of construction.

Keywords

Gypsum waste, construction and demolition waste, recycled materials, sustainable concrete, mechanical properties, environmental benefits.

Assessing First and Last Mile Connectivity Around Metro Stations – A User Perception-Based Study for Sustainable Urban Mobility

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Abstract

Sustainable urban mobility depends not only on the operational efficiency of metro systems but also on the quality of first and last mile connectivity (FLMC), which critically influences how users utilise metro networks in rapidly urbanising cities. This study assesses the level of first and last mile connectivity around selected metro stations using a user perception-based approach, with the goal of identifying significant gaps impacting accessibility, comfort, safety and seamless mode integration. Study examines three metro rail stations and 500m radius around St. Thomas Mount, Alandur, and Chennai Mofussil Bus Terminus (CMBT), selected for their contrasting land uses, high commuter ridership, and role as multimodal nodes integrating suburban rail, bus terminus and intermediate public transport (IPT). Primary data were collected through surveys. A Composite Connectivity Quality Index (CCQI) score was developed using 15 indicators covering pedestrian infrastructure, safety and security, feeder services integration, comfort, and environmental quality. Results reveal moderate overall first and last mile connectivity, with major gaps in pedestrian infrastructure such as footpath connectivity, shading, and barrier free access. The study recommends planning measures focusing on pedestrian priority, safer crossings and better-organised feeder services that can be applied across metro system to improve first and last mile connectivity.

Real-Time Sugarcane Bud Detection and Grading Using YOLO-Based Deep Learning and Raspberry Pi

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Abstract

Sugarcane is a crop of agricultural importance and it is directly proportional to the quality of buds used in planting as well as its future germination, vegetation growth and future production. Modern agronomic procedures usually involve the use of physical observation to assess sugarcane buds. Though it is simple, this method is tedious and requires constant human observation. The skill of the graders is therefore a dominant factor; besides, the elements like fatigue of the observers, insufficient light and biased perception could also cause inaccuracy which can be seen in poor crop growth and low productivity. The project will overcome these shortcomings by suggesting the design of an automated image-processing and deep-learning system to grade sugarcane buds. The system has incorporated the YOLOv8 object -detection algorithm and Raspberry Pi ecosystem to detect and classify the buds in real-time. Images obtained are processed and morphological features are extracted such as shape, size and condition of the surface, and the obtained data are used to discriminate between healthy and defective buds. The entire calculation is done in place, on the Raspberry Pi, eliminating the use of an internet connection. The results of the grading process are presented on an OLED screen, and there are extra LED indicators that give easy to interpret field-ready visual indicators. The system has been experimentally evaluated to provide accurate and repeatable evaluation with low latency. Therefore, this project can improve sugarcane farming and promote the implementation of effective smart technologies in the agrifood industry since it will decrease the use of human labour and simplify the process of picking high-quality buds.

Keywords

Sugarcane Bud Detection, YOLOv8, Deep Learning, Object Detection, Precision Agriculture, Raspberry Pi, Real-Time Embedded Systems.

Sustainable Route Optimization of Urban Vegetable Freight Distribution Using GIS with Carbon Emission Factors: A Case Study of Oddanchatram Gandhi Market, Dindigul District, Tamil Nadu

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Abstract

Urban freight logistics play a vital role in ensuring the efficient movement of goods within cities, particularly for perishable commodities such as vegetables that require timely delivery. However, urban freight transport often faces challenges including traffic congestion, longer travel times, higher transportation costs, inefficient routing, and increased environmental impacts due to vehicle emissions. This study focuses on optimizing vegetable freight distribution routes to minimize travel distance, delivery time, and transportation costs while also addressing sustainability concerns. The research analyzes existing freight movement patterns and operational characteristics within the selected study area using primary data collected from freight operators, drivers, and field observations. Key factors influencing route efficiency such as travel time, distance, vehicle utilization, congestion levels, and fuel consumption are evaluated using analytical methods and Geographic Information System (GIS)-based route optimization techniques. The study follows a systematic methodology that includes literature review, data collection through traffic counts and surveys, data analysis, and validation of the optimized route model. In addition to operational efficiency, the study incorporates a carbon emission assessment to evaluate the environmental impact of freight transportation. Carbon emissions are estimated based on travel distance, vehicle type, and fuel consumption. The results identify optimized vegetable freight routes that reduce travel distance, operational costs, delivery time, and carbon emissions. The study concludes by proposing strategic recommendations to improve the efficiency, sustainability, and environmental performance of urban freight logistics systems.

A Multimodal AI Framework for Lung Cancer Detection and Treatment Recommendation Using Deep Learning and Quantum Machine Learning

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Abstract

This paper presents an innovative and intelligent artificial intelligence framework for automated lung cancer detection and clinical decision support. Conventional diagnostic approaches based on manual interpretation of computed tomography (CT) scans are time-consuming and limited in their ability to integrate clinical and molecular information. To address these limitations, this paper implements a unified system that combines deep learning-based tumor detection from CT images, hybrid quantum-classical learning for early risk prediction from symptom data, and classical machine learning for treatment category recommendation using clinical and biomarker information. The proposed framework was validated on lung CT image data and structured clinical records. The results of the tumor detection model have shown a mean average precision (mAP) of 87.8% and a mean inference time of 12.4 ms per image. The early lung cancer risk prediction model developed by the hybrid quantum neural network (QNN) achieved a total accuracy of 90.32%, and the recommendation of treatment model achieved an accuracy of 93.25% across different classes of treatments. The results of this research demonstrate that the diagnostic accuracy of this framework is enhanced by the integration of imaging, clinical, and molecular data into a single AI-based process, and, therefore, provides an effective automated means of diagnosing lung cancer and assisting clinicians in making personalized treatment recommendations, compared to methodologies based on a single modality only.

Keywords

Lung cancer detection, deep learning, quantum machine learning, YOLOv11, treatment recommendation, computed tomography (CT) scans.

AI-Based Mental Health Therapy Chatbot

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Abstract

Mental health disorders, such as anxiety, depression, and stress, have become increasingly prevalent in modern society, creating a growing demand for accessible and timely mental health support. However, the limited availability of professional therapists, high consultation costs, and social stigma often prevent individuals from seeking immediate help. To address these challenges, this study presents an AI-based mental health therapy chatbot developed using Generative Artificial Intelligence and Retrieval-Augmented Generation (RAG) architecture. The proposed system combines semantic information retrieval and large language model (LLM) generation to provide empathetic, context-aware, and human-like responses to user queries. Mental health-related datasets were processed and embedded using Sentence Transformer models, and relevant contextual information was retrieved efficiently using the FAISS vector database. Responses were generated using the Groq generative AI model accessed via an API-based interface. The chatbot was deployed as a web application with a responsive user interface and Express-based backend. Experimental evaluation demonstrated that the system provides coherent, emotionally supportive, and contextually relevant responses while maintaining user privacy. Although the chatbot is not intended to replace professional therapy, it serves as an effective first-level mental health support system that offers continuous availability and scalability. The proposed approach highlights the potential of generative AI to enhance digital mental healthcare solutions.

Keywords

Mental Health Chatbot, Retrieval-Augmented Generation, Emotional Support Systems, Artificial Intelligence in Healthcare.

Phrase-Level Hand Gesture Recognition Using MediaPipe Landmarks and Random Forest Classifier

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Abstract

Hand gesture recognition is the process of recognizing how a person moves their hands and using that movement to provide instructions or indicate feelings so that they can communicate with people in a more natural manner. Vision-based techniques for recognizing hand gestures are the most prevalent because they do not require any additional sensors and are less obtrusive than other methods. Landmark-based techniques use key points on the hand rather than using raw images to identify important joints in the hand such as the fingers and wrist to reduce the volume of data needed to identify hand gestures and provide a more accurate and consistent identification of hand gestures regardless of changing lighting conditions, distractions and imperfections in the image captured by the camera. MediaPipe Hand Landmarker is an application that is capable of quickly locating the key points on each hand that have three-dimensional coordinates from a normal video image, with each hand having twenty-one distinct key points. By creating a feature vector with 126 dimensions for each video frame based on the hand landmarks identified using MediaPipe Hand Landmarker combined with a Random Forest Classifier, a simple system is built to automatically recognize phrases created using hand gestures without the use of an advanced machine learning model or deep learning model and instead rely on single or double hand features to identify the hand gesture made by the user.

Keywords

Hand gesture recognition, sign language, MediaPipe, Random Forest, phrase recognition, real-time vision.

Study of AI-Based Aircraft Health Monitoring and Repairing System

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Abstract

In modern commercial air transportation, structural fatigue, along with progressive fracture propagation, is a significant problem, particularly for narrow-body aircraft operating under high-cycle loading conditions. This paper proposes an integrated system of AI-based Aircraft Health Monitoring and Prognostics, designed particularly for a Boeing 737 aircraft platform. This system incorporates real-time 3D visualization within a simulation environment, deep learning-based temporal prediction, and multi-subsystem structural modeling.

The aircraft has five primary subsystems, namely, the wing, fuselage, engine, landing gear, and tail, which are monitored using the suggested system. To simulate the fatigue-prone characteristics of the aircraft, a large dataset was created, comprising 41 structural and operational parameters, including crack length progression, stress-strain, vibration, load factors, pressure, etc. To simulate the structural deterioration of the aircraft, a physics-informed crack growth simulation was carried out using exponential propagation laws, intended to mimic multi-aircraft, multi-cycle fatigue.

A single-layer Long Short-Term Memory (LSTM) neural network structure is applied for learning the sequence dependencies in the flight cycles for prognostics and degradation learning. The network is trained to simultaneously predict the following:

- Aircraft health state classification (Healthy, Warning, Critical)
- Crack growth development
- Cycle of crack initiation
- Cycle of critical failure
- Remaining Useful Life (RUL) for hours and cycles of operation
- Prediction accuracy parameters

The time series learning of the network detects early signs of degradation, such as those occurring in the early stages of degradation, before the critical threshold is crossed. This enables the scheduling of proactive maintenance, as indicated by the results, with high prediction stability for time, as well as accurate prediction of fracture initiation and critical transition points.

The incorporation of AI predictions in real time into a Unity-based environment for 3D visualization is a major contribution of this research. Structural visualization of subsystems, crack growth animation, health state prediction, and RUL prediction are all provided by the digital twin environment, which is based on Unity. The gap between interpretability for ground engineers and AI prediction is filled by this research.

The components of the system architecture include:

1. Multi-aircraft dataset development, which is synthetic and physics-consistent (up to 12,000 cycles per aircraft)
2. Time series preprocessing and feature scaling
3. Prognostic modeling using LSTM
4. Failure threshold classification and health mapping
5. Digital twins integration for decision support using Unity

The proposed framework offers a scalable predictive maintenance approach, as discussed, and is in line with the concept of next-gen digital aviation solutions. This research is a step forward in the development of intelligent aviation maintenance systems, reducing downtime, and increasing safety and efficiency with the integration of structural fatigue modeling, deep RNNs, and interactive 3D system integration.

Quantitative Performance Validation of a Low-Cost Offline Bluetooth-Based Smart Home Automation System

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Abstract

This study demonstrate a low-cost smart home automation system which operates entirely offline has been tested successfully through experiments. The system functions in complete local mode because it allows users to operate it through voice commands and mobile devices without needing an internet connection. It uses a 4-channel relay interface to manage home appliances which undergoes testing through controlled performance evaluation. The test results achieved a total command execution success rate of 97.5 percent and a switching reliability rate of 100 percent while it executed 200 ON/OFF commands with an average delay of 1.48 seconds across 120 command tests. The system maintains voice recognition accuracy above 91 percent when exposed to moderate noise conditions which produce sound levels of approximately 55 decibels, while users can communicate effectively from distances up to 8 to 10 meters inside buildings. Dependable automation system without needing cloud-based platforms is developed, which makes it appropriate for homes that need to keep expenses down while using limited resources. Static PIN-based authentication with non-encrypted communication is implemented, which creates a security gap that must be addressed through upcoming system enhancements.

Keywords

Home Automation, Arduino, Voice Control, Bluetooth Module, Smart Home, User Friendly Design.

Smart Ear Probe for Vital Monitoring

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Abstract

Continuous vital parameter monitoring is becoming increasingly important in telemedicine, early diagnosis, and personal health management. Though the traditional methods of monitoring, such as fingertip pulse oximeters, chest belts, and digital thermometers, are very accurate, they are not suitable for continuous or long-term use because of their bulkiness and discomfort.

This paper demonstrates a compact, ear-mounted wearable device that is able to monitor heart rate, SpO₂, respiration rate, and body temperature by combining PPG sensing, in-ear acoustic detection, and digital temperature measurement. This device uses Bluetooth Low Energy (BLE) for wireless communication with a dedicated mobile application to enable real-time visualization, data storage, health tracking, and user notifications.

The ear was chosen as the location for sensing due to its stable blood perfusion, low motion interference, proximity to core temperature, and natural ergonomic anchoring, supported by previous literature. A custom PCB integrates a MAX30102 PPG module, MEMS microphone, temperature sensor, ESP32 microcontroller, battery, and charging module. The app provides a user dashboard, graphical trends, alarm system and enables seamless device pairing.

This work demonstrates the feasibility of a compact, user-friendly wearable ear-based monitoring system with integrated hardware and mobile software for continuous health management.

Keywords

Wearable sensors, ear-PPG, mobile health app, BLE communication, respiration sensing, temperature monitoring.

An Integrated Machine Learning Framework for Crop Recommendation, Yield Prediction, Soil Classification, and Fertilizer Optimization

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Abstract

Though the application of precision agriculture is of utmost significance for the enhancement of agricultural productivity, resource utilization, and sustainability, most farmers lack efficient data-driven solutions for decision-making. This paper proposes a multi-module predictive model for yield prediction, suitable soil type identification, optimal crop recommendation, and suitable fertilizer recommendation based on the chemical composition of soil. The proposed system employs data preprocessing methods such as label encoding, class balancing, outlier elimination, and feature scaling. Various supervised machine learning models are applied on the dataset, and their performance is measured. The best models are delivered to the user through a user-friendly web interface for rapid predictions. The experimental outcome reveals outstanding performance with an accuracy of about 98% for crop recommendation, 100% for fertilizer recommendation, 78% for soil type classification, and R^2 value of 0.98 for yield prediction. The proposed system is scalable, and the system offers significant insights to the farmers. The system allows farmers to take informed agricultural decisions and has the potential to be integrated with IoT sensors and geospatial data in future precision agriculture systems.

Keywords

Crop Recommendation, Yield Prediction, Soil Classification, Fertilizer Recommendation, Machine Learning, Random Forest, Precision Agriculture, Ensemble Learning, Smart Farming.

Hybrid Deep Learning Framework for Face-Swap Deepfake Video Detection Using CNN-RNN Architecture

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Abstract

The rapid growth of deepfake technology has made it increasingly easy to create highly realistic yet fabricated images and videos, raising serious concerns about misinformation, identity misuse, and digital security. This study presents a hybrid deep learning framework designed to detect face-swap deepfake content in both images and videos with improved reliability. The proposed approach combines spatial feature extraction, global contextual analysis, and temporal sequence modelling to identify subtle visual inconsistencies and motion-related irregularities. The system is trained and evaluated on large-scale benchmark datasets containing both real and manipulated media. Experimental results demonstrate that the hybrid architecture achieves strong detection accuracy and improved robustness compared to conventional single-model approaches. To ensure practical applicability, the trained model is integrated into a lightweight web-based platform that enables users to upload media files and receive real-time authenticity predictions with confidence scores. By effectively analysing both frame-level details and motion consistency across sequences, the proposed system provides a scalable and dependable solution for digital forensics, media verification, and online content moderation. The framework contributes to ongoing efforts to strengthen trust and transparency in digital media environments.

Keywords

Deepfake detection, hybrid deep learning, spatial-temporal analysis, digital forensics, media authentication.

Formation Mechanism and Crystallinity Optimization of TiC Nanopowders

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Abstract

This research utilized titanium n-propoxide, acetic acid as a chemical modifier, and saccharose as a carbon source to synthesize nanosized titanium carbide through a simple sol-gel method. Nanocrystalline TiC powders were prepared by carbothermal reduction of the xerogel precursor in an argon atmosphere. The xerogel precursor was formed by combining titanium (IV) isopropoxide (TTIP) and sucrose using the sol-gel technique. To produce a stable sol, TTIP was directly mixed with a solution of sucrose and acetic acid. The resulting gels consisted of nanoscale tetragonal TiO₂ and a well-distributed amorphous carbon. Subsequent heat treatments above 900°C led to the formation of titanium carbide with some oxygen incorporated into the lattice. Increasing the heat treatment temperature from 1100°C to 1300°C resulted in a reduction of the oxygen content. The results indicate that TiC nanocrystalline powders with excellent crystallinity, a fine average crystallite size (~12.25 nm), and a nearly standard lattice parameter (~0.4316 nm) were produced at 1300°C for one hour. The lattice constants for the TiC phase in the different samples were measured at 0.4306 nm, 0.4302 nm, and 0.4316 nm, respectively, indicating that the order improves as the titanium content decreases.

Keywords

Carbides, Xerogels, Carbothermal reduction, DSC, XRD.

SwinIR–Diffusion Hybrid Framework for Anatomically Consistent Medical Image Enhancement

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Abstract

For clinical diagnosis and treatment planning, medical imaging modalities like computed tomography (CT), magnetic resonance imaging (MRI), and X-ray are essential. However, degradations such as noise, blur, low contrast, and acquisition artifacts brought on by hardware constraints, low-dose protocols, and patient motion frequently appear in images taken in actual clinical settings. These deteriorations impair perceptual clarity and may make it difficult to see minute anatomical features that are crucial for a precise diagnosis. Conventional enhancement methods based on spatial filtering or global histogram equalization often distort structural information and amplify noise, which limits their clinical usefulness. Although most supervised models require paired high-quality reference images, which are challenging or dangerous to obtain in medical imaging contexts, recent deep learning-based restoration techniques have shown improved enhancement capability.

This paper presents a reference-free hybrid medical image enhancement framework that explicitly enforces anatomical consistency while combining diffusion-based probabilistic refinement and SwinIR transformer-based restoration. While the diffusion refinement stage uses iterative denoising to improve fine-scale textures, the SwinIR module uses hierarchical transformer attention to perform global context-aware denoising and deblurring. In order to avoid hallucinated anatomical features and preserve morphological fidelity, a structure-preserving constraint is included. The suggested framework outperforms histogram equalization, CLAHE, and CNN-based techniques in terms of perceptual and structural enhancement, as demonstrated by experimental evaluation on degraded MRI images, with PSNR of 31.9 dB and SSIM of 0.91. The suggested method is appropriate for clinically safe diagnostic visualization and preprocessing applications since it offers dependable medical image enhancement without requiring paired ground-truth data.

Keywords

SwinIR, diffusion models, transformer restoration, anatomical preservation, medical image enhancement, and reference-free learning.

Systematic Mapping of Blockchain Research: From Consensus Mechanisms to Real-World Applications

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Abstract

The study introduces a systematic mapping of blockchain technology discovery in the period of 2020-2025 to deconstruct the emergent trends, technology, and unidentified challenges. The purpose of this discovery is to categorize scholarly benefactions, based on operation disciplines, architectural models, mechanisms of agreements and security issues. It was espoused that a structured review methodology was followed in which peer-reviewed papers in major digital libraries were gathered, sifted, and categorized by using predefined criteria on addition. In the study, key areas of blockchain relinquishment that are comparable to healthcare, to force chain, FinTech, IoT and Web3 are identified and pressing patient concerns are related to scalability, interoperability, preservation sequestration and governance. The results indicate a trend of increasing to mongrel on- chain/off-chain infrastructures and permissioned blockchain frameworks to be deployed in businesses. The paper also identifies major gaps in the research and provides unborn solutions to advancing safe, sustainable, and regulation- biddable blockchain systems. The idea is to offer a roadmap to experimenters and interpreters to develop blockchain-based results extensively.

Keywords

Blockchain Technology, Systematic Mapping Study, Distributed Ledger, Consensus Mechanisms, Smart Contracts, Decentralized Applications, Security, Scalability, Transparency.

A Robust Deep Learning Framework for Zero-Day Attack Detection Through Behavioral Anomaly Analysis

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Abstract

The rapid development of networked systems has made the digital infrastructure more susceptible to sophisticated cyber-attacks, especially zero-day attacks, which use unseen security vulnerabilities. Conventional security systems depend largely upon the use of attack signatures, which are ineffective against unseen attacks. To overcome the inefficiency of conventional security systems, this paper proposes a framework for anomaly detection based on the use of deep learning techniques, especially the use of the Auto encoder, which learns the normal behavior of the network instead of learning the patterns of attacks. In the proposed framework, the Auto encoder, which is a type of neural network, is trained using only the normal behavior of the network. The use of the Auto encoder helps the framework to identify anomalies based on the behavior of the network. To improve the accuracy of the framework, the output of the Auto encoder is passed through a Random Forest classifier. To improve the accuracy of the framework, a probability-based threshold optimization strategy is used. Moreover, the use of the Auto encoder is combined with the use of the isolation-based anomaly detection method to improve the accuracy of the framework. In addition, federated learning is integrated to facilitate the training of the model by more than one organization without the need to share the raw network data, thus ensuring the privacy of the users. Moreover, explainable artificial intelligence is utilized, such as the SHAP method, which aids the users in getting the required information regarding the features. This helps the users understand the decision-making process of the anomaly detection method. Experimental results using the UNSW-NB15 dataset prove the efficiency of the proposed framework, where the accuracy is found to be 95.19%, thus ensuring the detection of unseen cyber-attacks.

Keywords

Zero-Day Cyber Attack, Anomaly Detection, Auto encoder, Federated Learning, Ensemble Learning, Adaptive Thresholding, Explainable AI.

Stress-Strain Response of Horizontal Axis Wind Turbine Tower under Wind Load and Thermal Load

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Abstract

Horizontal Axis Wind Turbines (HAWTs) are a prominent technology for harnessing wind energy, with increasing deployment globally. While extensive research has focused on aerodynamic performance and structural integrity under wind loads, the impact of thermal effects on HAWTs remains a critical aspect often overlooked. Temperature fluctuations, caused by environmental conditions, operational heat generation, and material thermal expansion, can induce significant stresses and deformations in the turbine tower at an height of 87.6m. The structural response of a wind turbine tower subjected to a combination of lateral loads like wind, self-weight, and thermal effects. A 3D finite element model of Autodesk Fusion 360 is developed to simulate the tower behavior under these multiphysics loads, focusing on key performance indicators such as von Mises stress, principal stresses and strains, and deformations. The analysis reveals the interplay between wind-induced lateral loads, self-weight, and thermal stresses, providing insights into the tower stress-strain response and potential failure modes. Results indicate that lateral loads dominate the stress distribution, while thermal effects induce significant additional stresses. The tower's deformation pattern and critical stress locations are identified, highlighting areas prone to failure. This research contributes to the design optimization and safety assessment of wind turbine towers, informing strategies for mitigating structural risks and enhancing performance.

Keywords

Wind Turbine Tower, Lateral Load, Thermal Effects, Von Mises Stress, Principal Stresses.

Integrated Risk Prediction System for Cardiovascular, Diabetic, and Renal Conditions

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Abstract

This project presents an intelligent healthcare system designed to predict the risks of cardiovascular disease, diabetes, and kidney stones using advanced machine learning algorithms. By leveraging historical health data and user inputs, the system enables early detection of these diseases, which are among the most common and life-threatening conditions globally. The core of the application integrates multiple predictive models; each trained on specialized datasets to ensure high accuracy and reliability. A key feature of the system is its user-friendly GUI developed using Tkinter, which facilitates easy navigation for users of all ages. The application includes secure login and registration functionalities, allowing users to manage their health data with privacy. Beyond predictions, the system incorporates a conversational AI chatbot to provide real-time health guidance, answer frequently asked questions, and enhance user engagement. This chatbot acts as a virtual assistant, delivering personalized insights based on the user's prediction results. By combining predictive analytics with interactive AI support, the proposed system not only empowers individuals to monitor their health regularly but also encourages preventive healthcare practices. Ultimately, this solution aims to bridge the gap between users and timely medical intervention, promoting improved healthcare outcomes and reducing the overall burden on clinical systems.

To Investigation of the Influence of Pr³⁺ Co-Doping on the PL and CL Properties of SiO₂:Eu³⁺/Tb³⁺

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Abstract

The influence of Ce³⁺ concentration, beam voltage, and current on the CL intensity of SiO₂:Pr³⁺-Ce³⁺ was examined. The study also explored the effects of Pr³⁺ co-doping on the CL and PL behavior of SiO₂:Eu³⁺ and SiO₂:Tb³⁺ systems, thereby providing insights into the role of co-doping in enhancing emission efficiency. The materials were synthesized using the sol-gel method, which offered controlled morphology and homogeneity in the formation of nanostructures. The synthesized samples were characterized using X-ray diffraction (XRD) for structural analysis. The XRD patterns from SiO₂:1 mol% Tb³⁺+0.2 mol% Pr³⁺ and SiO₂:1 mol% Eu³⁺+0.2 mol% Pr³⁺, scanning electron microscopy (SEM) for surface morphology. The FE-SEM images revealed the agglomeration of mostly spherical SiO₂ particles with an average particle size in the range of ~20 to 120 nm in diameter. Luminescence techniques such as PL and CL for emission properties. The PL emission spectra of SiO₂:1 mol% Eu³⁺ and SiO₂:1 mol% Eu³⁺+0.2 mol% Pr³⁺ obtained after excitation at 395 nm are compared. It can be seen from the spectra that the emission associated with 5D₀→7F_J (J=0, 1, 2, 3, 4) transitions of Eu³⁺ with the intense red emission corresponding to 5D₀→7F₂ transition were observed. and, both SiO₂:Tb³⁺, SiO₂:Tb³⁺+Pr³⁺ phosphor powders exhibited typical emission lines of Tb³⁺ located 410 nm (5D₃→7F₄), 433 nm (5D₃→7F₃), 488 nm (5D₄→7F₆), 543 nm (5D₄→7F₅), 588 nm (5D₄→7F₄), and 622 nm (5D₄→7F₃). The strongest green emission originates from the 5D₄→7F₅ transition at 543 nm. The CL intensity from SiO₂:Tb³⁺+Pr³⁺ was 95% less than that of SiO₂:Tb³⁺.

Interpretable Genomic Feature Learning for Early Lung Cancer Detection Using a Machine Learning Framework

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Abstract

Early detection of lung cancer is critical for improving patient survival, yet it remains challenging due to weak and noisy genomic signals in early-stage tumors and the high dimensionality of sequencing data. Conventional machine learning and deep learning models often struggle with overfitting and limited interpretability when applied to such data. To address these challenges, this study proposes an interpretable hybrid framework for early-stage lung cancer detection using genomic feature representation. Gene expression data from benchmark TCGA lung cancer cohorts were first preprocessed and then compressed using an autoencoder to learn compact and noise-resilient latent features. These learned features were subsequently classified using a Random Forest model. Experimental results show that the proposed approach achieved an accuracy of 95%, precision of 94%, recall of 96%, F1-score of 95%, and an AUC of 0.97, outperforming baseline models trained on raw genomic features. The results demonstrate that effective feature representation significantly enhances early-stage lung cancer detection while maintaining model interpretability and clinical feasibility.

Keywords

Early lung cancer detection, Genomic feature learning, Autoencoder, Random Forest, Interpretable machine learning, Gene expression analysis.

Speech Emotion Recognition Using MFCC and RNNs

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Abstract

Speech Emotion Recognition (SER) plays a key role in improving human-computer interaction by enabling systems to detect and respond to users' emotional states. This project proposes a deep learning-based SER framework that utilizes Mel Frequency Cepstral Coefficients (MFCC) for feature extraction and Recurrent Neural Networks (RNN) for classification. MFCC features capture the spectral and temporal characteristics of speech, while RNNs effectively learn local time-frequency patterns for emotion recognition. The system is trained and evaluated on benchmark datasets such as RAVDESS, TESS, and SAVEE, covering emotions including happiness, sadness, anger, fear, neutral, and calm. To improve robustness, preprocessing steps such as normalization, noise addition, pitch shifting, and time stretching are applied. Experimental results show that the proposed MFCC-RNN framework provides a strong baseline for emotion classification, though challenges remain with imbalanced datasets and confusable emotions such as neutral and calm. This study highlights the potential of RNN-based models for SER and discusses future improvements including hybrid RNN-RNN architectures, transfer learning, and multimodal approaches for more accurate and scalable emotion recognition in real-world applications.

Keywords

Speech Emotion Recognition, Mel Frequency Cepstral Coefficients (MFCC), Recurrent Neural Networks (RNN), Deep Learning, Audio Processing, Affective Computing, Machine Learning.

PawTrace : AI-Enabled Lost Pet Complaint Registration and Owner Reconnecting Platform

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Abstract

PawTrace is an innovative solution designed to address the growing problem of missing pets. Many pet owners face emotional distress when their pets go missing, and traditional methods such as posters, social media posts, or word-of-mouth often fail to ensure timely recovery.

The proposed system integrates web or mobile platforms where pet owners can register a formal complaint by providing essential details such as the pet's name, photo, description, and owner's contact information. The system leverages Artificial Intelligence and Computer Vision techniques to perform image-based matching between reported lost pets and photos uploaded by community members who encounter stray or doubtful pets. If a match is found, the system automatically facilitates owner reconnection by displaying the registered owner's details to the finder.

This approach not only enhances the efficiency of lost pet recovery but also encourages community participation in animal welfare. Unlike existing solutions, **PawTrace** emphasizes formal complaint management, AI-driven image recognition, and direct owner-finder communication, making it highly reliable and impactful. The platform thus serves as a bridge between technology and compassion, aiming to reunite lost pets with their families in a faster and more systematic way.

Keywords

Lost Pets, Complaint Registration, Artificial Intelligence (AI), Computer Vision, Owner Reconnection, Image-Based Matching.

CoLearn: A Collaborative Coding Platform for Peer-Driven Learning and Reflective AI Support

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Abstract

Programming education often isolates learners, requiring them to independently bridge the gap between theoretical concepts and practical application. While professional collaborative coding tools exist, they lack pedagogically grounded support for novice programmers. This paper introduces CoLearn, a web-based collaborative programming platform designed to support peer-driven learning through synchronous coding, structured learning pathways, and reflective AI guidance.

CoLearn integrates real-time collaborative development, secure multi-language code execution, and a Learning Module grounded in social constructivism and reflective practice. The platform provides curated problem libraries, adaptive learning progression, collaborative challenges, peer feedback mechanisms, and a Reflective AI assistant that promotes conceptual understanding through Socratic questioning rather than direct code generation.

The system is implemented using a scalable microservices architecture supporting low-latency synchronization and sandboxed execution environments. Experimental evaluation demonstrates real-time collaboration latency of 50–120 ms, code execution under 1.5 seconds, and AI response times between 1.2–2.5 seconds. A user study with 45 undergraduate students indicates increased engagement, improved conceptual understanding, and strong preference compared to traditional individual coding environments.

CoLearn bridges independent practice and social learning in programming education, demonstrating how pedagogically informed collaborative systems can enhance learning outcomes while maintaining real-time performance at scale.

WebForge: A Visual Website Builder with Bi-Directional Code Synchronization and AI-Powered Instructional Assistance

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Abstract

WebForge is a unified visual-coding platform designed to simplify the development of production-ready Next.js applications. By combining a Figma-style canvas with a VS Code-like real-time code editor, it enables developers to visually design interfaces while simultaneously modifying actual code through bi-directional synchronization. The platform supports drag-and-drop UI creation, cloud-based project persistence with Supabase, OAuth authentication, and an AI assistant that provides instructional guidance—generating layout blueprints, component hierarchies, and styling specifications to help users learn while building. Unlike traditional website builders, WebForge generates clean, deployable Next.js code that developers can directly export. This integration of visual design, programmatic flexibility, cloud storage, and AI-powered instructional assistance bridges the designer-developer gap, improving productivity and offering a scalable approach to modern web development.

A Comprehensive Review of Deep Learning Approaches for Retinal Disease Detection and Grading from Fundus Images

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Abstract

Diabetic retinopathy is a common eye condition, which can lead to blindness in the event it is not diagnosed when at a young age. In addition to this, other eye diseases such as glaucoma, age related macular degeneration, hypertensive retinopathy, cataract as well as normal retinal conditions also embrace a large number of individuals in the world. Fundus imaging is a widely deployed method to examine the retina and in the recent years, deep learning has been applied to examine such images and techniques of automated examination. Most of the existing literature has merely been accomplished on diabetic retinopathy and they are accomplished using convolution based models which are just interested in little bits of the picture yet they do not have the general understanding of the retina structure. The majority of these systems are also limited to a single disease detection system as well as articulation of their predictions to enable them to be suitable in clinical practice. The presented review paper offers the overview of the modern deep learning based approaches to the retinal disease analysis with the particular focus on the diabetic retinopathy grading and the multi disease detection of a fundus image. Much consideration is provided to transformer based models that are in a position to capture not only finer details of lesions but also the global retinal pattern to a better extent than the traditional convolution based methods. The explainable artificial intelligence techniques also mentioned in the review are the visual attention mapping tool, which will help to point out the major retinal areas and increase the degree of confidence of automated systems. In the literature review, this paper was able to generalize the existing issues as well as outline the future potentials where accurate, understandable and useful diagnostic systems of retinal diseases can be conducted.

Keywords

Diabetic retinopathy, Deep learning, Fundus image analysis, Multi-disease retinal detection, Medical image processing, Explainable artificial intelligence.

AI-Enhanced Predictive System for Early Stroke Risk Assessment: Comparative Analysis of Ensemble Machine Learning Models and Real-Time Deployment Via Streamlit

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Abstract

Stroke is a major global health burden requiring early risk identification for effective prevention and clinical intervention. This paper presents NeuroGuard-CDSS, a hybrid Clinical Decision Support System that integrates machine learning-based prediction with established clinical risk scoring to provide a unified stroke risk assessment framework. The proposed system employs a Logistic Regression model trained on structured healthcare data and combines its probabilistic output with a Framingham-based clinical scoring mechanism using a weighted hybrid strategy (70% machine learning, 30% clinical scoring). This integration generates a standardized 0–100 stroke risk score, enabling structured risk stratification into Standard, Urgent, and Critical categories. The architecture is designed with a modular offline training pipeline and an online deployment pipeline implemented using a Streamlit-based web interface. The system supports real-time patient data processing, integrated risk computation, visualization through gauge indicators, batch risk analytics, and automated PDF clinical report generation. Experimental evaluation demonstrates strong discriminative performance with robust ROC-AUC metrics while maintaining interpretability and clinical alignment. The proposed hybrid framework enhances predictive reliability and practical deployment feasibility, making it suitable for primary screening and preventive healthcare applications.

A Reinforcement Learning-Based Intrusion Detection Model for Multi-Agent Feature Selection Networks

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Abstract

Intrusion detection is an essential part of network security, and with the increasing sophistication of cyber-attack more sophisticated measures are needed to combat the exponentially rising threats. Conventional machine learning-based intrusion detection systems (IDS) tend to perform poorly with large, imbalanced datasets, where redundant and irrelevant features impair model performance. Moreover, the dynamic nature of network attacks necessitates IDS to learn about new threats efficiently. To overcome these issues, we introduce MAFSIDS (Multi-Agent Feature Selection Intrusion Detection System), an IDS framework using Deep Q-Learning (DQL). This work presents a new way of feature selection and attack identification. It utilizes a multi-agent reinforcement learning system that converts the traditional 2N feature selection space to N agent representations, simplifying the selection process and minimizing model complexity. In addition to improving feature representation, we add a Graph Convolutional Network (GCN) for extracting deeper structural patterns from data to enhance informative feature selection. For attack detection, MAFSIDS makes use of a Deep Reinforcement Learning (DRL) module that uses Mini-Batch encoding so that reinforcement learning can operate effectively in a supervised learning setting. The policy network is also implemented with a minimalist architecture for enhancing computational efficiency. By merging multi-agent reinforcement learning with graph-based feature extraction, MAFSIDS learns to choose optimal features and improve IDS flexibility for adapting to new threats, which distinguishes it from traditional machine learning-based detection methods.

Keywords

Intrusion Detection System, Multi-Agent Reinforcement Learning, Graph Convolution Network, Deep Q- Learning, Feature Selection Optimization.

Interpretable Detection of Stress from Text on Social Media Using TF-IDF and Word Cloud-Based Linguistic Analysis

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Abstract

Mental as well as physical health are both greatly impacted by stress and social media platforms are known to be a source of user-generated content that reflect experiences which are stressful in nature. Through this study, a model is proposed to identify stress using textual data obtained from Reddit and Twitter. The datasets used—Reddit_Combi, Reddit_Title, Twitter_Full, and Twitter_Non-Advert—were preprocessed through several steps, such as text cleaning, tokenization, stopword removal, and lemmatization. Feature representation was carried out by using the TF-IDF technique. Three machine learning classifiers - Logistic Regression, Support Vector Machine (SVM), and Random Forest, were trained and evaluated using metrics such as accuracy, precision, recall, and F1-score. Results of the experiment indicate that SVM outperformed the other models by achieving accuracy levels of more than 90% on Reddit datasets while also maintaining roughly the same performance on Twitter data. In order to highlight the keywords which distinguish between stressful content and non-stressful content word cloud visualisations were incorporated. All in all, the results demonstrated the effectiveness of using machine learning for detecting stress in social media text and suggested the potential for future studies using deep learning.

Keywords

Stress detection, Mental health, Social media analysis, Text preprocessing, Machine learning, Text classification, TF-IDF, Logistic Regression, Support Vector Machine, Random Forest, Reddit, Twitter.

High-Performance CMOS Counter with Uniform Delay and Pre-Scaled Architecture

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Abstract

This paper describes the design of a fast CMOS counter with equal delay to all outputs and a pre-scaled architecture to promote speed and robustness in digital systems. In conventional counters, the propagation delay increases with the count value, limiting the maximum clock speed. Our solution overcomes this limitation by providing equal delay to all output bits, allowing all bits to change simultaneously. The proposed design is based on a multi-stage pre-scaling architecture realized using Johnson counter cells. The lower stages produce Pre-Enable (PEN) signals, which successively enable the higher stages, effectively slowing them down to synchronize with the overall timing. To maintain the speed of the PEN signals, an early state detection technique is used, which prevents the critical path in the combinational logic and significantly enhances the overall speed. An illegal state detection system is also included to provide reliable performance and to prevent the counter from entering illegal states. In addition, we introduce a pass-transistor-based state detection logic with reduced transistor count, lower parasitic capacitance, and improved switching transitions.

Keywords

Uniform Delay Architecture, Pre-Scaled Counter Design, Early State Detection, Illegal State Detection, Pass-Transistor Logic.

Assessing Pedestrian Safety at Urban Midblock Crossings Across Various Land Use Types

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Abstract

Rapid urbanization in the Chennai Metropolitan Area (CMA) has led to increased pedestrian-vehicle interactions, particularly at midblock locations where formal traffic control is limited. This study assesses pedestrian safety across different land use types, specifically comparing institutional areas like C. Kandaswami Naidu College and commercial zones like Kovai Pazhamudhir Nilayam in Anna Nagar. Utilizing video-based traffic observations and YOLO-based object detection, the research tracks trajectories to quantify the spatial-temporal risk of pedestrian platoons. By calculating Surrogate Safety Measures (SSM) such as Time to Collision (TTC) and Post-Encroachment Time (PET), the study identifies how platoon cohesion and density influence conflict severity in mixed traffic conditions. The findings emphasize how land-use characteristics dictate pedestrian-vehicle friction, ultimately recommending targeted interventions like raised crosswalks and refuge islands to support safer, data-driven urban street planning.

BLOCKSTAKERS: An NFT Staking Platform on Solana Blockchain for Enhanced Utility and Community Engagement

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Abstract

The Non-Fungible Token (NFT) industry is dealing with a number of pertinent problems, most notably the lack of utility, which lowers user engagement and slows NFT sales globally. In order to solve these issues, this paper presents BLOCKSTAKERS, a new NFT staking platform based on the Solana blockchain that combines community governance with a fully functional staking mechanism.

Users of BLOCKSTAKERS can stake their NFTs and get a variety of rewards, such as in-game asset rewards from different games in the ecosystem and metaverse, collectible digital goods, and native tokens of the network where they stake the NFT. BLOCKSTAKERS offers a scalable solution for transforming digital assets that have historically been static into ones that can offer utility through continuous passive income by leveraging Solana's incredibly quick transactions and extremely low transaction fees. The implementation of BLOCKSTAKERS makes use of React.js for the front-end interface, extensive security, governance module components, and Rust for the creation of smart contracts and the Anchor framework. Overall, this study offered proof that blockchain-based staking mechanisms can be used as a tool to improve community involvement in a digital asset ecosystem, increase the usefulness of NFTs, and create long-term financial incentives for digital asset holders.

Exploring Ayurvedic Functional Physiology (Kriyā Śarīra) in the Purāṇas

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Abstract

Ayurveda explains human physiology through the concept of Kriya sharīra, which focuses on the functional and dynamic processes responsible for the maintenance of health. While classical Ayurvedic Saṃhitās are the principal sources of these concepts, Purāṇic literature also preserves significant physiological ideas embedded within religious, philosophical, and cultural narratives. This paper explores Ayurvedic functional physiology (Kriyā Śarīra) as reflected in the Purāṇas and examines its conceptual relevance to classical Ayurvedic principles. A qualitative textual analysis of selected major Purāṇas was conducted, with specific attention to references related to doṣa, dhātu, mala, agni, prāṇa, sensory functions, and psycho-physiological processes. These concepts were interpreted and correlated with established descriptions found in Ayurvedic treatises such as the Caraka Saṃhitā and Suśruta Saṃhitā. The analysis reveals that the Purāṇas, though primarily theological in nature, implicitly convey core physiological notions including functional balance, metabolism, digestion, vitality, and the integrative relationship between body and mind. The study highlights that Purāṇic literature serves as an important supplementary source for understanding the philosophical foundations of Ayurvedic physiology. The holistic depiction of life processes in the Purāṇas reflects an integrative health model that unites physical, mental, ethical, and spiritual dimensions. This exploration contributes to a broader understanding of ancient Indian medical thought and underscores the relevance of traditional knowledge systems in contemporary discussions on holistic and integrative physiology.

Keywords

Ayurveda, Kriyā Śarīra, Purāṇas, Functional Physiology, Traditional Medicine.

CardioSpeech: AI-Based Speech Signal Analysis for Heart Failure Detection

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Abstract

Heart failure is a progressive cardiovascular disease that very often remains asymptomatic until severe symptoms occur. Early detection would contribute significantly to the reduction of complications and improvement of the prognosis. The paper presents an AI-based system investigating human speech as a possible biomarker for heart failure. Preprocessing is done using noise reduction, trimming of silent areas, and extraction of mel-spectrogram features. Afterwards, a CNN model identifies if speech belongs to a healthy subject or one with heart failure. Experimental results demonstrate high accuracy that can be achieved, proving that features from voice, such as variations in pitch, breathiness, and energy distribution, may serve as non-invasive biomarkers. A further Streamlit web application is provided for real-time prediction; therefore, this system may be good for remote health monitoring or preliminary screening.

Keywords

Heart Failure Detection, Speech Analysis, Deep Learning, Convolutional Neural Networks (CNN), MelSpectrogram, Audio Processing, Biomedical Signal Processing, Artificial Intelligence, Remote Health Monitoring, Vocal Biomarkers.

AI-Powered Chatbots for Mental Health Support

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Abstract

Stress, anxieties, and depression some of the issues associated with mental. Well-being is predominantly an issue addressed towards youth, and students are definitely not an exception. Nevertheless, as an alternative to the aforementioned solution, a new approach that has emerged in the form of AI-powered chatbots for mental well-being has been adopted. AI chatbots are computer programs coded. "Native will see to it that twenty-" However, Four times seven: Cheap, anonymous care in the wake of a lack of professional medical care. Buying in bulk does not guarantee the success of the medication because the pials. These pials would regulate the conduct of the rienvce: It is realized through function and success in developed chat robots. By following the concepts of Cognitive Behavioural Therapy and Natural Language Processing, there are some of the critical points that are being addressed in this context. The methodology that has been followed in this research study is phq methodology, and that assumes a multi ethodological approach. It is questionnaire.

- AI-powered chatbots
- Mental health support
- Natural Language Processing (NLP)
- Cognitive Behavioural Therapy (CBT)
- Emotional well-being

Keywords

AI-powered chatbots, Mental health support, NLP, CBT, Emotional well-being.

A Multimodal Fusion-Based Machine Learning System for Parkinson's Disease Prediction and Stage Classification

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Abstract

Parkinson's Disease (PD) is a long-term neurodegenerative condition that gradually impacts motor abilities such as speech, handwriting, & gait. Identifying Parkinson's Disease at an early stage is important for timely medical treatment; however, traditional diagnostic methods often fail to identify the disease at its initial stages and rely heavily on subjective clinical evaluation. Additionally, existing automated diagnostic systems commonly utilize a single modality of data and lack interpretability, which limits their accuracy and acceptance in real-world medical practice. These challenges are further intensified in rural and remote regions where access to neurological specialists is limited. This paper presents a multimodal machine learning-based system for early Parkinson's Disease prediction using voice, handwriting, and gait data. The proposed system follows a modular and sequential process model that includes data acquisition, preprocessing, feature extraction, feature fusion, and predictive modeling. By combining features from multiple modalities, the system improves prediction robustness and accuracy compared to unimodal approaches. The machine learning model outputs both the probability of Parkinson's Disease and the estimated disease stage based on the Hoehn and Yahr scale, thereby providing clinically meaningful and interpretable results. The system is implemented using a client-server architecture that integrates a web interface with a Python-based machine learning engine, enabling real-time, scalable, and user-friendly deployment. Although the system involves computationally complex tasks such as feature selection and model optimization, heuristic and approximation techniques are employed to ensure practical feasibility. The proposed solution aims to support early diagnosis, enhance clinical decision-making, and improve accessibility to Parkinson's Disease screening, especially in resource-constrained environments.

Keywords

Parkinson's Disease, ResNet18, Gait Analysis, Multimodal Fusion, Handwriting Analysis, Speech Processing, Convolutional Neural Network.

Parkinson's Disease Detection using Deep Learning CNN

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Abstract

Parkinson's disease (PD) is a progressive, long-lasting neurological condition that mainly affects motor functions. Symptoms include bradykinesia, rigidity, tremors, and postural instability. Early and precise diagnosis is crucial for successful treatment and enhanced quality of life because the disease develops gradually. Conventional diagnostic techniques, on the other hand, mainly depend on subjective clinical observation and neurologist expertise, which may not be sufficient to identify Parkinson's disease in its early stages. This study offers a deep learning system based on convolutional neural networks (CNNs) for the automated detection of Parkinson's disease in order to get around these restrictions.

The suggested system makes use of magnetic resonance imaging (MRI) scans, spiral drawings, and DaTscan images, among other medical imaging data associated with Parkinson's disease. Preprocessing techniques such as noise removal, normalization, and resizing are applied to improve data quality, followed by data augmentation methods to enhance robustness. To automatically extract discriminative features and categorize cases as either healthy or positive for Parkinson's disease, a CNN-based architecture is used. Strong performance is shown by experimental evaluation in terms of F1-score, recall, accuracy, and precision. The findings demonstrate how well deep learning-based image analysis works as a non-invasive, dependable, and effective diagnostic tool for the early detection of Parkinson's disease.

Keywords

Parkinson's Disease, Deep Learning, Convolutional Neural Network, Medical Image Analysis, MRI, DaTscan, Spiral Drawings.

Tiny Pest Intelligence: Multi Class Detection & Recommendation System

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Abstract

Tiny agricultural pests pose a growing threat to global food security. Studies have estimated that these pests can cause yield losses of up to 80% in heavily infested crops around the world. This is especially true during the early growth stages of crops when infestations often go unnoticed. Current pest detection systems based on computer vision usually focus on identifying a single pest species. This limits their effectiveness in real agricultural settings where different pest types exist together. Finding tiny insects in field images is particularly difficult due to their small size, dense clustering, occlusion, and complex backgrounds. These challenges often lead to inaccurate detection and delayed decisions on pest management. Here we built Tiny Pest Intelligence, an AI-based framework for detecting multiple types of tiny agricultural pests and providing automated support for farmers. The proposed method improves the YOLOv11 object detection model by adding a P2 high-resolution feature layer for better representation of small objects and using Normalized Wasserstein Distance (NWD) loss to tackle localization issues with tiny pests. The model is trained on the Pest24 dataset and can detect and count multiple pests directly from field images. A pest density analysis module further divides infestation levels into Low, Medium, and High, allowing for better-informed intervention decisions. Experimental results show that this system achieves 75 to 85% detection accuracy, demonstrating reliable performance in spotting small pests in complex agricultural conditions. Additionally, a Large Language Model (LLM)-based advisory module offers pest management recommendations based on the severity of the detected infestations. This system provides a scalable solution for intelligent pest monitoring and precision agriculture.

Keywords

Multi-pest detection, YOLOv11, P2 high-resolution layer, Normalized Wasserstein Distance, Pest24, tiny object detection, large language models, precision agriculture, severity estimation.

Proactive Cognitive Fatigue Prediction and Management using Future-Aware Reinforcement Learning

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Abstract

Cognitive fatigue is a problem that affects how well we work and make decisions. It also affects our health. This is especially true for people who use computers for a time. We need a way to find out when someone is getting tired. The old ways of doing this are not very good. Some ways ask people how they are feeling. Other ways watch what people are doing in a way that's not very nice. This paper is about a system that can tell when someone is getting tired. It does this by looking at how they use the computer. The system can tell when someone needs to take a break. The system looks at things like how someone types on the keyboard. It also looks at how someone moves the mouse or clicks on things. The system even looks at how someone is not doing anything. All of this information is used to figure out how tired someone is. The system then tells the person if they need to take a break. There is a website that shows how tired someone is and what they can do about it. We tried out the system. It works very well. The system is good for people who use computers a lot. It helps them stay healthy and work well. The system is also very good, at keeping people's information private. It only looks at things that're not very personal. The system is a way to help people manage cognitive fatigue when they are using computers.

Keywords

Cognitive Fatigue, Machine Learning, Random Forest, Activity Monitoring, Real-Time Prediction, Human-Computer Interaction, Privacy-Preserving Systems, Productivity Optimization.

Exploring the Experimental Possibilities of AI based Real-Time Virtual Reality Assisted Touchless Home Appliance Control

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Abstract

As artificial intelligence (AI), the Internet of Things (IoT), and virtual reality (VR) have advanced so quickly, smart home technologies have also changed to become more intelligent and intuitive. However, usability, hygiene, and real-time engagement are limited by the majority of current home automation systems, which rely on voice commands, mobile applications, or physical switches. In order to allow users to operate domestic appliances with hand gestures without making physical touch, this article offers an AI-Driven Real-Time Virtual Reality Assisted Touchless Home Appliance Control System. To control appliances like fans and lights, the suggested system makes use of IoT connection, AI-based processing, and computer vision-based gesture detection. Real-time feedback from a VR-based visualization interface improves situational awareness and user involvement. A camera records hand movements, which are then processed by machine learning algorithms and sent over the MQTT protocol to an ESP32 microcontroller. The system is appropriate for real-time applications because of its high accuracy and low latency. The suggested solution is perfect for smart homes, healthcare settings, and assistive living systems since it enhances efficiency, accessibility, and hygiene. The trial findings show dependable operation, quick reaction times, and successful IoT, VR, and AI technology integration.

Keywords

Artificial Intelligence, Virtual Reality, Gesture Recognition, IoT, Touchless Control, Smart Home Automation.

Enhancing Rare Class Attack Detection in Intrusion Detection Systems

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Abstract

The IDSs we use secure our modern networks from unauthorized access and cyber threats. However, conventional IDS models based on Machine Learning (ML) struggle because real-world network traffic data is highly unbalanced. Most the network activity is benign, with only a small fraction of it representing real intrusions. Therefore, traditional ML models tend to be biased toward the majority class, thus leading to poor detection. Detection of intrusion types is non-representative due to the occurrence of rare but critical intrusion types and high false-negative rates. Thus, to detect rare attack classes. This paper leverages a Generative Adversarial Network to tackle the challenge of rare attacks. Paucity and imbalance in IDS datasets. GANs produce realistic synthetic data using networks called discriminators and generators. These synthetic samples were generated by train GAN on rare categories, thereby increasing their representation in the overall dataset. This balancing enables the model to make more use of the information from all classes and reduces overfitting and false signals. The Random Forest we are using in the experimental design and k-Nearest Neighbors classifiers. The baseline model is trained on the imbalanced CICIDS-2017 dataset, while the proposed model is trained on a GAN augmented version of dataset. We evaluate the performance using the performance metrics with emphasis on results for rare classes. Our results indicate that GAN-based data augmentation yields an accuracy of 90% with a Random Forest classifier and 87% with a K-NN classifier, helping remedy class imbalance and improving IDS performance.

Keywords

IDS, GAN, K-Nearest Neighbors, Random Forest, Machine Learning.

Studeals: A Secure Campus-Centric Marketplace for Buying, Selling, and Renting Second-Hand Items

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Abstract

College students know the struggle—buying expensive stuff like textbooks or electronics just to use them for a semester or two. Afterward, these things often end up in the trash, still in great shape. It's a waste of money and, honestly, just waste in general. Sure, there's OLX and other online marketplaces, but they don't really work for campus life. Trust is a big issue. Scams are everywhere, and students end up feeling exposed. That's where Studeals comes in. This project is all about giving students their own safe marketplace. It's an app—built with Flutter—where you can buy, sell, and, most importantly, rent used things like books and electronics from other students. Safety's built in. You need a university email to sign up, so you know you're dealing with real students. Studeals doesn't just stop there. The app makes selling ridiculously easy. Snap a photo, and a machine learning model figures out what the item is. If you only know the name and description, an AI tool suggests a fair price. The idea? Make student life cheaper and greener. By helping students reuse what they already have, Studeals cuts down on waste and keeps money in people's pockets—all while making the process a whole lot safer than random online swaps. In the end, Studeals isn't just about saving cash or recycling stuff. It's about building a smarter, more connected student community that looks out for each other.

Keywords

Campus Marketplace, Peer-to-Peer (P2P) Renting, Machine Learning, AI Price Prediction, Product Image Recognition, Waste Reduction, Student E-commerce, User Trust & Safety, P2P Trading.

Predictive Modeling of Customer Churn in the Telecommunications Industry

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Abstract

The Telecommunications Industry is known as one of the most highly competitive industries with a low barrier for customers switching from one company to another. Customer Churn, which refers to customers terminating their relationship with their provider, presents a major challenge for the industry as it has a direct impact on revenue and growth. In addition, acquiring new customers is usually much more expensive than retaining existing customers; therefore, companies have begun to implement predictive strategies for customer churn management. Our comprehensive approach included an initial Exploratory Data Analysis (EDA) of the data to identify Customer Behavior Patterns and the Driving Factors for Customer Attrition. Additionally, we created and evaluated multiple Classification Models (Logistic Regression, Decision Tree, Random Forest, and Gradient Boosting) using Accuracy, Precision, Recall, and F1 Score as evaluation metrics. This research will help to identify the most important factors associated with Customer Churn using three key factors: Contract Type, Customer Tenure, and Monthly Cost. Finally, we used a comparative analysis of Model Performance to identify the Model that provides the best combination of Predictive Power and Business Understanding, and we discuss the implications of these findings for improving Customer Retention Strategies.

Integrating Digital Twin and Cyber Forensics for Enhanced Cybersecurity in Smart Grids

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Abstract

In order to efficiently create, distribute, and ingest electrical energy, smart grids rely on present digital control and information techniques. Modern technologies are susceptible to cyberattacks and pose serious dangers and failures due to their increased interconnection. By combining digital twins and computer forensics, this research proposal aims to provide an integrated method that improves smart grid safety and reliability. A digital twin develops a real-time computerized model of the grid's subsystems and allows ongoing evaluation, anomaly detection, and predictive analysis of the cyber threat case. In order to discover the roots of the offense and comprehend their structure, cyber forensic techniques assist with the identification, scrutiny, and preservation of electronic records during any cyber assault. The recommended strategy blends these two technologies to provide earlier danger alerting, faster event processing, and increased smart grid infrastructure resilience. Real-time choice-making, automation, and efficiency have all significantly increased since electrical power networks have been changed to smart grids. Smart grids are more susceptible to sophisticated attempts when they have more digital connections. This study provides an integrated cyber security framework that combines digital twins and computerized forensics data to enhance threat detection, analysis, and response in the context of systems to manage energy.

Keywords

Electronic proof, smart grid structures, attack detection, forensic science, secure electrical networks, virtual replicas, electronic forensics, cyber security, anomaly detection, continual surveillance, statistical analysis, reaction to incidents, and cyber analysis of threats.

An Improved Deep Learning Model (IDLM) for Brain Tumor Detection

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Abstract

Diagnosing Brain tumor at the earliest is crucial for designing treatment and wellbeing of the patients. Analyzing and processing of Magnetic Resonance Image (MRI) can be tedious and prone to human errors. This study proposes an IDLM framework which automates the identification and classification of tumor by involving preprocessing of MRI datasets, enhancing the quality of image, feature extraction using Convolutional Neural Networks (CNNs) and classification using advanced DL algorithm. Through comparative analysis it would be established that DL models like CNN, Gradient Boosting and CatBoost provide better accuracy, precision, and recall than traditional ML classifiers. The integration of these models leads to enhanced generalization further reducing false detection rate. Findings in our study demonstrate that DL models have superior efficacy therefore potentially helping radiologists in making reliable and consistent results quickly.

Keywords

Magnetic Resonance Imaging, Convolution Neural Network, Gradient Boosting, Deep Learning, CatBoost.

Invistream: A Live Video Capture Steganography with Tamper Detection and Self Destruction

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Abstract

This paper proposes a secure live video steganography system based on Discrete Cosine Transform (DCT) embedding with real-time tamper detection and self-destruction. Secret data is embedded in the frequency domain to achieve high imperceptibility while maintaining robustness against common signal distortions. The proposed framework enables reliable data extraction at the receiver end while ensuring minimal visual degradation of the video content.

A boundary-based tamper detection mechanism is incorporated to effectively identify zoom-in and zoom-out attacks during live video playback by analyzing frame boundaries and pixel consistency across consecutive frames. Upon detection of tampering, the system immediately halts video transmission and prevents further data extraction, thereby ensuring enhanced security. Additionally, detailed logs of embedded videos and detected tamper events are maintained for auditing and forensic analysis. The proposed approach demonstrates strong suitability for secure real-time video communication applications such as surveillance, military communication, and confidential multimedia transmission.

DevRoot: A Phase-Constrained, Risk-Aware Workload Optimization Framework for Creative-Educational Production Pipelines

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Abstract

The increasing demand for high-quality educational content has led to more complex creative production pipelines in the EdTech industry. These pipelines involve multiple distinct phases (pre-production, production, post-production) and heterogeneous workloads, often requiring resource-intensive tasks (e.g., video rendering, animation processing). Existing scheduling approaches for such pipelines are largely heuristic and do not exploit fine-grained phase information. This paper presents DevRoot, a phase-aware workload optimization framework tailored to EdTech content production. DevRoot dynamically identifies the current phase of each pipeline task and allocates resources accordingly, using a mathematical optimization model for scheduling. We simulate DevRoot on representative EdTech production workloads and demonstrate substantial improvements in performance: for example, up to a 3× reduction in overall pipeline completion time compared to a phase-unaware baseline [1]. These results highlight the potential of phase-aware optimization in educational content pipelines. The increasing demand for highquality educational content has led to more complex creative production pipelines in the EdTech industry. These pipelines involve multiple distinct phases (pre-production, production, post-production) and heterogeneous workloads, often requiring resource-intensive tasks (e.g., video rendering, animation processing). Existing scheduling approaches for such pipelines are largely heuristic and do not exploit fine-grained phase information. This paper presents DevRoot, a phase-aware workload optimization framework tailored to EdTech content production. DevRoot dynamically identifies the current phase of each pipeline task and allocates resources accordingly, using a mathematical optimization model for scheduling. We simulate DevRoot on representative EdTech production workloads and demonstrate substantial improvements in performance: for example, up to a 3× reduction in overall pipeline completion time compared to a phase-unaware baseline [1]. These results highlight the potential of phase-aware optimization in educational content pipelines.

This paper presents DevRoot, a governance-oriented Asset Lifecycle Management (ALM) framework that integrates phaselock security, a pipeline taxonomy, metadata-aware dependency graphs, and an adaptive workload optimization engine. We formalize workload and risk measures, propose a practical phase constrained reallocation algorithm, and evaluate the approach using a comprehensive simulation. Results demonstrate substantial improvements in workload balance and delay reduction over static assignment strategies. We also discuss managerial implications and steps toward real-world deployment and provisional patenting.

Keywords

Workload optimization, phase-aware scheduling, dependency graphs, engineering management, asset lifecycle, risk modeling.

A Blockchain and Smart Contract Based Voting Framework for University Governance

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Abstract

Student governance is essential because of university elections, which, however, are often fraught with vote-rigging, impersonation, lack of transparency, and errors in the manual counting process and inadequate identity check. Though e-voting on blockchain has been extensively studied, the majority of the current solutions are generic, and they do not support university-specific restrictions like role-based elections (CR, GR, Senate, Hostel, Department), semester/department eligibility policies, and the necessity of having privacy without compromising on verifiability. The current paper presupposes a privacy-saving smart contract-based voting system, which is specially designed to work with university management. The system combines Decentralized Student Identity as a means of authenticating the voter and uses the Zero-Knowledge Proof as a means of casting the vote anonymously but verifiable. The rule of one person one vote is implemented on the level of the smart contract, excluding the possibility of double voting and identity fraud. The framework endorses dynamical generation of numerous elections basing on roles and qualifications requirements and offers a real-time and publicly verifiable tally without disclosing voters. The prototype is deployed on Ethereum blockchain by way of Solidity smart contracts, not scaled using Ganache, and interacts with MetaMask. The offered framework of the university-scale elections proves to be feasible, secure, and scaled, which is proven in experiments. The suggested model increases trust, openness, privacy, and automation of campus voting procedures and offers an efficient guideline on decentralized governance of academic institutions.

Keywords

Blockchain, Decentralized Identity (DID), Ethereum, Smart Contracts, University Elections, Zero-Knowledge Proof (ZKP).

A Multi-Modal Vision Transformer and Spatio-Temporal Graph Neural Network Framework for Cloudburst Prediction

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Abstract

Cloudbursts are very localized and brief intense precipitation that commonly causes flash floods and landslides, especially in a complicated topography and heavily populated regions. Accurate prediction remains challenging due to strong nonlinearity, rapid temporal evolution, and complex interactions among atmospheric, cloud-scale, and geographical factors. This paper presents a multi-modal deep learning framework for short-term cloudburst prediction that integrates satellite imagery, ground-based meteorological time-series data, and spatial relationships among observation stations. Satellite images and Gramian Angular Field representations of meteorological time-series are encoded using Vision Transformers to capture long-range spatial and temporal patterns. Spatial dependencies between stations are modeled using a spatio-temporal graph neural network, enabling the learning of geographically informed interactions. An attention-based fusion mechanism adaptively combines features from multiple modalities, allowing the model to emphasize the most informative sources under varying atmospheric conditions. The framework employs a dual-output design to perform binary cloudburst classification and continuous risk score estimation. Experimental evaluation using ERA5 reanalysis data and India Meteorological Department rainfall observations demonstrates that the proposed approach consistently outperforms single-modality models, spatial graph-based baselines, and multi-modal architectures without attention-based fusion in terms of F1-score, recall, and area under the ROC curve. The results highlight the effectiveness of multi-modal representation learning and spatio-temporal graph modeling for improving short-term extreme rainfall prediction and supporting risk-aware early warning systems.

Keywords

Cloudburst prediction, extreme rainfall forecasting, multi-modal learning, Vision Transformer, spatio-temporal graph neural network, meteorological time-series analysis, satellite imagery, attention-based data fusion, early warning systems.

Automated Wheelchair with Integrated Safety and Health Monitoring Features

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Abstract

People with quadriplegia often face significant mobility challenges and depend heavily on assistive devices for daily movement. In addition to mobility, continuous health monitoring and safety mechanisms are important to ensure their well-being. This paper presents the design and experimental evaluation of a low-cost automated wheelchair integrated with safety and biomedical monitoring features. The proposed system upgrades a conventional manual wheelchair into an electrically driven assistive device using dual DC geared motors controlled by an embedded microcontroller. A chin-operated control mechanism enables hands-free navigation, allowing users with limited upper-limb mobility to maneuver the wheelchair independently. To enhance safety, the system integrates several sensors, including heart rate and SpO₂ monitoring, a temperature sensor for body temperature measurement, and an MPU6050 inertial measurement unit for fall and posture detection. When abnormal health readings or unsafe tilt conditions are detected, the system automatically stops the wheelchair and sends real-time alerts to caregivers through a GSM communication module. The design focuses on affordability by using widely available low-cost components, making it significantly cheaper than many conventional electric wheelchairs. Experimental testing shows reliable performance for loads up to 100 kg with an operational runtime of approximately 3 hours using a lithium-ion battery pack. Overall, the proposed system provides an affordable and intelligent assistive mobility solution that improves safety, independence, and accessibility for individuals with quadriplegia.

Performance Analysis of Integration of IoT in Downdraft Gasifier

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Abstract

Biomass gasification is an effective thermochemical process that converts solid fuels into a combustible gaseous mixture known as synthesis gas (syngas). This study presents the design, fabrication, and experimental evaluation of a laboratory-scale downdraft gasifier developed for converting solid fuels into useful energy. The system was designed to investigate the operational characteristics of the gasification process using readily available fuel sources such as coal and wood chips.

The constructed gasifier consists of a reactor chamber, fuel feeding section, air inlet system supported by a blower, grate assembly, and a gas outlet section. Air is introduced into the reactor to facilitate the gasification reactions. Inside the reactor, the fuel undergoes a sequence of thermochemical stages including drying, pyrolysis, oxidation, and reduction, which occur in different zones of the gasifier. These stages collectively contribute to the conversion of solid fuel into combustible gases.

Temperature inside the reactor chamber was monitored using temperature sensors to evaluate the operational performance of the gasifier. During the experimental trials, the reactor temperature reached approximately 550°C, indicating active gasification within the reactor. The target operational temperature range for efficient gasification is typically between 700°C and 800°C, and system modifications were considered to improve the temperature profile within the reactor.

The produced gas primarily consists of combustible components such as carbon monoxide (CO), hydrogen (H₂), and methane (CH₄), which can be utilized for thermal applications or energy generation. The performance of the gasifier is influenced by factors such as fuel properties, air supply rate, and reactor design.

The results demonstrate that the developed downdraft gasifier is capable of converting solid fuels into combustible gas under controlled conditions. This work contributes to the development of small-scale gasification systems that can provide an alternative energy solution for decentralized and sustainable energy applications.

Keywords

Biomass Gasification, Downdraft Gasifier, Syngas, Coal and Wood Chips, Renewable Energy.

AI-Based Multilingual Long-Form Educational Video Structuring and Intelligent Learning Assistance System

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Abstract

Online educational platforms such as YouTube contain many hours of academic video content, including university lectures, computer programming lessons, and technical training. However, the long duration and lack of structured organization often make it difficult for learners to identify key learning concepts, review important topics, and revisit specific sections of interest. Existing solutions such as automatic captions and basic summarization tools provide limited assistance. These tools mainly generate transcripts or simple summaries of video content and do not sufficiently support learners in transforming the original content into structured academic learning resources. This project proposes an AI-Based Multilingual Long-Form Educational Video Structuring and Intelligent Learning Assistance System that converts lengthy lecture videos into structured and revision-friendly learning materials. The system integrates several AI techniques, including automatic speech recognition for transcript generation, semantic topic segmentation to identify conceptual boundaries, and multilingual translation to improve accessibility for learners across different languages. Additionally, the system generates a knowledge graph that represents relationships between topics and concepts. A retrieval-augmented question answering module allows learners to ask questions and receive contextual explanations linked to specific timestamps in the video. This approach transforms unstructured lecture videos into organized and interactive learning resources, improving comprehension and learning efficiency.

AI-Powered Multi-Lingual Resume Screening System

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Abstract

Recruiters often struggle to efficiently screen the growing number of resumes received for job openings. Traditional manual evaluation is time-consuming, labor-intensive, and susceptible to human bias and inconsistency. To address these challenges, this paper presents an AI-driven resume screening system powered by a **BERT-based deep learning model**, replacing traditional TF-IDF and cosine similarity techniques with advanced contextual language understanding.

The proposed system leverages Bidirectional Encoder Representations from Transformers (BERT) to perform semantic analysis between resumes and job descriptions. Unlike keyword-based approaches, the BERT model captures contextual meaning, enabling more accurate candidate-job matching. The system parses resume in PDF and DOCX formats and extracts key information such as skills, work experience, qualifications, and certifications using Natural Language Processing techniques including tokenization and Named Entity Recognition (NER). Candidates are ranked dynamically based on these structured KPIs combined with semantic similarity scores.

By combining deep learning, KPI-driven schematics, and intelligent automation, the proposed system enhances recruitment efficiency, reduces bias, and supports data-driven hiring decisions, enabling organizations to identify the most suitable candidates within seconds.

Gold Market Insights Ai Based Price Prededction System

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Abstract

The volatility of the gold market presents significant challenges for investors, traders, and policymakers seeking stable financial strategies. Predictive analytics powered by machine learning and artificial intelligence enables accurate forecasting of gold price trends, transforming decision-making from speculative to data-driven. This study presents an AI- based price prediction system designed to forecast gold prices using historical and real-time market data through Long Short-Term Memory (LSTM) neural networks. It outlines current methodologies and technologies in financial time series modeling, explores their integration into trading and investment platforms, and discusses the challenges and opportunities in adopting such systems for market analysis. By leveraging global economic indicators, sentiment analysis, and real-time financial feeds, the predictive model can identify market patterns and predict price fluctuations with improved accuracy. Implementing these technologies can enhance investment strategies, reduce financial risks, and support sustainable economic planning. A scalable and ethical framework for deploying AI in financial forecasting and gold market analysis is also proposed.

Keywords

Gold Market, Price Prediction, LSTM, Artificial Intelligence, Machine Learning, Predictive Analytics, Financial Forecasting, Time Series Analysis, Real-Time Data, Investment Strategy, Market Volatility, Risk Management, Economic Indicators, AI in Finance.

TaskWeave: AI-Driven Smart Task Allocation and Workload Balancing System

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Abstract

In today's fast-paced software development world, allocating tasks fairly and efficiently is a major challenge for managers. Many organizations still rely on manual task assignments, which often leads to problems like skill mismatches, unbalanced workloads, and wasted time. This paper introduces TaskWeave, an intelligent system that uses artificial intelligence to automate and improve the task allocation process. TaskWeave works by analyzing task descriptions using Natural Language Processing (NLP) to understand what skills are needed, then uses Machine Learning to predict how long tasks will take. The system then recommends the best team members based on their skills, current workload, and past performance. What makes TaskWeave special is its fairness optimizer—it ensures that work is distributed evenly across the team to prevent burnout and keep everyone engaged. Built using modern technologies like React.js, Node.js, MongoDB, and Python, TaskWeave is scalable and can grow with your organization. Our testing showed impressive results: 89% of recommendations were accepted by managers, workload variance decreased by 55%, and managers saved 42% of their decision-making time. The system also keeps workload inequality below acceptable levels, making it a practical solution for teams of any size.

Keywords

Artificial Intelligence, Task Allocation, Machine Learning, Natural Language Processing, Workforce Optimization, Skill Matching, MERN Stack, Workload Balancing.

Integrating AI into Human Creative Processes

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Abstract

The adoption of artificial intelligence in the creative processes is a paradigm shift of traditional human creativity to hybrid human-AI interactive systems. The paper explores the possibility of successful introduction of deep learning-based generative models into the human creative process in a variety of applications such as visual arts, music composition, and creative writing. We gauge the effectiveness of co-creative systems in which AI is used to generate ideas, create content, and refine content in a mixed-methods study of 45 professional creatives. We have shown that AI-aided processes enhance creative output (34 percent) and diversity of ideas (28 percent) and decrease blocks of creativity dramatically. Nonetheless, we outline key issues concerning the trust of the user, the transparency of the algorithm, and the creative ownership that should be tackled to cooperate successfully. We suggest a model of human-AI co-creativity and offer design principles of the future collaborative creative frameworks.

Keywords

Human-AI Collaboration, Co-creative Systems, Generative AI, Deep Learning, Generative Creativity, Human-Computer Interaction.

Optimizing Crop Recommendations through Soil and Rainfall Integration

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Abstract

Achieving precise crop guidance begins with linked technology designed for agricultural improvement. Instead of isolated decisions, choices around planting emerge from combined insights – rain forecasts paired with ground-level sensor readings analyzed through machine learning methods. Built into the approach are two core elements relying on ML: one anticipates rain patterns, another estimates soil hydration levels ahead of time. Before any analysis could proceed, raw information required careful structuring – a task that proved unexpectedly demanding. Handling inconsistencies across sources occupied significant effort throughout development. Cleaning and organizing the data came first, done thoroughly to avoid mistakes or skewed results, ensuring trustworthy model outputs. Which algorithm worked best was found through testing several options: K-Nearest Neighbors appeared early on, then Random Forest followed, while Linear Regression showed steady behavior, though Naive Bayes delivered under specific conditions. After comparison, only those delivering highest precision remained selected – specifically for forecasting rain levels and ground dampness. Their role is central – not because they are advanced but due to supplying necessary information at critical points in the process. Farmers gain higher harvests, lose fewer resources, move toward long-term land use when such forecasts merge into guidance routines.

Keywords

Crop recommendation system, machine learning, rainfall modeling, precision farming, data preprocessing, and soil moisture prediction.

Unimodal Emotion Recognition from Facial Expressions Using Deep Learning

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Abstract

Facial Emotion Recognition (FER) remains challenging in human-computer interaction, as traditional models often fail to capture complex spatial and sequential dependencies needed for accurate classification. To address this, we developed a hybrid deep learning model combining a pre-trained ResNet50 CNN with recurrent layers, specifically Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU). ResNet50 extracts a 2048-dimensional feature vector from each image, which is reshaped and passed to a 128-unit LSTM followed by a 64-unit GRU. We adopted a two-phase training strategy: first freezing the feature extractor, then fine-tuning with a low learning rate (1×10^{-5}) for the eight emotion classes in the CKDataset. Experimental results show the hybrid model achieved 89.47% accuracy. It enables accurate and computationally efficient recognition of complex facial expressions. The system provides a scalable solution for real-time emotion recognition in smart environments and psychological monitoring.

Keywords

Facial Emotion Recognition, ResNet50, LSTM, GRU, Hybrid Deep Learning, Computer Vision, Transfer Learning, Sequence Modeling.

Hybrid Graph Neural Network Framework for Real-Time Credit Card Fraud Detection with Explainable AI

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Abstract

Increased accuracy and interpretability A credit card fraud has highly become advanced with the growth of digital payment, and thus requires more accurate and interpretable detection systems. Rule-based systems and regular machine learning models are not good at identifying the relationships on which fraud networks coordinate themselves, and deep learning models, though potent, are more of a black box, which is a real issue in controlled financial settings. The current paper presents a recent hybrid intrusion detecting framework based on a combination of Graph Attention Networks (GAT) and Multi- Layer Perceptron (MLP) frameworks to intercept fraudulent credit card transactions in real time. The system performs on 314 designed features which include temporal trends, card velocity measures, and network topology measures over a graph constructed upon a sample size of 100,000 transactions sampled on the IEEE-CIS fraud detection dataset. The architecture achieves 92.34 percent ROC-AUC, 84.56 percent precision and 62.34 percent recall at a false positive rate of 1.44 percent and inference latency to less than 43ms per transaction. Five- level hierarchical explainability (to basic and expert), SHAP- based feature attribution, Monte Carlo Dropout quantification of uncertainty, and self- diagnostic reliability assessment are built in the framework. It is connected by a Streamlit-based monitoring dashboard that offers a real-time view of the network topology, fraud rings, attention heatmaps, and counterfactuals. Ablation experiments prove that the hybrid GAT+MLP architecture out- performs a single graph-based architecture (F1: 0.689) and plain MLP-based architecture (F1: 0.702) by 7.1 percentage points- are statistically significant; these results justify the argument that topology-sensitive fraud detection methodology is useful in live financial systems.

Keywords

Credit card fraud detection, Graph Attention Networks, Explainable AI, SHAP Analysis, Real-Time Monitoring, Counterfactual Explanations, Uncertainty Quantification, Federated Learning, Network Topology Analysis, Financial Cybersecurity.

AI-Based Insider Threat Detection System in Enterprise Networks

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Abstract

In today's enterprise, employee attacks present a very strong risk to data integrity and network security. These threats are often from legitimate users who are using their access privilege incorrectly, which makes traditional perimeter-based security systems ineffective. The proposed project presents an AI-based Insider Threat Detection System based on network packet analysis to detect and categorize potential invasions to the enterprise networks. The system works with the Random Forest algorithm to process and analyze network data collected in real-time in the aim of discovering abnormal or malicious activities with a measurable confidence score. Using the CICIDS dataset as a source of benchmarking the project is about simulating enterprise network behavior in terms of packet-wise streaming, where each packet is streaming for analysis on its individuality, to know if it is a normal traffic or if it is an intrusion attempt. Once an intrusion is detected, the system will provide an instant alert notification through email or SMS, so it can react and mitigate quickly. The model also offers a feature importance graph which enables administrators to understand which network attributes were most influential as part of the decision made by the model, which can improve explainability and transparency for AI-driven cybersecurity.

Keywords

Insider Threat Detection, Enterprise Networks, Random Forest, Machine Learning, Network Security, Intrusion Detection, CICIDS Dataset, Streamlit, Flask, Artificial Intelligence.

Mechanical Characterization and Enhanced Structural Performance of Hybrid Carbon Glass Fiber Reinforcement

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Abstract

Aim: The purpose of the research is to design, make, and mechanically test hybrid carbon-glass fiber reinforced polymer. To overcome the limitations of traditional single-fiber systems and create a more effective one, (C/G-FRP) composites are used. lightweight, reasonably priced, and structurally sound material can be used in advanced engineering applications in the car and aircraft industries and civil engineering.

Materials and Methods: In this paper, glass and carbon fibers were used. then bonded with a Bisphenol-A epoxy resin matrix to form hybrid laminates in small batch hand lay-up process and standardized processes of curing.

Group 1: The comparative groups of specimens that were produced in accordance. that contained glass fiber composites, carbon fiber composites, and composite C/G-FRP laminates.

Group 2: Tensile, flexural, impact, hardness, and interlaminar shear were used to mechanically characterize them. strength (ILSS) tests. The interaction of fiber-matrix, failure, and development of damage were investigated with the help of. micro-tests based on scanning electron microscopy (SEM). The evaluation of the statistical analysis was done statistically. predictability and importance of experimental data. Result: The hybrid C/G-FRP (102.350) laminates were found to be better. and more equal mechanical performance as compared to glass (63.000) and carbon fiber composites (95.625). There were significant improvements in tensile and flexural strength, impact energy absorption and ILSS and this implies. improved stiffness, toughness and delamination resistance. The high interfacial bonding of the hybrid laminates which is less brittle. SEM testing was used to verify fracture and other higher effectiveness of stress transfer. The significance and validity of the Statistical analysis also established the performance enhancement caused by hybridization (7000.082.).

Conclusion: The results of the study indicate that hybrid carbon-glass fiber reinforced polymer composites are useful. and another viable alternative to conventional single-fiber systems. The structural of the hybrid laminates produced is superior. reliability, wear resistance and affordability through a powerful combination of the rigidity of carbon fibers with the rigidity of glass fibers, which renders them suitable in the next generations of lightweight engineering.

Keywords

ASTM testing, SEM analysis, mechanical characterization, structural performance, carbon fiber, glass fiber, fiber-reinforced polymer, hybrid composites, epoxy composites, lightweight materials.

Academic Performance Prediction Using Socioeconomic Factors in Rural and Urban Tamil Nadu: Pre- and Post-COVID Analysis

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Abstract

This study investigates the influence of socioeconomic status (SES) and post-pandemic learning experiences on academic performance in rural and urban districts of Tamil Nadu. Publicly available datasets, including UDISE+ and Kaggle sources, were merged to form a unified sample of 590 observations spanning 32 districts. Key SES indicators (literacy and graduation rates) were analyzed along with COVID-era variables (hours spent online, device access, stress levels, motivation, and parental support). The methodology integrates descriptive statistics, principal component analysis (PCA), multiple regression, and machine-learning classifiers (Random Forest and XGBoost). The results reveal that digital participation (hours online) accounts for 58.3% of variance in performance, while traditional SES indicators exhibit weaker direct effects. Statistical tests (t-tests, ANOVA, Chi-square) confirm significant rural-urban disparities in device access and academic outcomes. The findings underscore the need for targeted investments in digital infrastructure and optimized online-learning strategies to bridge educational gaps after the pandemic. Limitations include reliance on district-level and synthetic COVID data, prompting recommendations for validation with student-level datasets in future research.

Optimizing Preterm Birth Prediction Using a Hybrid Deep Learning and Ensemble-Based Model

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Abstract

Preterm birth has been cited as one of the greatest causes of neonatal morbidity and mortality in all parts of the world and therefore it is important to anticipate the dangers early enough, this way the clinical intervention will be instituted on time. A hybrid deep learning model in this paper will be proposed to predict pre term births using the clinical information of the patient in a relatively small sample size of approximately 100,000 patient records with multiple clinical characteristics. The initial steps are to pre-process and normalize data in general and address the imbalance between classes with the assistance of Synthetic Minority Over-sampling Technique (SMOTE). Deep neural network is built in such a manner that it learns non-linear feature of relationships between the clinical data hence creating a robust feature learning. Predictive performance of the model on the standard classification measures, which include the ROC curve analysis and the confusion matrix, are specifically tested on unknown test data. This paper has demonstrated that they are precise and have a high discriminatory power and this implies that the deep learning hybrid models will give credible forecasts concerning preterm births. This means that the findings can have clinical implications which can be utilized in the determination of the choice which can be adopted in the early pregnancy stages and affect the preventive approach towards handling the high-risk pregnancies.

Keywords

Preterm Birth, Neonatal Health, Maternal Factors, Clinical Prediction, Risk Assessment, Early Detection, Healthcare Analytics.

Machine Learning-Based Early Risk Screening for Maternal Health Complications and Postpartum Depression Using Physiological and Demographic Factors

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Abstract

Complications in maternal health and postpartum depression (PPD) are significant public health concerns that affect both maternal health and neonatal outcomes. It is imperative to identify high-risk mothers at an early stage to prevent complications. This paper proposes a machine learning approach that can help identify significant socio-demographic and physiological factors associated with maternal health complications. It can further help in developing predictive models that can aid in early screening. This paper uses statistical techniques such as multinomial logistic regression, Kruskal-Wallis tests, Chi-square tests to identify significant predictors in low, mid, and high-risk groups. This paper uses Logistic Regression and XGBoost models to classify maternal health risk levels. It further evaluates the performance of the models using accuracy, precision, recall, F1-score, and AUC-ROC. This paper uses the Maternal Health Risk Dataset that consists of 1,014 observations. It has various variables such as age, systolic blood pressure, diastolic blood pressure, blood sugar, body temperature, heart rate, and maternal risk level. The results show that systolic blood pressure, diastolic blood pressure, blood sugar, and the age of the mother have a high association with maternal risk. XGBoost has better performance compared to Logistic Regression. XGBoost has obtained an F1 score of 0.87 and AUC ROC of 0.94. It is evident that machine learning can be used in the early detection of maternal risk.

Career Compass: Ai-Driven Placement Prediction for Smarter Campus Futures

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Abstract

With the rise in a competitive job market, it has become challenging for people to judge their employment readiness and determine skills needed to make them more employable. Traditional career development and employment placement support services rely heavily on manual analysis processes and employ non-changeable criteria, which are no longer effective in meeting the changing needs of the industrial sector. This study proposes a Career Compass solution, which is an AI-enabled career development solution to gauge employment readiness, predict employment placement probability, and provide user-specific recommendations on skill-building to make them employment ready. This solution uses machine learning algorithms in analytical logic to provide recommendations to individuals, and a hybrid solution is developed using intelligence sub-layer developed in Python, making it efficient, effective, and more scalable to be integrated in a Java-based development solution. The solution will help individuals to make well-informed career choices to make them employment ready, making it possible for organizations to gauge employability trends in a better manner. Empirical analysis suggests that automated employment analysis and recommendations have a significant positive impact on making individuals employment ready.

Keywords

Career Compass, Placement Prediction, Skill Recommendation, Career Guidance System, Machine Learning, Artificial Intelligence, Employability Analysis, Placement Readiness Score, Personalized Learning Roadmap, Hybrid Web Application.

Autonomous Climate Mitigation System

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Abstract

Flood disasters continue to pose severe threats to human life, infrastructure, and economic stability due to delayed prediction, fragmented response mechanisms, and inefficient post-disaster recovery coordination. This paper proposes an Autonomous Climate Disaster Management System (ACDMS), a multi-agent, AI-driven platform designed to predict, monitor, respond to, and recover from flood disasters in real time. The system integrates deep learning models for disaster prediction and monitoring, reinforcement learning for optimal resource allocation, graph-based evacuation planning, and AI-assisted recovery support. By fusing real-time weather data, satellite imagery, social media signals, and geospatial information, ACDMS enables centralized coordination, rapid emergency response, and data-driven decision-making. Experimental simulations and system evaluations demonstrate improved response efficiency, optimized resource deployment, and enhanced situational awareness compared to traditional disaster management approaches. The proposed framework establishes a scalable, intelligent, and resilient solution for modern flood disaster mitigation.

Structural Limitations of CVE-Based Vulnerability Assessment: A Systematic Survey and Empirical Analysis

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Abstract

Traditional vulnerability risk assessment frameworks centered on CVE databases and CVSS scoring fail to address modern network environments characterized by rapid infrastructure changes, heterogeneous IoT/cloud deployments, and evolving adversarial tactics. This study conducts a systematic empirical comparison of three leading vulnerability scanners—Nessus, OpenVAS, and Nuclei—across 93 ground-truth vulnerabilities in controlled testbeds representing VMs, containers, and network devices. Key findings reveal three structural limitations: (1) CVE metadata incompleteness (67-85% across tools) increases analyst validation burden by 100%; (2) static modeling produces 15-23% coverage gaps between traditional IT (96%) and IoT devices (71-87%); (3) absence of multi-source intelligence (EPSS/KEV) sustains false positive rates of 11-22%, consuming 3.8-4.2 hours per scan cycle.

Nessus excels in coverage (93.5%) but generates most noise; Nuclei leads precision (88.8%) and speed (2.8h scans); OpenVAS offers best interoperability. ANOVA analysis confirms statistically significant performance differences ($p < 0.05$) across all metrics. These results expose fundamental trade-offs in current approaches, motivating development of dynamic, topology-aware vulnerability management integrating real-time threat intelligence and asset interdependencies for next-generation network security.

Keywords

Vulnerability assessment, CVE, CVSS, network security, risk analysis, vulnerability scanning, threat intelligence.

Eye-Blink Controlled Smart Wheelchair Using Vision-Based Interface and IoT Integration

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Abstract

People who suffer severely debilitating physical injuries can be significantly hindered in their daily lives by the fact that they are unable to travel independently. Individuals severely disabled are unable to utilise a variety of the motorised wheelchairs now commercially available as these have controls requiring hand movements, voice activation or the use of biomedical sensors worn on the body. A smart wheelchair control system that utilises eye movements is described in this study, thereby allowing the user to control the vehicle through their eye movements. Designed so that no physical contact with the user is required, the system is economical, pleasant and easy to operate. A standard webcam continually photographs the user's facial expression. The software relies on OpenCV to process the images from the video to determine eye movements and blinking. The device tracks the user's eye movements to identify voluntary commands, cancelling out any unintended movements. Each of the eye movements is linked to a specific action of the powered wheelchair such as turning left, going forward, going backward or turning right. People with disabilities are also able to easily use this system; the system has a very intuitive interface and does not require a lot of training on the part of the user nor much mental effort. Following the creation of the command, this is then sent to an Arduino Uno via a serial link. Two DC motors of high torque, capable of safely moving real world loads, are powered by a BTS7960B H bridge motor driver. This driver is controlled by the microcontroller after it has processed the data it received. The ultrasonic sensor continuously scans its surroundings to improve user safety through its function. In the event of an obstacle coming too close, the system automatically applies the brakes to the chair to avoid a collision. In addition to mobility assistance, a wireless link is used to integrate IoT functions. The system lets users use pre-programmed eye movements to control fundamental smart home devices and to send out SOS signals in emergencies to their caregivers. This suggested system is a cost-effective, non-invasive and user-friendly technology which offers assistance in the daily life, safety and independence of people with disabilities.

Keywords

Eye-Blink Detection, Smart Wheelchair, Computer Vision, Arduino, OpenCV, IoT, Assistive Technology.

LiDAR-Aided Blockage Prediction for mmWaves with 5G Networks

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Abstract

This paper is the design and development of an autonomous robotic system that is capable of maintaining reliable wireless communication links in crowded or dynamically varying environments. In order to keep in touch with a base station, the system employs LiDAR-based obstacle tracking, SLAM-based mapping, directional antenna steering, and smart mobility. In case a line-of-sight (LOS) obstacle disrupts the signal of the wireless, the robot tries to fix the issue by turning the antenna and changing the height. In case these measures cannot be performed, the robot will automatically change to an already mapped area which should result in better signal quality. The outcomes of the experiment indicate that the proposed solution significantly improves the continuity of communication during the process of negotiating challenging interior conditions. Applications could be search-and-rescue, industrial automation, military communication relays and autonomous network rollout.

Keywords

LiDAR, SLAM, Autonomous Navigation, Antenna Control, Robotics, Wireless Communications.

Fusion Based Semi Supervised Neural Framework for Predicting Complex Drug Interactions

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Abstract

Drug drug interactions (DDIs) arise when the effect of one medication is altered by the presence of another, which can result in serious adverse reactions, reduced therapeutic benefit, or unexpected toxicity. Reliably identifying potential DDIs before they occur in clinical practice remains challenging because experimental screening is expensive and incomplete, and real world pharmacovigilance data are sparse and noisy. This work introduces a fusion based semi supervised neural framework for predicting complex DDIs using heterogeneous drug information. The proposed model integrates chemical structure features, biological target profiles, pathway and enzyme annotations, and phenotype level side effect data into a unified similarity representation between drug pairs. Cosine similarity over high dimensional descriptors is combined with a Gaussian Interaction Profile (GIP) kernel derived from known interaction networks, and the resulting integrated similarity matrix is used to train a Regularized Least Squares (RLS) classifier under a semi supervised learning scheme. Extensive experiments with 5 fold, 10 fold, and de novo drug cross validation demonstrate that the framework consistently outperforms representative state of the art baselines in terms of AUC, AUPR, and F1 score, while maintaining competitive computational cost. Case studies on predicted novel interactions further highlight the model's ability to generalize to previously unseen drugs and to support safer drug design and clinical decision making.

Keywords

Drug Drug Interaction (DDI), Semi Supervised Learning, Integrated Similarity, Regularized Least Squares, Gaussian Interaction Profile, Computational Pharmacology, Drug Safety.

AI-Assisted Diagnostics from Medical Imaging

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Abstract

This project presents an AI-based medical disease prediction system developed using Deep Learning, Machine Learning, and the Flask web framework to support early disease detection and clinical decision-making. The system integrates four diagnostic modules into a single platform. The Lung Disease Prediction module analyzes X-ray or CT images to detect lung abnormalities and generate heatmap visualizations highlighting affected regions. The Brain Tumor Detection module uses deep learning models to identify tumor presence from brain scans and localize abnormal tissues using heatmaps. The Heart Disease Prediction module applies machine learning algorithms to clinical parameters to predict disease risk with a probability score. The Bone Fracture Detection module analyzes bone images to detect fracture regions. All modules are deployed through a Flask-based web application, providing a user-friendly interface for uploading medical data and viewing results, thereby improving diagnostic efficiency and supporting healthcare professionals.

Fabrication and Characterization of Teak Leaf – Bagasse Fiber Reinforced Hybrid Composites for Sustainable Automotive Interior Applications

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Abstract

Aim: To compare the effectiveness of teak leaf fiber and sugarcane bagasse fiber as natural reinforcements in epoxy-based hybrid polymer composites using tensile, compression, flexural, impact, and hardness evaluations.

Materials and Methods: In this research, Group 1 is the reference for composite made from sugarcane bagasse fiber with epoxy resin to determine the standard mechanical properties and used as a reference to determine the extent to which the fiber system has improved and both groups are tested using ASTM standards to determine the mechanical properties. Group 2 is the hybrid composite which is prepared by adding teak leaf fibers to bagasse fibers.

Results: The hybrid composites exhibited distinct mechanical behavior based on fiber composition. Teak leaf fiber contributed to improved strength and bonding, while bagasse fiber enhanced stiffness and structural stability. The independent samples t-test showed that the t-value was 5.84 with 28 degrees of freedom and a two-tailed significance value of 0.0016.

Conclusion: The present paper establishes that teak leaf fibers and sugarcane bagasse fibers can be used in the future in developing lightweight and eco-friendly hybrid polymer composites.

Keywords

Teak leaf fibers, sugarcane bagasse fibers, epoxy composites, mechanical properties, tensile, compression, flexural, fiber-matrix.

A Multi-Model AI-Enabled Real Estate Management Ecosystem Integrating Personalized Recommendations, Behavioral Analytics and Market Intelligence

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Abstract

The fast digital changes which affect real estate platforms now create a need for advanced property management systems which use predictive analytics and personalized features and secure pricing systems. Real estate platforms which follow traditional methods use unchanging search filters together with manual pricing methods which prevent users from receiving personalized experiences and understanding pricing details. The research introduces a Multi-Model AI-Enabled Real Estate Management Ecosystem which connects an Ensemble-Based Property Recommendation Engine with a Rule-Based RentLock pricing framework. The system uses Random Forest models to predict structured user preferences and employs a TensorFlow-based Neural Network to study user behavior patterns. The system combines user preferences together with property attributes and interaction data to create customized property recommendations. The RentLock mechanism uses database-backed contract validation logic to maintain constant rental prices during the entire term of the established contract. The experimental evaluation achieved a recommendation accuracy rate of 92.4% which showed high precision at 91.8% and recall at 90.6%. The proposed system enhances user interaction together with pricing visibility and rental price consistency while operating its complete system deployment through React and Node.js and Express and MongoDB and TensorFlow.

Keywords

Real Estate Analytics, Property Recommendation System, Ensemble Learning, Behavioral Analytics, RentLock Mechanism, Artificial Intelligence, Market Intelligence.

Hybrid Digital Twin Framework for Monitoring Greenhouse and Underground Conditions

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Abstract

Digital twin technology is an emerging concept that enables the creation of a virtual replica of a physical system for real-time monitoring, analysis, simulation, and control. This project proposes a hybrid digital twin model for greenhouse and underground environments to improve environmental monitoring, safety, productivity, and resource management. Greenhouses require continuous monitoring and control of environmental parameters such as temperature, humidity, soil moisture, and light intensity to ensure optimal plant growth and sustainable agricultural production. Similarly, underground environments including tunnels, mines, and storage facilities require reliable monitoring of environmental conditions such as temperature, humidity, and harmful gas levels to maintain safety and system stability. Traditional monitoring methods often rely on manual observation or isolated sensing systems, which may lead to delays, inaccuracies, or inefficient resource usage. The proposed hybrid digital twin model addresses these challenges by combining real-time sensor data with virtual simulation models to create a synchronized digital representation of both greenhouse and underground environments. IoT-based sensors continuously collect environmental data and transmit it to a digital platform where the data is processed, visualized, and analyzed. The hybrid approach ensures that both real-world measurements and simulation-based predictions work together to provide a more comprehensive understanding of environmental conditions. The proposed model demonstrates how digital twin technology can be effectively applied to smart agriculture and underground environmental monitoring systems, offering a scalable, cost-effective, and sustainable solution for modern environmental management applications. This project highlights the potential of hybrid digital twin systems to support intelligent monitoring, improve operational efficiency, and enable future advancements in automation and smart environmental control technologies.

Keywords

Digital Twin, IoT, Greenhouse Monitoring, Underground Environment, Environmental Sensors, Real-time Monitoring.

A Blockchain-Driven Framework for Secure Document Versioning and Role-Based Access Enforcement in SaaS Systems

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Abstract

Secured document management systems fail because they depend on central storage systems which expose their system to security breaches. The traditional SaaS platforms that operate through cloud-based systems allow businesses to expand their operations but they do not provide customers with permanent data protection and secure data management. The paper introduces a secure document versioning system which uses blockchain technology to control access through SHA-256 cryptographic hashing and IPFS decentralized storage and Ethereum smart contracts for role-based access management and immutable version control. Documents get stored on IPFS through off-chain storage systems which create content hashes and metadata that get stored on-chain to provide proof of document integrity. The smart contract establishes detailed access control rules that define document ownership and editing and viewing permissions while creating complete audit trails of all document changes. The testing results from the Polygon testnet show that the system can identify all unauthorized data changes and it has protected the system from all security breaches during testing and it takes 1.18 seconds to confirm transactions and the system uses less gas for version updates. The architecture provides decentralized trust and permanent version control and secure document sharing which meets the requirements of enterprise SaaS applications.

Keywords

Blockchain, Secure Document Management, Smart Contracts, SHA-256, IPFS, Role-Based Access Control, Immutable Versioning, Decentralized Storage, SaaS Security, Ethereum.

Effect of Precursor Molar Ratio on the Physicochemical and Electrochemical Characteristics of Sol–Gel Derived ZnO Nanoparticles

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Abstract

In this study, ZnO nanoparticles (NPs) were synthesized via a cost-effective sol–gel method by varying the precursor molar ratios (1:5 and 1:10) to investigate their physicochemical properties for piezoelectric applications. Thermogravimetric analysis (TGA) revealed a significant reduction in total weight loss from ~35–36% for ZnO (1:5) to ~7–8% for ZnO (1:10), indicating improved thermal stability and efficient precursor conversion. X-ray diffraction (XRD) confirmed the formation of a highly crystalline hexagonal wurtzite structure, with enhanced crystallinity for ZnO (1:10), exhibiting larger crystallite size (23.97 nm vs. 21.69 nm), lower dislocation density (0.0021 vs. 0.0026 nm⁻²), and reduced microstrain (0.0014 vs. 0.0023). FESEM analysis showed a transition from agglomerated and irregular morphologies (~160 nm) to well-defined and uniformly distributed nanostructures (~196 nm), indicating controlled nucleation and growth. UV–DRS studies revealed a slight red shift in absorption edge (~369–370 nm) and band gap reduction from 2.89 eV to 2.81 eV, suggesting enhanced optical absorption and improved charge carrier dynamics. The improved thermal, structural, and morphological properties of ZnO (1:10) lead to reduced defect density, enhanced dipole alignment, and minimized charge screening, thereby significantly improving piezoelectric performance. This study highlights the critical role of precursor molar ratio in tuning ZnO nanoparticle properties and demonstrates that the optimized 1:10 ratio is highly suitable for advanced piezoelectric energy harvesting applications.

Keywords

Zinc oxide, Sol–gel method, Physicochemical, Piezoelectric.

Fairness and Bias in Credit Scoring Models

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Abstract

Credit scoring models, widely adopted in financial institutions, aim to assess creditworthiness efficiently using machine learning techniques. However, these models often inherit biases from historical data, leading to unfair outcomes against protected groups such as those based on gender, age, or income. This study explores the presence of bias in credit scoring by evaluating models like Logistic Regression, Random Forest, and XGBoost on both performance metrics and fairness metrics such as Statistical Parity, Equal Opportunity, and Disparate Impact. Using the German Credit Dataset, we demonstrate that higher accuracy does not always ensure fairness. We implement bias mitigation strategies including reweighing and fairness-constrained algorithms to reduce discrimination while maintaining predictive performance. The results underscore the need to embed fairness in model development to ensure ethical and equitable lending decisions, making the case for responsible AI in finance.

Keywords

Credit Scoring, Fairness, Bias, Machine Learning, Disparate Impact, Statistical Parity, Equal Opportunity, Reweighting, Ethical AI, Financial Inclusion.

Redefining Modern Warfare through Artificial Intelligence: The Role of Generative AI and Cybersecurity

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Abstract

Artificial Intelligence (AI) is rapidly transforming the nature of modern warfare by enabling faster decision-making, improved intelligence analysis, and more autonomous military operations. In recent years, the emergence of generative AI has introduced new possibilities for strategic planning, battlefield simulation and automated cyber operations. At the same time, cybersecurity has become a critical dimension of military power as digital infrastructures and information networks increasingly influence the outcomes of conflicts. Despite the growing body of research on AI applications in defense, most studies examine generative AI, cyber warfare and military strategy separately. As a result, there is still a lack of integrated models that explain how generative AI systems interact with cybersecurity capabilities and operational military structures within a unified framework. To address this gap, this study proposes two original contributions. First, it introduces the Generative AI Warfare System (GAWS) framework, which conceptualizes how generative AI can be integrated into military intelligence, cyber operations and command-and-control decision processes. Second, the paper develops the Generative AI Warfare Readiness Index (GAWRI), a structured index designed to evaluate the level of preparedness of nations to adopt generative AI within their defense ecosystems. Together, the GAWS framework and the GAWRI provide a systematic approach for understanding AI-driven warfare and offer insights that may influence future military doctrine, strategic planning and cyber defense policies.

Keywords

Generative AI, autonomous military systems, warfare framework, readiness index, cybersecurity.

Machine Learning - Based Web Application for Rabies Prediction in Dogs

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Abstract

Rabies is a fatal viral zoonotic disease in dogs that poses a significant menace to human health because of its rapid neurologic progression and lack of timely clinical intervention. Conventional laboratory confirmation, though with high accuracy, is impractical for a rural or resource-limited setting owing to the high cost, technical expertise, and delay in receipt of results. This work intends to propose an intelligent early warning through a Flask-based web application for the prediction of rabies likelihood based on observable canine symptoms from a supervised machine learning model. The system pipeline acts on label encoding, symptom-based classification with a trained scikit-learn model stored as .pkl, instantaneously yielding an output of either Rabies or Not Rabies through a modern visual HTML/CSS interface. Its primary intention lies in the assistance of non-experts and veterinarians for rapid decision support, thereby facilitating early medical escalation rather than the replacement of laboratory confirmation. Thus, the novelty of this work rests on the integration of real-time, symptom-driven rabies triage with a lightweight, deployable Flask web UI for practical field-level accessibility.

Keywords

Rabies Prediction, Canine Health, Zoonotic Disease, Early Detection, Veterinary Decision Support, Digital Diagnosis, Public Health Prevention.

Skill Matrix: A Data-Driven Student Evaluation and Recruitment Support System

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Abstract

The widespread acceptance of skill-based hiring in various organizations has brought forth the shortcomings of conventional academic selection procedures. For example, an emphasis on cumulative grade point averages and conventional tests allows hiring managers and recruiters to overlook the various skills a student has developed in practical experience programs like internships, online courses, hackathons, and extracurricular activities. The lack of a common and easily trackable and verifiable system makes recruiters and academics worry about issues of authenticity, fairness, and domain readiness.

In order to overcome the aforesaid challenges, the authors of the present paper propose a system named Skill Matrix System, an online portal that can carry out automated verification of student certificates and conduct an all-round student evaluation in multiple dimensions. The system proposed here includes an automated student certificate verification system where the authenticity of certificates is ensured by verifying the issued certificates using the QR code and email verification techniques.

The all-round student scoring is done through a weighted scoring system where the overall skill matrix score is an aggregation of several parameters. In addition, there is a domain readiness evaluation module, where existing competencies can be mapped and matched with specific roles in the industry, such as data analyst, software developer, cloud engineer, cybersecurity analyst, and AI/ML engineer. There is a special analytics section specifically designed and developed for recruiters, including features of student ranking, filtering, and even student portfolios. This helps recruiters make objective and data-driven hiring decisions without relying on manual screening of resumes. The experimental results on the prototype also confirm transparency in assessment, reduced verification time, and reduced fraudulent submissions. The results also confirm that there is an improvement in the level of alignment between the skills exhibited by students against the requirements needed by a specific industry for a given role, thereby confirming its efficiency in placement. Consequently, the proposed Skill Matrix System is a key solution that is viable, secure, and future-ready for improving the assessment system for students, thereby building trust in the academic recruitment space.

Keywords

Skill Matrix System, Student Skill Assessment, Data-Driven Recruitment, Automated Certificate Verification, Domain Readiness Mapping, Educational Data Analytics, Candidate Evaluation, Decision Support System.

Nilam Share: A Digital Platform for Transparent Agricultural Land Leasing

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Abstract

Leasing of agricultural land in India is still mostly done in a very informal manner, without any regulation or documentation, thereby, resulting in disputes, lack of trust and the loss of income among both landowners and tenant farmers. Nilam Share is a digital platform that aims to make the land leasing process more formal and efficient. The platform allows landowners to register agricultural lands, upload patta documents, describe the conditions of the land (soil type, water resources, previous crops), and create legal digital lease agreements and invoices. Tenant farmers can look for available lands, apply for leases, negotiate terms, and complete leasing workflows in a secure manner. The platform is built on a three-tier architecture consisting of React (frontend), Node.js/Express (backend), and MySQL (database). Nilam Share brings in transparency, documentation, and digital traceability which are some of the key features of the platform in the normally informal leasing system. The proposed system is a good example of how a simple, easily accessible digital tool can go a long way in reducing land-related conflicts, increasing the trust level of farmers, and facilitating the agricultural ecosystem of Tamil Nadu to move towards the next level of development. Extensions of the system in the future can be the integration of official APIs from the Tamil Nadu Patta-Chitta verification system for the automated validation of ownership.

Keywords

Agricultural land leasing, patta-chitta, digital contracts, farmer empowerment, land management system, tenancy documentation, Tamil Nadu agriculture.

Federated Learning–Driven Resource Management Strategies for Cloud Computing Environments

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Abstract

With the increasing scale and diversity of cloud infrastructure and the need for increased data security, resource optimization becomes a complex problem. Traditional approaches to resource centralization involve large amounts of data collection on a global scale, which may work against efficiency due to increased computational requirements for processing large amounts of data and may also compromise sensitive data through too many sharing channels. This report proposes a novel solution through the application of federated learning together with resource management systems in cloud computing infrastructure to address these problems. One proposed approach enables separate cloud devices to collaborate on optimizing resource allocation strategies without having to disclose their own operational details. This approach models different cloud environments by evaluating different strategies for resource management, such as fixed allocation, central artificial intelligence optimization, distributed AI-based allocation, and environmentally friendly algorithms. Criteria for evaluating performance include measures such as power usage efficiency, service level agreement, fair resource allocation, network traffic volume, and environmental impact assessments. A dynamic graphical user interface enables instantaneous testing and simultaneous comparison of data points. Empirical evidence shows that federated learning outperforms traditional approaches in providing comparable yet fair results while consuming minimal resources and ensuring data integrity. Federated learning is shown to be a beneficial strategy in managing future cloud resources due to its scalability and feasibility.

Keywords

Federated Learning, Cloud Computing, Resource Management, Energy Efficiency, Privacy Preservation, Distributed Systems, Sustainability-Aware Computing.

IoT-Based Personal Climate Control System

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Abstract

The need to maintain a comfortable environment is important and can only be achieved through a system of climate controls. In environments where climate conditions change frequently, the importance of climate controls cannot be overstated. In this regard, this Project presents a proposal for a system of climate controls based on Internet of Things technology, with sensors monitoring and controlling the temperature, humidity, and quality of air. The system uses data from these sensors to provide a more personalized environment and maintain a comfortable climate. The data is then sent to a mobile application to be controlled and accessed remotely.

Keywords

IoT, personal climate control, temperature sensing, humidity sensing, air quality monitoring, HVAC control, environmental monitoring, automated adjustment, user preference learning, smart comfort system, mobile application, remote monitoring, remote control, energy efficiency, smart environmental.

Comparative Analysis of Clustered Deep Cross Neural Networks (DCNN) for Enhanced Hardware Trojan Detection in Reconfigurable FPGA Architectures

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Abstract

The pervasive globalization of the semiconductor supply chain has introduced profound security anxieties, specifically regarding the surreptitious integration of Hardware Trojans (HT) within Integrated Circuits (ICs). As traditional verification methodologies struggle to keep pace with the exponential complexity of Field Programmable Gate Arrays (FPGAs), the research community has pivoted toward machine learning (ML) paradigms to bypass the rigid, often unavailable requirement of "golden" reference chips. However, established architectural frameworks such as Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN) frequently encounter performance ceilings due to their inability to resolve high-dimensional netlist intricacies or identify malicious triggers lacking spatial locality. While emerging Graph Neural Networks (GNN) offer superior topological insights, they often incur heavy computational penalties and can overlook the subtle, non-linear functional correlations existing between disparate signal paths.

This paper presents a specialized Deep Cross Neural Networks (DCNN) Framework designed to address these fundamental gaps through a multi-stage analytical pipeline. By implementing an initial unsupervised clustering phase to isolate behavioural and structural anomalies, the DCNN architecture explicitly quantifies inter-feature dependencies—such as the intricate mathematical coupling between path propagation delays and gate switching activity—that remain invisible to independent-feature classifiers. This "cross-correlation" logic allows the model to identify stealthy Trojans that exhibit minimal deviations in isolated parameters but create detectable signatures through their collective interaction. Empirical evaluation conducted on the standardized Trust-Hub benchmark suite confirms that the DCNN-Framework achieves a peak detection accuracy of 98.4% and a remarkably low False Alarm Rate (FAR) of 1.2%. These results consistently surpass the performance of conventional CNN and GNN-based alternatives, establishing correlation-aware neural learning as a superior, scalable, and highly resilient methodology for safeguarding contemporary reconfigurable hardware against evolving adversarial threats.

Keywords

Hardware Trojan Detection, FPGA Security, Deep Cross Neural Networks (DCNN), Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), Graph Neural Networks (GNN), Feature Correlation.

Fusion Antenna for 5G: Achieving Unprecedented Speed and Reliability through MIMO/mmWave Integration

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Abstract

The rapid expansion of data-intensive applications and ultra-low latency services has significantly increased the demand for high-speed and reliable wireless communication in fifth-generation (5G) networks. To address these requirements, advanced antenna technologies such as Multiple-Input Multiple-Output (MIMO) and millimeter-wave (mmWave) communication have emerged as key enabling solutions. However, challenges such as signal loss, limited coverage, and interference at mmWave frequencies require innovative antenna designs.

This paper presents a fusion antenna design that combines MIMO and mmWave technologies to improve data speed, spectral efficiency, and link reliability in 5G systems. The proposed design integrates compact antenna elements with optimized beamforming and spatial diversity techniques to support high-frequency operation while ensuring strong performance. Simulation and performance analysis show that the fusion antenna greatly improves transmission speed, cuts down latency, and boosts signal quality compared to traditional antenna systems. The findings demonstrate that a fusion antenna architecture combining MIMO and mmWave technologies constitutes an effective solution for advanced 5G and beyond wireless networks.

Keywords

5G communication, fusion antenna, MIMO, millimeter-wave (mmWave), beamforming, high-speed wireless, spectral efficiency, antenna design.

IoT-Based Real-Time Electricity Theft Monitoring and Prevention System with Pole-Level Hooking Detection and Remote Relay Control

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Abstract

Electricity theft is becoming a serious problem for power distribution companies. It causes heavy financial losses and also affects proper power management. To reduce this issue, our project proposes an IoT-based power theft detection system that can detect illegal power usage in real time. In this system, electrical parameters are measured at both the supply side and the load side using Potential Transformer (PT) and Current Transformer (CT). The collected data is processed using a Raspberry Pi Pico. The controller continuously compares the input and output values. If there is any mismatch or unusual difference, it indicates possible power theft. When theft is detected, the system automatically turns off the load using a relay. At the same time, a notification is sent through an IoT platform so that authorities can monitor the situation remotely. This system helps improve power security and makes monitoring easier and more efficient.

Keywords

Arduino ATmega328P, Current sensors, Distribution pole grid, Electricity theft, GSM communication, Hooking detection, Internet of Things (IoT), Power loss, Real-time monitoring, Remote relay control, Smart metering.

Deep Learning-Based Industrial Defect Detection Using Siamese U-Net Architecture

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Abstract

Manufacturing industries utilize industrial quality control as a fundamental aspect of their operations in order to produce products that meet customer expectations and maintain the integrity of their business. Quality control processes have historically been based upon the manual visual inspection of manufactured goods and infrequently utilized traditional image processing methods. These two approaches to quality control rely heavily on human judgement and are, therefore, very subjective. They also take a long time to complete and yield very inconsistent results and thus cannot provide accurate or precise information about the presence of defects in products. In addition to suffering from the inconsistent nature and long duration of manual inspections or traditional image processing methods, conventional methods of quality control also perform poorly at identifying subtle defects and do not provide a precise localization of any defects they identify. In order to address these limitations, we present an industrial defect detection system based on deep learning technology that uses a Siamese U-Net architecture with a ResNet backbone. Our systems utilize a reference image that is free of defects to compare against a test image of a manufactured good to identify any defects in the manufactured good based upon differences at the feature level of both images. The encoder of the ResNet backbone extracts high-quality features from both the reference image and the test manufactured good image. The decoder of the U-Net architecture performs pixel-wise segmentation, generating a mask that accurately identifies the location of defects. We train and evaluate our systems using the MVTec Anomaly Detection Dataset, which is a collection of real-world images of manufactured goods, and their corresponding pixel-level ground truth masks. Our results demonstrate that our model performs much better than conventional approaches for defect identification and localization. Our systems will greatly reduce the amount of required manual inspection and enable intelligent quality control for manufacturers in the age of Industry 4.0.

Keywords

Industrial Defect Detection, Deep Learning, Siamese Network, U-Net, ResNet, Anomaly Detection.

Secure Anonymous File Transfer System Using Hybrid AES–RSA Encryption Over Tor Network

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Abstract

Public networks continue to present security problems because their protected file transfers can be intercepted through various methods. Symmetric encryption operates efficiently for large data encryption tasks, yet it fails to provide secure methods for distributing encryption keys. Asymmetric encryption allows users to exchange encryption keys securely but increases processing requirements when handling extensive data. Encrypted communication methods fail to provide built-in mechanisms that protect sender identities. The Secure Anonymous File Transfer System requires a Tor onion routing network to function with its hybrid AES–RSA encryption system. The system uses AES-256 to achieve rapid file encryption and RSA- 2048 to protect symmetric key transfer. The system uses Tor to send encrypted data, which hides the sender's IP address and prevents traffic detection. The system architecture provides three security features which include data protection and secure key distribution and network traffic concealment. The performance test results show that AES encryption speed increases with larger file sizes and that RSA encryption requires almost no extra processing when using key-only encryption and Tor brings about delays within acceptable limits. The security study showed the system could protect against man-in-the-middle attacks, IP tracking, brute-force attempts, and passive traffic monitoring under the defined threat model. The proposed system uses hybrid cryptographic-anonymous framework to create a secure method which enables users to transfer files privately through unprotected networks.

Keywords

Hybrid Encryption, AES-256, RSA-2048, Tor Network, Onion Routing, Anonymous Communication, Secure File Transfer.

Design and Verification of a 2-10 & 6-20 GHz Low Noise Amplifier

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Abstract

A wideband low-noise amplifier (LNA) that works in 2-10 GHz and 6-20 GHz frequency ranges are discussed in this paper. It is built using 90nm CMOS technology. The LNA uses a current reuse cascade design to achieve wideband gain with better power efficiency. It has a common source input stage followed by multistage cascade amplification to support wideband operation. Shunt resistive feedback helps achieve wideband input impedance matching. Inductive source degeneration and a gate inductor are used to improve both matching and noise performance. To cover the broad operating range effectively, the LNA consists of two separate designs that are optimized for the 2-10 GHz and 6-20 GHz bands. Simulation results show that 2-10 GHz LNA achieves a gain of about 24 dB, a noise figure 3.12 dB, and a power consumption of 75.55 mW. A 6-20 GHz LNA achieves a gain of 11.177 dB, a noise figure of 3.02 dB, and power consumption of 2.88 mW. These results suggest that the proposed CMOS LNA is suitable for wideband RF front-end applications that need low noise and efficient power use.

Keywords

Low-noise amplifier (LNA), Cascade amplifier architecture, Current-reuse technique, Resistive feedback matching, Inductive source degeneration, Multi-band LNAs design.

A Per-Warp Configurable SIMT Vision Fusion Architecture for Efficient Embedded Convolution Processing

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Abstract

The acceleration of embedded vision systems needs to be achieved on a high degree of efficiency, along with minimal compromises on programmability. In this paper, a fast vision fusion method with the SIMT architecture is discussed. The presented method enables specialization of kernels at the warp level, along with the availability of the techniques of convolution and nonlinear activation data flow. The architecture is able to allow independent warps to execute simultaneously, along with the implementation of the technique of runtime scales and approximation. The method combines multiply accumulate and ReLU nonlinear functions by bypassing the need for extra processing steps and minimizing the instruction count overhead. Applying an experimental evaluation methodology on steady- state 3x3 convolution kernels, the proposed method results in an effective cost of 3.5 cycles per pixel. In contrast, the analytical scalar estimates an execution cost of 25 cycles per pixel. With a reduction of a factor of 7, the validity of integrated SIMD execution is successfully demonstrated.

Keywords

Embedded vision, SIMT architecture, warp- level specialization, approximate computing, fused execution, convolution acceleration.

Emotion Recognition Based on Speech and Semantics in the Context of Deep Learning Perspective

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Abstract

The Human-Computer Interface has a significant impact on the process of identifying the emotional state of a speaker from the voice. It's crucial for identifying natural and effective methodologies in allowing systems to respond to the mood or emotion of the speaker based on the modulations in the voice. The algorithmic approach used in this research is the fusion of Neural Networks that are of the convolutional and recurrent networks. The layers used here are the temporal sequence modelling that is related to the bidirectional long-term memory. The designed algorithm is a fusion of a convolutional and recurrent architecture related to neural networks. The networks are about learning hierarchical spatial features and the process of sequential data by storing it in memory. The summary accurately captures the role of each component in a Convolutional-Recurrent Neural Network (CRNN) fusion architecture. This design is highly effective for data that has both spatial patterns and sequential dependencies, for speech data. The capture of the time-dependent patterns and long-range temporal dependencies in the speech sequences. The Integration is related to better overall emotion identification. The research relates to the hybrid deep learning model that processes the input for identifying the local patterns and spectral dependencies in the special features. The recurrent layers are used for temporal sequence modelling. They capture the time-dependent patterns and long-range temporal dependencies in the speech sequences, which are essential for understanding how emotion unfolds over time. For experimental purposes, a dataset is used to identify emotions, where the dataset consists of eight distinct emotions of expressions, such as sad, angry, happy, fearful, Neutral, Disgust, Surprise, and calm. The audio signals are first transformed into numerical representations that the model can process the Mel spectrogram and Mel frequency cepstral coefficients. The results and significance are based on the outperformance, enhanced recognition based on the hybrid temporal spectral modelling that enhances emotional context recognition in speech. Finally, the graphical analysis is given based on the accuracy and loss, along with a confusion matrix. The Experimental analysis was provided based on different emotions and statistics of precision, recall, F1-score and support.

Keywords

Speech, Semantics, Emotion Recognition, Deep Learning.

AI-Based Online Voter Registration System with Validation and Anomaly Detection

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Abstract

Online voter registration systems have the capacity of improving accessibility during the democratic processes, efficiency, and transparency. These systems are however highly susceptible to identity fraud, duplicate registration, bot attack and cyber threat. The design of an online voter registration system, proposed in the current paper, would ensure the safety and AI-implementation of the design that will involve machine learning-based validation and anomaly detection to ensure the authenticity and integrity of the voter information. Another type of system is the supervised and unsupervised learning models that are used to authenticate the voter identity, abnormal registration pattern, and real-time fraud. The solution suggested is built on Python, machine learning systems, and secure web technologies and database management systems to enhance the trust, scalability, and resilience of digital electoral infrastructure.

Keywords

Online Voter Registration, Artificial Intelligence, Machine Learning, Anomaly Detection, Cybersecurity, Fraud Detection.

Accident Detection and Alert System Using AI

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Abstract

This project is a Real Time Development of Accident Detection and Alert System using a YOLO based object detection model integrated in the Flask web application. The system is designed to detect the accident events from video streams by performing frame-level inference with a trained YOLO model. The dataset is in the YOLO annotation format and includes labelled bounding boxes for instances of accidents. Transfer learning is used in the process of fine-tuning a lightweight YOLO model to detect accident-related objects using bounding box localization. In the inference, the model goes through each frame and applies a method of filtering by confidence to identify potential accident events. To reduce false positives, a consecutive frame validation mechanism is added prior to triggering alerts. When the accident is detected in the same frame time in every frame, the system takes the corresponding image, and after that, an automated email alert is sent via an alert module based on the standard mail transfer protocol (SMTP). The alert procedure is managed on a separate execution thread, so as not to block real-time performance. The system also offers a browser-based monitoring interface to visualize the detection results in real time. Training artifacts and evaluation outputs show that the model was validated using standard object detection workflows. Overall, the project presents an end-to-end deployment framework of deep learning, real-time video processing, automated alert generation and web-based visualization for intelligent monitoring of accidents applications.

Keywords

Accident detection, YOLO, object detection, real-time monitoring, automated alert system, Flask deployment.

Thermo-Electric Energy Harvesting with Air Pollution Monitoring System

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Abstract

The rapid industrialization and urbanization, especially in developing countries like India, have contributed to significant environmental challenges, including excessive waste heat and air pollution. Traditional energy sources are depleting, and the lack of efficient energy recovery and pollution monitoring systems exaggerate these issues. The system proposes a hybrid system combining ThermoElectric Energy Harvesting and an IoT-based Air Pollution Monitoring System to address both energy inefficiency and environmental concerns. The Thermo-Electric Generator (TEG) module is utilized to recover waste heat from industrial processes, converting it into usable electricity, which can reduce energy loss and thermal pollution. An output voltage of 5V was obtained by a series connection of TEG modules. The output voltage was further used to power-up the ESP32. Simultaneously, the air pollution monitoring system tracks real-time emission levels from industrial sites, detecting harmful gases and particles using MQ-135 to detect pollutants in the air such as ammonia (NH₃), nitrogen dioxide (NO₂), carbon dioxide (CO₂), benzene, and smoke; MQ-2 to detect LPG (liquefied petroleum gas), propane, methane, hydrogen, smoke, and alcohol vapours; MQ-7 to detect Carbon-monoxide specifically. Real time sensor data was collected and processed. The processed sensor data was stored in a database. Frontend retrieves the stored data and aids in visualisation by charting graphs. The system offers timely alerts via SMS notifications when pollutant levels exceed safety thresholds, enabling swift action from authorities. The integration of these technologies aims to improve energy efficiency, mitigate air pollution, and support sustainable industrial development. By aligning with eco-friendly practices, this combined solution promotes cleaner, more efficient industrial operations, contributing to a greener and more sustainable future.

Keywords

ESP32, MQ-135, MQ-2, MQ-7, ThermoElectric Energy Harvesting, Air Pollution Monitoring System.

A Vehicle-to-Infrastructure (V2I) Based Automatic Parking Slot Negotiation and Reservation System

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Abstract

Parking in urban areas is a time-consuming and frustrating process, which significantly contributes to traffic congestion and unnecessary fuel consumption. The current smart parking solutions depend heavily on cell packages, which require drivers to search manually for and reserve parking slots. This research work presents a Vehicle-to-Infrastructure (V2I)-based automated parking negotiation and reservation system. Unlike other solutions, the proposed device allows vehicles to communicate simultaneously with parking infrastructure, analyze available options, and automatically reserve the best suitable slot primarily based on factors such as distance, price, and availability. By integrating this system with the vehicle's navigation system, the proposed solution will minimize search time, fuel consumption, and congestion. This model results show enhanced parking efficiency, congestion relief, and fuel conservation.

Twinx-Bio: Intelligent Digital Twin Framework for Proactive Bioreactor Monitoring

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Abstract

Our project focuses on developing an Bio Reactor Digital Twin – a comprehensive digital replica of a physical bioreactor – by leveraging 3D modeling, IoT connectivity, cloud control, and immersive visualization technologies. The objective is to bridge real time physical operations with an intelligent virtual environment, enabling monitoring, analysis, optimization, and remote interaction. At the core of this initiative is the creation of a high-fidelity 3D model of the bioreactor using industry-standard 3D modeling software. Every structural component – from the chamber and agitator to valves, connectors, and sensor mounts – is accurately modeled. Additionally, functional animations are embedded within the model to illustrate dynamic behaviors such as rotor movement, fluid agitation, and valve operations, providing an intuitive and realistic representation of reactor processes.

Design and Layout Principles for Electrical Wiring in Multi-Zone Small Scale Industries

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Abstract

Small-scale industries today depend on effective, reliable, and safe electrical systems to keep machinery, office equipment, and communication systems running smoothly. With the growing variety of industrial loads, ranging from heavy three-phase motors in production areas to sensitive electronic devices in offices and conference rooms, a well-designed electrical system is essential. This research paper presents a thorough study of electrical wiring practices in multi-zone small-scale industries. It focuses on three key areas: the Office Zone, Machine/Production Zone, and Conference/Meeting Zone. Each zone has its own power features, including different types of loads, harmonic values, sensitivity to voltage changes, and power factor values.

The paper covers design elements such as distribution panel design, selective loading, conductor size, voltage drop, earthing, surge protection, and methods for correcting power factor. It also addresses practical aspects of designing electrical systems according to the guidelines of major international standards like IS 732:2019, IS 3043, IEC 60364, and IEEE 141, incorporating real-world industrial wiring practices. The conclusion of the paper is that a zone-wise wiring system, along with suitable loading and cable selection, can significantly enhance system reliability, reduce downtime, minimize electrical hazards, and increase overall energy efficiency. This approach offers a practical framework for electrical engineers involved in industrial wiring design.

Keywords

Electrical wiring, small-scale industry, multi-zone design, load separation, distribution panel, conductor size, earthing, power factor correction, voltage drop, energy efficiency.

Integrating Digital Twin and Cyber Forensics for Enhanced Cybersecurity in Smart Grids

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Abstract

In order to efficiently create, distribute, and ingest electrical energy, smart grids rely on present digital control and information techniques. Modern technologies are susceptible to cyberattacks and pose serious dangers and failures due to their increased interconnection. By combining digital twins and computer forensics, this research proposal aims to provide an integrated method that improves smart grid safety and reliability. A digital twin develops a real-time computerized model of the grid's subsystems and allows ongoing evaluation, anomaly detection, and predictive analysis of the cyber threat case. In order to discover the roots of the offense and comprehend their structure, cyber forensic techniques assist with the identification, scrutiny, and preservation of electronic records during any cyber assault. The recommended strategy blends these two technologies to provide earlier danger alerting, faster event processing, and increased smart grid infrastructure resilience. Real-time choice-making, automation, and efficiency have all significantly increased since electrical power networks have been changed to smart grids. Smart grids are more susceptible to sophisticated attempts when they have more digital connections. This study provides an integrated cyber security framework that combines digital twins and computerized forensics data to enhance threat detection, analysis, and response in the context of systems to manage energy.

Keywords

Electronic proof, smart grid structures, attack detection, forensic science, secure electrical networks, virtual replicas, electronic forensics, cyber security, anomaly detection, continual surveillance, statistical analysis, reaction to incidents, and cyber analysis of threats.

Gesture Control Mouse Using Deep Learning and Augmented Reality

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Abstract

The growing trend of Human-Computer Interaction (HCI) has led to the development of natural, contactless, and intelligent control systems. This paper presents an innovative Gesture Control Mouse system that combines Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM) networks, and Augmented Reality (AR) feedback. Unlike conventional gesture-controlled systems that use static image processing alone, the proposed system simultaneously extracts spatial and temporal information from gesture patterns. The complementary use of CNN and LSTM networks allows for accurate dynamic gesture recognition, and AR feedback further improves real-time interaction and visual feedback. Experimental results on a self-built dataset show excellent accuracy, low latency, and strong adaptability to lighting and background changes. Comparison studies show that the proposed system outperforms conventional CNN-based and optical flow-based models. The experimental results demonstrate the potential of AI-based HCI for immersive AR/VR applications, assistive technology, and industrial automation. Index Terms—Gesture Recognition, Deep Learning, CNN, LSTM, Augmented Reality, Human-Computer Interaction, Virtual Mouse.

Keywords

Gesture Recognition, Deep Learning, CNN, LSTM, Augmented Reality, Human-Computer Interaction, Virtual Mouse.

IoT - Driven Road Conditions Monitoring Using LiDAR

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Abstract

Road infrastructure plays a crucial role in transportation safety and efficiency, yet traditional road inspection methods are time-consuming, costly, and often reactive. This paper presents an IoT-driven road condition monitoring system using LiDAR technology to enable real-time, accurate, and automated assessment of road surface conditions. The proposed system integrates LiDAR sensors with IoT-enabled microcontrollers to continuously capture high-resolution distance and surface profile data. These data are processed to detect road anomalies such as potholes, cracks, surface unevenness, and elevation variations. The collected information is transmitted via wireless communication to a cloud-based platform, where it is analyzed and visualized for road authorities and maintenance teams. Real-time alerts and condition reports assist in early identification of road damage, reducing maintenance costs and improving road safety. The system supports scalable deployment and can be integrated with smart city infrastructure. Experimental results demonstrate that the proposed solution offers improved accuracy, reduced inspection time, and efficient monitoring compared to conventional manual inspection methods. This IoT-LiDAR-based approach provides a reliable and cost-effective solution for intelligent road infrastructure monitoring. This project presents an IoT-driven road condition monitoring system using LiDAR to detect road surface irregularities in real time. LiDAR sensors capture distance and elevation data to identify defects such as potholes and uneven surfaces. The sensed data is transmitted through IoT modules to a cloud platform for analysis and visualization. The system enables continuous monitoring, quick detection of road damage, and timely maintenance, thereby improving road safety and reducing inspection costs.

Keywords

LiDAR, Internet of Things (IoT), Road Condition Monitoring, Smart Transportation, Pothole Detection, Real-Time Monitoring, Smart Infrastructure, Cloud Computing.

IoT - Based Personal Climate Control System

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Abstract

The need to maintain a comfortable environment is important and can only be achieved through a system of climate controls. In environments where climate conditions change frequently, the importance of climate controls cannot be overstated. In this regard, this Project presents a proposal for a system of climate controls based on Internet of Things technology, with sensors monitoring and controlling the temperature, humidity, and quality of air. The system uses data from these sensors to provide a more personalized environment and maintain a comfortable climate. The data is then sent to a mobile application to be controlled and accessed remotely.

Keywords

IoT, personal climate control, temperature sensing, humidity sensing, air quality monitoring, HVAC control, environmental monitoring, automated adjustment, user preference learning, smart comfort system, mobile application, remote monitoring, remote control, energy efficiency, smart environment.

Federated Intrusion Detection Framework for Heterogeneous Network Traffic Using Multi-Client Deep Learning Aggregation

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Abstract

The rapid expansion of cloud computing, Internet of Things (IoT) ecosystems, and large-scale enterprise networks has intensified the complexity and frequency of cyber attacks. Traditional centralized Intrusion Detection Systems (IDS) require aggregation of raw network traffic from multiple distributed sources, raising significant concerns related to data privacy, regulatory compliance, communication overhead, and scalability. These challenges limit effective collaborative security across heterogeneous network environments.

This paper presents a federated intrusion detection framework that enables decentralized collaborative learning without sharing raw network traffic data. A lightweight Multilayer Perceptron (MLP) model is trained across three independent federated clients using the Federated Averaging (FedAvg) algorithm. Each client is assigned a distinct real-world benchmark dataset – CICIDS2017, UNSW-NB15, and NSL-KDD – introducing authentic non-IID data heterogeneity in terms of dataset size, feature dimensionality, class imbalance, and attack taxonomy. The framework ensures strict data locality by transmitting only model parameters during aggregation.

Experimental results demonstrate that the global federated model achieves 87% accuracy with balanced precision (0.86), recall (0.86), and F1-score (0.85), representing a 20 percentage-point improvement over the weakest local model. Convergence analysis confirms stable performance under non-IID conditions, while communication overhead is reduced by approximately 1000× compared to centralized training.

These findings validate federated learning as a scalable, privacy-preserving, and communication-efficient alternative for intrusion detection across diverse network domains.

Keywords

Federated Learning, Intrusion Detection System, Network Security, Privacy Preservation, Non-IID Data, FedAvg, Distributed Learning.

Secured VANET Communication using Machine Learning and Block Chain Communication

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Abstract

VANET (Vehicular Ad-hoc Network) communication requires robust security measures to ensure the integrity and authenticity of exchanged data. Integrating machine learning and blockchain mechanisms can provide a secure framework for VANET communication. Machine learning algorithms can detect anomalies and predict potential threats, enabling proactive security measures. Blockchain technology provides a decentralized, immutable ledger for secure data storage and exchange, ensuring transparency and tamper-proofing. By combining these technologies, VANETs can achieve secure and reliable communication, protecting against cyber threats and maintaining the trustworthiness of exchanged data. This hybrid approach enables secure vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication, supporting applications like intelligent transportation systems and autonomous vehicles.

Voltage–Width Co-Optimization and Power–Stability Trade-off Analysis of 6T, 7T, and 9T SRAM Cells in 90 nm CMOS Technology

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Abstract

Static Random Access Memory (SRAM) design encounters significant challenges in scaled Complementary Metal–Oxide–Semiconductor (CMOS) technologies due to aggressive supply voltage reduction and degraded noise margins, which directly affect stability and power efficiency. This work presents a systematic comparative analysis of 6-transistor (6T), 7-transistor (7T), and 9-transistor (9T) SRAM cell architectures under simultaneous transistor width optimization and supply voltage scaling. The objective is to investigate the power–stability tradeoff and determine the most suitable topology for application specific requirements. Simulations were performed using 90 nm CMOS technology at the Typical–Typical (TT) process corner and 27°C ambient temperature. The supply voltage was varied from 1.8 V to 1.2 V, and transistor widths were swept from 120 nm to 360 nm. Transient analysis was employed to evaluate dynamic power consumption, while direct current (DC) analysis using the butterfly curve method was used to extract Read Static Noise Margin (SNM). The results show that dynamic power increases with transistor width due to higher parasitic capacitance, whereas voltage scaling reduces power quadratically but significantly degrades read stability. The 6T cell achieves minimum power at lower voltages but exhibits considerable SNM degradation. The 7T architecture demonstrates improved read stability across operating conditions at the cost of increased switching power. The 9T cell provides moderate power performance but shows reduced robustness under aggressive voltage scaling. This study establishes a voltage–width–architecture co-optimization framework for reliable SRAM topology selection in scaled CMOS technologies.

Keywords

SRAM Cell Design, 6T/7T/9T Topologies, Supply Voltage Scaling, Read Static Noise Margin, Transistor Width Optimization, Power Analysis, CMOS Technology.

SMART-CAPS: A Campus Placement Prediction and Career Advising System Run on AI

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Abstract

The growing intensity of competition in the international job market has intensified the need to have smarter career advising system that can have accurate results of campus placement and help the students in making wise career choices. Most of the traditional methods used in guidance of placements are based on manual assessments and little or no historical analysis, which are not usually scalable, objective, or predictive. In order to overcome these shortcomings, this paper suggests a SMART career advising system which is grounded on machine learning-based prediction of campus placement through AI. The suggested system evaluates detailed student profiles that include academic performance, technical skills, soft skills, certifications, experience in internship, extracurricular activities and past placement trends. They use supervised machine learning algorithms to learn meaningful patterns with the use of historical data and approximate placement probability of individual students. The system creates tailored career suggestions that allow students to detect the areas of skills deficiency and enhance employability. In order to make it more accessible and able to be used in real-time, the prediction model is embedded into a web-based system which gives a real-time feedback and career advice. Also, the system helps placement administrators by letting them find those factors that influence the results of the recruitment and optimize the institutional placement strategies using the available information. The experimental analysis reveals better prediction quality and strength than the traditional evaluation methods. The suggested AI-based framework will be effective in filling the gap between the capabilities of the students and the demands of the employers as it will provide scalable, personalized and data-driven insights. The SMART career advising solution helps to make the campus recruiting system more of a modern solution and enhance the rate of placement success at higher education institutions.

Keywords

Artificial Intelligence (AI), Machine Learning (ML), Prediction of Campus Placement, Career Advising, Predictive Modeling, Employability Analysis.

Single-Ended Near-Threshold 10T SRAM for Energy-Critical Applications

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Abstract

As the CMOS technology is scaled down into deep nanometer technology nodes, the task of achieving energy efficient SRAM operation at near-threshold voltages (NTV) is expected to become even more challenging. To address these problems, a 10T single-ended SRAM cell design is presented for ultra-low-power applications where SRAM reliability and energy efficiency are of utmost importance. The proposed 10T SRAM cell design provides significantly improved read stability and write ability compared to the conventional 6T and 8T SRAM cell designs. In conventional SRAM designs, the shared read/write paths are well known to cause read disturb issues, particularly at low voltage conditions. The 10T SRAM cell design addresses this issue by providing a decoupled read path, which decouples the internal storage nodes from the bitline activities. The cell performs single-ended read/write operations, which reduces bitline switching activity and thus the leakage power consumption. Additionally, write assist methods such as wordline boosting or bitline voltage modulation are utilized to enhance the write margin and ensure successful bit flipping even with limited transistor drive strength. With these optimizations, the 10T SRAM cell realizes significant energy savings with acceptable performance. Simulation experiments show a 40-60% power reduction over 6T SRAM cells, with enhanced read/write noise margins. While the circuit consumes more transistors, it is area-frugal and appropriate for energy-limited applications such as IoT, biomedical implants, wearable sensors, and edge-AI processors.

Keywords

Near-Threshold Computing, 10T SRAM, SingleEnded Read- /Write, Low-Power Memory, Read Stability, Write Assist, Subthreshold Operation, Energy-Efficient SRAM, IoT Memory, Leakage Power Reduction.

Real-Time Collaborative Whiteboard

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Abstract

Here's a look at Collaboard.io (CollabBoard), a real-time collaborative whiteboard built with the MERN stack—so, MongoDB, Express.js, React, and Node.js. It uses Socket.IO for fast, two-way WebSocket communication, letting people draw together in shared rooms with everything staying in sync. The main focus is on keeping interactions super responsive, the drawing smooth and stable, and making sure user access is organized and the whiteboard's state sticks around even if someone disconnects.

To keep drawing smooth and visuals consistent, Collaboard.io uses two canvases: one for strokes in progress, and another for everything that's already finished. Every time you finish a stroke, the system saves it as an object in MongoDB. That way, if someone refreshes their browser or briefly drops out, the whiteboard can rebuild itself exactly as it was.

The app handles all the basics around rooms—creating them, editing them, deleting them, and keeping everyone updated in real time as things change. For security and control, the backend enforces Role-Based Access Control (RBAC), sorting users into Owners, Editors, and Viewers, each with their own permissions.

During tests in an academic setting, Collaboard.io held up well. Real-time syncing worked smoothly and people could always recover their work, even when a few users were online at once.

Overall, Collaboard.io shows how you can pull together REST and WebSocket communication, smart rendering, Collaboard user permissions, and detailed stroke saving to build a reliable, real-time whiteboard for teams.

Keywords

Real-time collaboration, MERN stack, MongoDB persistence, Socket.IO, Flicker-free rendering, Collaborative drawing, Distributed systems, Whiteboard application, WebSocket architecture, Synchronization protocols.

Smart Persona: AI Interview Platform – AI-Powered Voice and Video Interview Platform

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Abstract

Recruitment interviews are important for determining the qualifications of candidates, but can be very time-consuming and difficult to scale when there is a lot of recruiting happening at once. Due to advances in technology and re-search, AI-powered and voice-based interviews can provide a better way to improve efficiency and consistency. However, most products developed to date focus on providing practice for the candidate only. The goal of this paper is to introduce an AI-powered solution to recruitment, "Smart Persona," which is a voice-based AI interview solution that can automate the early-stage screening of job applicants, while still allowing for a natural, human-like, conversational experience. It was developed using modern web technologies and provides role-specific interviews via real-time voice interaction, automatically generates interview questions, intelligently analyzes the candidate's responses, and produces structured feedback to be reviewed by the recruiter. Smart Persona's design places emphasis on automating the recruiter-side of the process, instead of replacing the decision-making capabilities of the recruiter. This will minimize the manual effort required to screen applicants using traditional methods, while also enhancing the overall quality of preliminary interview evaluation, and ensuring that all applicants are treated fairly, consistently, and efficiently throughout the recruitment process in the real world.

Keywords

Prompt Engineering, Interview Simulation, Speech-to-Text, OpenAI API, Va-pi, AI-driven Feedback, Realistic Practice Environment, Interactive Learning.

AI Moral Compass: Context-Aware Ethical Reasoning System, Natural Language Understanding, and Dynamic Moral Framework Adaptation

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Abstract

As Artificial Intelligence (AI) increasingly influences vital domains such as legal systems, medical care, and public administration, ensuring these technologies align with human values has become a critical challenge. This research introduces the “AI Moral Compass,” a sophisticated platform developed to evaluate complex real-world dilemmas through a multifaceted ethical prism. By blending Natural Language Processing (NLP) with diverse philosophical traditions—ranging from Utilitarianism and Kantian Deontology to the nuanced principles of Indian Ethics—the framework assesses situations based on their Ethical Validity, Aesthetic Tone, and Moral Policing impact. Our study departs from traditional binary computations to champion a socially conscious, transparent AI model that honors individual backgrounds and cultural differences. The integration of explainable reporting ensures that users are not just given a result, but are educated on the underlying ethical logic and potential social consequences of their actions. By prioritizing transparency over “black-box” decision-making, the system fosters a sense of trust and agency in human-AI collaboration. Ultimately, this framework serves as a scalable blueprint for developing AI that aligns with evolving global values while remaining deeply rooted in individual cultural identities. Moreover, the project establishes a foundation for future iterations that can autonomously adapt to shifting legal landscapes and regional policy changes.

Keywords

Ethical Artificial Intelligence, Computational Moral Reasoning, Natural Language Processing, Interpretable Machine Learning, Cultural Value Alignment, Personalized Decision Support, Explainable AI (XAI), Ethics, Personalization, Cultural Adaptation.

AI-Based Automated Hiring Platform

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Abstract

The AI-Based Automated Hiring Platform is an intelligent system designed to simplify and automate the end-to-end recruitment process with minimal human intervention. The platform enables recruiters to post job openings with detailed descriptions and requirements, while applicants submit resumes directly through the system. Utilizing AI-driven resume analysis, the platform automatically evaluates each application against job criteria, shortlisting only the most suitable candidates. In the subsequent stage, shortlisted candidates complete automated skill assessments or project-based tests predefined by recruiters. The system ensures fair evaluation by analyzing submissions including code repositories and assignments using AI models to assess technical proficiency, problem-solving ability, and project quality. Qualified candidates proceed to the final interview stage where the platform automatically schedules interviews, generates meeting links, and notifies both recruiters and applicants. This fully automated workflow eliminates repetitive manual tasks, reduces hiring bias, and significantly accelerates the recruitment cycle. The project leverages AI, automation, and data analysis to create a transparent, efficient, and unbiased hiring experience for both employers and job seekers. By combining resume screening, skill testing, and interview scheduling within a single intelligent platform, it provides a streamlined and scalable solution to modern recruitment challenges. Future enhancements include integrating predictive analytics for talent matching, chat-based applicant interactions, and real-time performance insights to further optimize the hiring experience and achieve complete process automation.

Keywords

Artificial Intelligence, Recruitment Automation, Resume Screening, Machine Learning, Talent Acquisition.

AI-Driven Stock Manipulation Detection in High Frequency Trading Environments

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Abstract

The High Frequency Trading (HFT) platforms produce microsecond-level precision in the limit order book (LOB) data, providing opportunities for sophisticated forms of market manipulation such as spoofing and layering. However, these sophisticated forms of market manipulation are difficult to detect using traditional rule-based surveillance systems due to their dynamic patterns and high-dimensional LOB data. This research proposes a microstructure-aware deep learning architecture for the real-time detection of manipulative trading activity in the HFT markets. The proposed architecture incorporates engineered features from the LOB data using hybrid spatial-temporal neural networks. Convolutional neural networks (CNNs) are utilized to capture the spatial dependencies in the LOB data, and long short-term memory (LSTM) networks are utilized to capture the temporal dependencies in the trade sequences. Experiments on NASDAQ ITCH and LOBSTER datasets show that the CNN-based architecture achieves 95.8% accuracy and better F1-score compared to LSTM and Random Forest classifiers. Furthermore, the latency in the detection process also validates the feasibility of real-time deployment within sub-5 millisecond constraints. This research suggests that the spatial dependencies in the LOB state using convolutional neural networks improve the overall performance in the detection process.

Keywords

High-Frequency Trading, Market Manipulation, Spoofing Detection, Machine Learning, Anomaly Detection, Order Book Analysis, Stock Market Surveillance, Deep Learning, Market Microstructure.

Wellness Wings - A Community Centric Platform for Empowering Elderly and Physically Challenged Individuals

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Abstract

In this paper, we propose a new online service, called Wellness Wings, which aims to address the interconnected challenges of the elderly and physically challenged place mobility combined with the problem of youth unemployment in urban environment. A lot of the elderly are finding it difficult to access essential medical care and social engagements due to physical constraints and the hectic timetables of the working members of the family. This has the effect of increased isolation and health risks. Meanwhile, a large number of unemployed graduates were waiting for their chances to contribute to the community. A two-fold solution to this issue is Wellness Wings because we would couple these groups at risk with a reliable network of young and enthusiastic volunteers. The site also has a convenient service request app and a volunteer portal that can be customized to fit schedules, and it has a designated family/guardian one that offers real-time GPS location tracking and post-visit reporting to create an additional measure of security and reassurance.

Keywords

Elder Care, Mobility Support, Community Volunteering, Youth Empowerment, Social Inclusion, Digital Platform, Real-time Tracking.

AI-Based Crop Recommendation for Farmers

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Abstract

Agriculture remains the backbone of the Indian economy, with close to half of its population involved in this industry and forming a significant component of the country's GDP. Nonetheless, farmers must keep fighting with the selection of appropriate crops due to changing market conditions, unpredictable weather, and variable soil conditions. Traditional decision-making methods are often based on localized knowledge or experience, and their application may be far from ideal in obtaining yields and may lead to losses.

One such response is from artificial intelligence and machine learning, which analyse multidimensional information at large scales to come up with accurate and data-driven suggestions related to farming. This work reviews the current crop recommendation systems based on their methods, datasets, and their assessment strategy. Herein, this paper also puts forward a hybrid model-based integration approach regarding the content of nutrients within the soil-air interface of a farmland area, meteorological characteristics, and market data. It presents the integration of Random Forest, Neural Networks, and regression-based models to improve the accuracy and scalability of the models. Additionally, the real-time flexibility of the proposed approach for market and weather updates is also emphasized through API-based connection. Increased revenue, better utilization of available resources, and the capability to make wise decisions for farmers. Procedures proposed in this paper are targeted at enhancing agriculture's sustainability.

PeerTasker: A Collaborative Task Sharing Platform with Hybrid Dynamic Priority Scheduling

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Abstract

Managing projects collaboratively can lead to challenges like having to manually coordinate tasks and the workload not being divided evenly among group members. Additionally, people often feel they are unable to manage their priorities flexibly or effectively when they work in a collaborative environment. This paper presents a Hybrid Dynamic Priority Scheduling Framework that manages deadline sensitivity, workload awareness, and lightweight lexical-semantic urgency model through a unified mathematical model called PriorityScore. This model is designed to function in a centralized client-server architecture and provide peer-to-peer collaborative task engagement within a group. The PriorityScore is determined using a weighted multi-criteria model that combines a user-defined priority, weighted inverse of deadline, weighted lexical-semantic urgency score, and workload balance. When dynamic tasks are created, they are added to a heap-based Priority Queue where they are dynamically reprioritized in real-time for adaptive scheduling. The system achieved an average throughput of 180 tasks per hour with a priority adherence rate of 96%, defined as the percentage of tasks executed in correct relative priority order. This corresponds to a 56% reduction in average completion time compared to FCFS ($p < 0.05$). The data shows that the use of semantic urgency detection and dynamic priority modeling will contribute to greater levels of responsiveness, fairness, and scalability when using collaborative task management systems.

Keywords

Collaborative Task Sharing, Dynamic Priority Scheduling, Deadline Sensitivity, NLP-Based Urgency Detection, Task Allocation.

A Systematic Review of the Use of Blockchain in Healthcare

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Abstract

The concept of blockchain technology has emerged and has been used as a solution to address many of the major problems in the healthcare industry, including data security, interoperability, transparency, and dealing with patient data. Traditional healthcare models often have centralized frameworks that are usually prone to information breach, malicious access and problems in the exchange of information among various stakeholders. The paper also discusses blockchain development tools and platforms, including Solidity used to develop smart contracts, Ganache is used to simulate local blockchains, Remix IDE is used to deploy smart contracts and crypto wallets are used to control secure identities and transactions. Despite a significant potential, the implementation of blockchain in healthcare has faced significant challenges such as scalability problems, regulatory compliance, the financial barriers of implementation, and integration issues with the older healthcare systems. This review highlights such challenges and provides insights into the research directions in the future that can serve to increase scalability, privacy controls and interoperability among various platforms. The findings have shown that blockchain can transform the healthcare data management system and establish a safer, transparent, and decentralized healthcare system.

Keywords

Blockchain Technology, Healthcare Systems, Electronic Health Records (EHR), Smart Contracts, Data Security, Decentralized Systems, Solidity, Ganache, Remix IDE, Cryptowallet.

Investigation of Structural Behavior of Precast Ferrocement-LGS Composite Beam for Application

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Abstract

Precast Ferrocement panel and LGS composite wall panel system is innovative low-cost construction system in trend. Its weight savings and efficiency in structural performance and effectiveness have raised interest in the industry for application to mass customised affordable construction projects. This research work proposes an assessment of the flexural characteristics of a ferrocement light gauge steel composite beam. The study assesses the flexural performance and the composite action of the composite LGS-ferrocement layer. The objectives of this work include experimental investigation of the load-deflection behaviour, cracking characteristics, stiffness, ductility, and failure mechanism of the composite beam system. An experimental program is proposed in which composite beam specimens will be fabricated using cold-formed light gauge steel sections combined with Precast ferrocement panel. Precast ferrocement panel is a factory product, reinforced two multiple layers of steel weld mesh. The T beam action of composite give structural advantage along with making it light weight section. This outcomes of this research provides valuable insights into the feasibility of design of structures using ferrocement-LGS composite technology. The findings are intended to contribute to the development of lightweight, economical, and sustainable structural systems suitable for low-rise and modular construction applications.

CNN-Driven Tomato Freshness Prediction for AI-Enabled Agricultural E-Commerce Systems

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Abstract

The fast growth of online agricultural marketplaces has enhanced the opportunity to establish a direct contact between a farmer and consumers, but the lack of automated quality controls of perishable goods is also a major obstacle. The images offered by sellers are usually accepted without objective opinions based on their freshness, which makes consumers uncertainty and trust online vegetable markets less.

The article demonstrates an example of a CNN-based tomato freshness prediction system that is embedded in a neural farm e-commerce system. The method of transfer learning is used to classify tomato photographs into one of five levels of freshness, with highest and lowest being very poor and very fresh respectively. The VGG19 convolutional neural network is utilized. Image preprocessing methods such as resizing, normalization and data augmentation have been used in the quest to enhance generalization and robustness. The trained model will be used in a Flask-based web app where farmers will be able to submit tomato images and, automatically, have AI-generated freshness ratings displayed to the customers in a real-time model.

Experimental review shows validation accuracy of 93.4 percent, which is a pertinent classification performance to be implemented in practice. The suggested system increases the level of transparency in the agricultural trading field online, lowers the uncertainties in quality, as well as builds consumer confidence by using controlled freshness checking.

Keywords

Convolutional Neural Network (CNN), Tomato Freshness Prediction, Deep Learning, Agricultural E-Commerce, Image Classification, Transfer Learning, Quality Assessment.

Intelli Gene: An Adaptive Ensemble Framework for Hereditary Disorders Risk

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Abstract

Genetic and hereditary disorders remain a major global health concern due to the complex interaction of genetic predisposition, maternal health conditions, physiological biomarkers, and inherited family traits. Early detection of hereditary risk is essential for timely intervention, preventive planning, and reducing long-term complications. However, traditional diagnostic methods often rely on genomic sequencing and specialist-led evaluations, which are expensive and difficult to implement for large-scale screening, particularly in resource-limited healthcare settings. To address these challenges, this study introduces Intelli Gene, a confidence-calibrated adaptive ensemble framework designed for real-time hereditary disorder risk stratification using routinely collected clinical and inheritance-related data. The framework integrates Random Forest, Bagging, and Naïve Bayes classifiers within a probabilistic fusion model and applies a hybrid weighting strategy that combines cross-validation F1-scores with posterior confidence estimation to dynamically adjust classifier contributions. To enhance robustness and manage class imbalance, the Synthetic Minority Over-sampling Technique (SMOTE) is incorporated during training, while SHAP-based explainable AI methods are used to improve transparency and clinical interpretability. Experimental results demonstrate that the proposed model achieves 90.5% accuracy with a macro-average AUC of 0.93, outperforming individual base learners and maintaining stable generalization across validation folds. Overall, the framework provides a scalable, interpretable, and cost-effective solution for early hereditary risk assessment without requiring genomic sequencing, making it suitable for practical healthcare screening and decision support systems.

Keywords

Machine Learning, Genetic Disorder Prediction, Ensemble Learning, Healthcare Analytics, Explainable AI, Risk Assessment, Clinical Decision Support.

To Check the Performance of Controlled Low Strength Material (CLSM) Concrete Using Laterite Soil and Quarry Waste

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Abstract

Controlled Low Strength Material (CLSM) is a self-compacting cementitious material primarily used as a backfill or fill material rather than structural concrete. It is commonly referred to as flowable fill due to its high flowability and ability to fill voids without the need for mechanical compaction. Conventional CLSM is typically produced using cement, fine aggregates, coarse aggregates, and water. In the project, an attempt has been made to develop a low-cost and sustainable CLSM using locally available materials. Based on previous research studies and relevant ASTM guidelines, the use of laterite soil and quarry waste in CLSM production is identified as a promising alternative to conventional materials. The main objective of this project is to develop and evaluate the performance of CLSM concrete using laterite soil (locally available in Thiruvananthapuram), quarry waste, and recycled concrete waste. In this investigation, cement is used as the primary binder, laterite soil and quarry waste are used as fine aggregate substitutes, and crushed concrete waste is used as coarse aggregate. A series of laboratory tests were conducted to evaluate the flowability, bleeding test, compressive strength and tensile strength, and durability characteristics of the developed CLSM. The study aims to assess the feasibility of utilizing locally available and waste materials for sustainable CLSM production.

Keywords

Controlled low strength material (CLSM), Flowable fill, Laterite soil, Quarry waste, Recycled concrete waste, Flowability, Bleeding test, Compressive strength and tensile strength, Durability characteristics, Sustainable construction.

Customer Churn Prediction and Retention Strategy in Telecom Industry Using Random Forest

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Abstract

In the telecom industry, customer churn is a major concern because when customers leave, it directly affects the company's revenue and overall growth. In this paper, I focused on building a churn prediction model using machine learning techniques. I used the Random Forest algorithm to analyze customer data and predict the probability of customers leaving the service. Based on the prediction results, customers are grouped into three categories: high risk, medium risk, and low risk. This classification helps the company understand which customers need immediate attention. For each risk level, suitable retention strategies are suggested so that necessary actions can be taken to reduce customer loss. The model showed good prediction performance during testing and helped in clearly segmenting customers based on churn risk. To make the results more understandable for business decision-makers, I also developed a dashboard that visually presents churn risk levels and recommended retention strategies. This approach supports better planning and improves customer retention efforts.

Keywords

Customer Churn Prediction, Telecom Industry, Random Forest, Machine Learning, Predictive Analytics, Customer Retention, Web-Based System.

Effect of Biocementation on Silty Sand Using Microbial Activity of Cow Dung

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Abstract

Various soil stabilisation materials, such as cement and lime, used for soil stabilisation pose a threat to the environment. This work utilises cow dung (CD) as a binding material in place of conventional binding materials such as cement and lime. Environmental degradation can be reduced by replacing conventional practices with eco-friendly techniques such as biocementation. Biocementation using CD, utilises microbial activity for binding soil particles. Microbial activity produces products such as calcium carbonate and extracellular polysaccharides, which bind soil particles by filling the soil voids. This study focuses on the stabilisation of soil by inducing it with CD. Unconfined compressive strength and California bearing ratio tests confirm the improvement in soil. Calcium carbonate precipitates are observed between soil particles in SEM images. CD can be used as a ground improvement method on a commercial basis, as it is easily available in society and byproducts are not harmful to the health of the soil and surrounding water bodies.

Keywords

Biocementation, Urease Activity, Microbially Induced Calcium carbonate (MICP), Cow Dung (CD), Soil Stabilisation, denitrification, extracellular polysaccharides (EPS), California bearing ratio (CBR).

Bank Customer Churn Rate Prediction and Minimization Using Machine Learning Techniques

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Abstract

Customer churn, which refers to the action of a customer abandoning their relationship with a bank, is a major issue that is confronting the financial institutions because it not only impacts the current revenue generation but also poses a threat to the long-term stability of the institution. As competition has been growing even in the banking sector, making customers stay is as important as making new customers. The current and advanced machine learning models that have been incorporated in this paper include logistic regression, random forest, XGBoost, naive bayes, decision tree, and AdaBoost, so as to forecast and avert customer churn. The methodology encompasses sound data preprocessing, like imputation, elimination of duplicates, and encoding of categorical variables as a way of preparing the dataset to be modelled. Exploratory Data Analysis (EDA) is performed to determine the underlying trends and correlation of customer attributes to obtain actionable information related to churn behaviour. As a result of the imbalance in the classes, we employ a method of under-sampling, the SMOTE and NearMiss algorithm, and test the resilience of the model. Several models are trained and highly tested with all the above key performance measures, although there is a higher focus on recall and ROC-AUC scores that are more related to the capacity of the bank to recognize customers with high churn possibilities. Models are fine-tuned with hyperparameter tuning to achieve optimal performance, and of all the models that were tried, AdaBoost was the best at recall with both training and testing data. Moreover, the ROC-AUC curve gives additional evidence of the trade-off between sensitivity and specificity and proves that the model is predictive.

Fail-Secure Edge Computing Architecture for Tamper-Resistant Protection of VLSI Intellectual Property Using AES Cryptography

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Abstract

The protection of VLSI Intellectual Property is a problem in the semiconductor industry. This is because there is a risk of people copying, sharing or changing VLSI Intellectual Property without permission when it is shared or used. The usual ways to protect VLSI Intellectual Property are not very good. They depend on agreements. Who has access but they do not do a good job of stopping bad things from happening when VLSI Intellectual Property is being used. This paper is about a way to protect VLSI Intellectual Property. It uses a kind of computer system and Advanced Encryption Standard cryptography to keep VLSI Intellectual Property safe, from people who want to hurt it. The new system uses a Raspberry Pi computer to store important VLSI hard IPs in a secret code. This way only people who are supposed to can get to the VLSI IPs. The system checks the secret code keys every time someone wants to use the VLSI IPs and it only keeps these keys for as long as the person is actually using the VLSI hard IPs. The system also watches out for people trying to cheat or break the rules like stopping the process or messing with the system. If someone tries to do something they are not supposed to the system will stop them from getting to the VLSI IPs and will get rid of the secret VLSI hard IPs in a safe way. The fail-secure design ensures that any interruption or attack leads to sudden loss of IP accessibility rather than data leakage. Experimental evaluation demonstrates that the proposed design provides effective IP protection with minimal processing, making it suitable for secure, low-cost, and portable VLSI IP management in edge computing environments.

Keywords

Edge Computing, AES Cryptography, Fail-Secure Architecture, Tamper-Resistant Systems, Secure IP Storage, Access Control Enforcement, Raspberry Pi Edge Server, Runtime Security Monitoring, Data Protection.

Kidney Disease Classification Using Deep Learning Technique

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Abstract

Automated image classification of kidney disease is a major part of improving the diagnosis of kidney disease, which is important for making clinical decisions faster and more consistently. Detecting kidney diseases (especially chronic kidney disease (CKD)) remains a critical challenge as symptoms are subtle and often the diagnosis and treatment is delayed. Traditional diagnostic techniques such as manual interpretation of CT scans by radiologists are susceptible to human error and time-consuming which affects the diagnostic speed and precision. This is a study that aims to develop a deep learning model based on the VGG16 convolutional neural network (CNN) architecture, by using transfer learning, to classify kidney abnormalities, such as cysts, stones and tumors, from CT scan images. The model is refined based on small datasets of medical images so that it is accurate and will provide classification of results in real time, thus providing a potential solution for effective and timely detection of kidney diseases.

Early Detection of Alzheimer's Disease Using Machine Learning and Explainable AI on Structured Clinical Data

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Abstract

Alzheimer's disease is represented in the list of the most common neurodegenerative disorders in the world population and represents one of the major disadvantages to the general population health, as the number of aged citizens constantly grows. Early identification of patients is essential in improving patient outcome, early treatment, and in addition to a health care plan. However, the traditional methods of diagnosis that involve a neuroimaging and laboratory work can be expensive and time-consuming and not available at most of the medical institutions. The study explores the methods of applying machine learning to forecast early onset of the Alzheimer's disease based on structured clinical and behavioral data. The analysis used publicly available data on the Alzheimer's disease on Kaggle comprised of 2,149 deanonymized records of patients. The variables were demographic data, lifestyle, cognitive and functional health. Several supervised machine learning algorithms were assessed and tested including Logistic Regression, Random Forest, Support Vector machine (SVM), and XGBoost. This has been coded in Python on Google Colab and the model performances were evaluated based on accuracy, precision, recall, F1-score, and ROC-AUC.

The results showed that it is possible to use machine learning models to predict occurrence of Alzheimer's disease using structured clinical data successfully. XGBoost worked the best of all the models with the accuracy of approximately 95% and ROC-AUC of 0.951. Random Forest was also effective, which highlights the utility and usefulness of the ensemble learning methods to healthcare prediction issues.

The interpretability was improved by SHAP (SHapley Additive Explanations), and to identify the most important predictors. The scores on the Functional Assessment, the Activities of Daily Living (ADL), Mini-Mental State Examination (MMSE) and the memory complaints were the most significant variables. This is in compliance with the known clinical knowledge about development of the Alzheimer's disease. Overall, this study demonstrates that machine learning, explainable AI, and data visualization may work together to assist in disease and healthcare analytics early detection. The findings also suggest the emerging opportunities of AI within the healthcare systems with a special consideration of its application in the United Arab Emirates in the future.

Real-Time Analytics for High-Velocity Data from IoT, Sensors, and Social Platforms

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Abstract

The growth of data generated by the Internet of Things (IoT) devices, sensor networks, and social media platforms has generated the acute necessity to use sophisticated real-time analytics structures that can handle high-velocity data streams with minimal latency and high reliability. The paper is the detailed research of the scalable infrastructures and the methods used to process continuous stream of data in real-time. The framework suggested includes distributed stream ingestion, fault-tolerant storage, and event-driven analytics to facilitate successful derivation of actionable insights out of the heterogeneous sources of data. The performance of the system is also assessed in terms of throughput, latency, fault tolerance and data quality considering the various workload conditions using advanced techniques including anomaly detection, stream mining, and adaptive resource optimization techniques. The experimental outcomes show that the suggested strategy helps to enhance the efficiency and responsiveness of the processing much better than conventional systems with a batch character. The results are used to make the next-generation real-time analytics that can be used in supporting the mission-based application like smart cities, industrial IoT, social monitoring, and cyber-physical systems.

Keywords

Real-Time Analytics, High-Velocity Data Streams, Internet of Things (IoT), Stream Processing, Event-Driven Architecture, Anomaly Detection, Big Data Analytics, Distributed Systems, Fault Tolerance, Stream Mining.

Gauges to Deep Learning: A Review of the Automatic Flood monitoring Technologies

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Abstract

One of the most destructive natural disasters in the world is flooding, which calls for precise, prompt, and scalable monitoring systems for response and readiness. The four primary groups of automatic methods of flood detection and volume estimation discussed in this review are (i) field surveys and ground-based observations; (ii) remote sensing (optical, SAR, LiDAR, and UAV); (iii) hydrological and hydrodynamic models; and (iv) machine learning and hybrid methods. Each type has its own typical preprocessing, evaluation measurements, representative algorithms, common, data sources, strengths and limitations which we present. In conclusion, we provide an overview of what operational systems and benchmark data sets might look like, trends in the field between 2000 and 2024, and potential areas of research where machine learning and physics-based models work together: (a) Real-time scalable systems; (b) multimodal data fusion (SAR + optical + in-situ); (c) standardization of evaluation measures and datasets; (d) quantification of uncertainty in volume estimates.

Keywords

Flood Monitoring, Satellite Imagery, Remote Sensing, Flood Extent Detection, Optical Imagery, Radar Imagery, Flood Modeling, Machine Learning, Flood Volume Estimation, Hydrological Models, Decision Support Systems.

A Blockchain-Based Ransomware Forensic Evidence Ledger

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Abstract

In this paper, a permissioned blockchain-based digital forensics evidence ledger is proposed that is designed to ensure integrity, traceability, and legal admissibility of digital evidences related to ransomware attacks. Both of these models are based on a single evidence repository and chain of custody documents that are manually created and maintained in a manner susceptible to tampering, unauthorized changes, or disputes in legal proceedings. Such limitations may affect the veracity of digital evidences presented in legal proceedings. To overcome these issues, a permissioned blockchain-based digital forensics evidence ledger is designed to keep a verifiable record for forensic evidences related to ransomware attacks. The primary digital asset is stored in a reliable offline environment, and its cryptographic hash value is anchored for integrity verification. All actions related to evidences are signed using organization- provided credentials for non-repudiation purposes and have enabled structured cooperation between forensic units, police officers, and judges. Apart from traditional evidences related to ransomware attacks, a structured ransomware attack record is included in the system, and cryptocurrency-based financial evidence examination is also included in the system. Additionally, the system enables the creation of forensic reports in a manner suitable for legal proceedings using blockchain-based transactions, timestamped evidences, hash values, and QR-based verification endpoints for self-verification.

Keywords

Blockchain, Digital Forensics, Chain-of-Custody, Hyperledger Fabric, Ransomware Investigation, Evidence Integrity.

Data-Driven Analysis of Public Service Efficiency in UAE: Reducing Bureaucracy through Digitalization within the Court System

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Abstract

Bureaucracy has been the foundation of public service delivery, providing structure and accountability but also occasionally causing inefficiency and delays. In this context, rising citizen expectations and government initiatives on digital transformation encourage public institutions to reduce bureaucratic burden to improve service efficiency. This study examines how bureaucratic system's impact on service efficiency in a government entity in the United Arab Emirates. Digitization is the moderating factor that mitigates the impact of bureaucracy and improves outcomes.

Drawing on theories of bureaucracy and digital government, this study seeks to achieve three objectives: (1) to examine the impact of bureaucratic structures on service efficiency; (2) to assess the role of demographics in bureaucratic efficiency; and (3) to evaluate the moderating effect of digitization on service outcomes. Quantitative analysis approaches will be conducted using administrative system data for the year 2024 (cases ending in 2024). The study adopts a Tobit regression analysis to test hypothesis of both the direct and moderating effects (partial moderation). The results indicate that higher levels of bureaucratic complexity are associated with longer service processing times, highlighting the efficiency challenges posed by procedural density. The use of technology, primarily computer-based case processing, significantly reduces service processing times and mitigates the impact of bureaucracy, demonstrating that digital tools can partially alleviate bureaucratic delays. Demographic and institutional factors also show varying impacts on service outcomes.

This study contributes both empirically and theoretically by illustrating how digitalization reshapes bureaucratic processes and improves public service efficiency. The findings offer practical insights that support the UAE government's digital agenda and provide broader implications for policymakers seeking to enhance administrative performance through digital governance.

Keywords

Bureaucracy, Service Efficiency, Digitalization, Public Administration, UAE.

The Relationship Between Environmental Sustainability and CSR Performance: The Mediating Role of Social Sustainability and the Moderating Role of Industry Type

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Abstract

This research aims to investigate the relationship between environmental sustainability and CSR performance using ESG (environmental, social, and governance) indicators. The study employs a quantitative approach based on secondary data from publicly traded companies across multiple industries.

The research further examines the mediating role of social sustainability and the influence of industry type on this relationship. Statistical techniques, including regression, mediation, and moderation, are used.

The results indicate that environmental sustainability has a significant impact on CSR performance, while the mediating role of social sustainability is supported, and the moderating effects of industry type is not significant.

This study contributes by integrating sustainability dimensions into a single empirical framework. The finding offers practical insights for companies and decision-makers by identifying how sustainability indicators relate to CSR. Furthermore, the results support the growing importance of data-driven approaches in sustainability research and highlight the significance of sustainability strategies.

Market Dynamics and Consumer Perception of Four-Wheeler Electric Vehicles in South India

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Abstract

The use of four-wheeler electric automobiles is rising because governments, manufacturers, and environmental agencies encourage sustainable ways of transportation. Electric cars have also become a cleaner option to traditional fuel-powered cars that have the advantages of reduced emissions, lower operational expenses, and better energy efficiency. Consumer adoption of the product is however moderate in South India because of a number of factors that influence the adoption of EVs, including the high price of initial purchase, the lack of charging facilities, a range anxiety, and also the level of consumer awareness. Meanwhile, the increasing environmental worries, the existence of favorable government subsidies, and technology progress are making consumers think about electric vehicles becoming an option to mobility.

This study aims to investigate the existence of market forces and consumer perception on adoption of four-wheeler electric vehicles in South India using quantitative survey data analysis. Structured questionnaires shall be used to gain knowledge of consumer awareness, perceived benefits, affordability, availability of infrastructure, and purchase intentions as primary data. The results will shed some light on the role of monetary rewards, development of infrastructure, and sensitizing consumers on the significance of environments in influencing their behavior. The proposed study will help guide automobile manufacturers, policymakers, and marketers in their efforts to use effective approaches to increase adoption and improve infrastructure and sustainable transportation, as well as contribute to environmental sustainability and the shift to clean mobility.

Smart Vision Based Quality Inspection System

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Abstract

This project presents a comprehensive computer vision-based quality control system designed for real-time manufacturing defect detection and inspection. The system leverages advanced image processing techniques and artificial intelligence to automate quality assurance processes in production environments.

The application implements nine distinct inspection methodologies operating in parallel: (1) dynamic colour adjustments for enhanced visualization, (2) adaptive thresholding for binary segmentation, (3) Structural Similarity Index (SSIM) for reference-based comparison, (4) absolute difference analysis with heatmap visualization, (5) colour histogram distribution analysis across multiple colour spaces,

(6) AI-powered defect detection using YOLOv8 deep learning architecture, (7) multi- algorithm edge detection (Canny, Sobel, Adaptive), (8) flexible colour space conversion, and (9) feature-based image alignment using ORB, SIFT, and ECC algorithms.

Built with PySide6 for the graphical user interface, OpenCV for computer vision operations, Ultralytics YOLOv8 for neural network inference, and scikit-image for advanced metrics computation, the system provides a professional-grade inspection platform with real-time feedback. A SQLite database backend maintains comprehensive inspection records, including session summaries, frame-by-frame results, and detailed defect classifications with confidence scores.

The system features a modular architecture separating the GUI frontend from the computational backend, enabling efficient resource utilization and responsive user interaction. Operators can dynamically enable or disable inspection methods, configure detection thresholds, capture reference images, and access detailed analytics dashboards showing session statistics, method performance metrics, and defect type distributions. All processing occurs locally, ensuring data privacy and eliminating dependencies on external services.

Performance optimization strategies enable the system to achieve 30 FPS with single-method inspection and 10-20 FPS with multiple concurrent methods, making it suitable for practical manufacturing applications. The configurable nature of the platform allows adaptation to various quality control scenarios, from simple visual inspection to complex multi-modal defect detection workflows.

Automated Embedded System for Grocery Vending Machine

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Abstract

The distribution of loose grocery items is mostly manual in nature, which is prone to delays and variabilities in measurement, and thus it involves more human labour in retail or rationing establishments. The development of a Smart Grocery Vending Machine is capable of automatically weighing and dispensing important commodities such as rice, wheat, and dhal. The system is interfaced with a keypad and an LCD to obtain user input through the microcontroller STM32. The material is dispensed through a screw-conveyor mechanism, by a motor whose speed is controlled through PWM. In addition, the real-time weight feedback and auto shutoff are achieved using a load cell coupled to an HX711 amplifier. Experimental results presented in the paper demonstrate that the proposed system provides a cost-effective, scalable, and accurate solution to automate loose grocery dispensing and achieves significantly higher speeds, greater precision, and operational efficiency compared to traditional methods of manual dispensing.

Keywords

Automated dispensing using STM32 microcontroller, screw conveyor, load cell, HX711 module, PMDW Motor, SMPS, PVC, real-time monitoring, grocery vending machine, embedded systems.

WebForge: A Visual Website Builder with Bi-Directional Code Synchronization and AI-Powered Instructional Assistance

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Abstract

WebForge is a unified visual-coding platform designed to simplify the development of production-ready Next.js applications. By combining a Figma-style canvas with a VS Code-like real-time code editor, it enables developers to visually design interfaces while simultaneously modifying actual code through bi-directional synchronization. The platform supports drag-and-drop UI creation, cloud-based project persistence with Supabase, OAuth authentication, and an AI assistant that provides instructional guidance—generating layout blueprints, component hierarchies, and styling specifications to help users learn while building. Unlike traditional website builders, WebForge generates clean, deployable Next.js code that developers can directly export. This integration of visual design, programmatic flexibility, cloud storage, and AI-powered instructional assistance bridges the designer-developer gap, improving productivity and offering a scalable approach to modern web development.

Innovation to Adoption: Science, Technology, and Financial Preparedness in the Electric Two-Wheeler Revolution in India

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Abstract

The application of electric mobility technologies in the transportation environment of India is actively becoming a part of sustainable development and the environmentally friendly mobility solutions. A radical change towards electric two-wheelers, with battery technology, intelligent energy systems, and the digital production process, has become one of the priorities in innovating towards the sustainable future with science and technology. With the growing awareness of urban consumers about the increasing fuel prices, environmental pollution, and long term financial effectiveness, the use of electric two-wheelers as a technologically progressive and cost effective mobility offer is on the rise. Yet, although technologically advanced and policy-welcoming, financial factors like cost of purchase, awareness of subsidies, financing alternatives, cost of battery replacement, insurance cover, and resale value perception are considered the most important to make adoption decisions.

This study aims at analyzing the financial and technological factors that affect consumer adoption of electric two-wheelers and analyzing corporate sustainability of Ather Energy in the developing electric mobility industry in India. Structured surveys contained research instruments that were administered to the consumers in order to gather data about consumer financial behavior, purchase intention, subsidy awareness, cost perception and confidence to invest in electric vehicles. The evaluation of the efficiency of the cost structure, the trends in profitability, and the breakeven performance was done with secondary financial information between FY2021 and FY2024. The obtained results of the research show that despite the awareness of consumers about the long-term economic and environmental advantages of electric mobility, the affordability factors and low awareness of policy incentives still moderate realistic purchase decisions. Also, the research suggests the evidence of quantifiable advances to operational sustainability at the firm level indicating that technological innovation and financial efficiency are key to the bolstering of long-term viability. All in all, the study enhances sustainable transportation in India through the combination of science, economic viability, and scalable businesses to expedite the shift to a more sustainable and technological mobility future.

Why Polyolefin Elastomer (POE) Is the Best Material for Solar Encapsulants

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Abstract

Polyolefin elastomer (POE) encapsulants have emerged as a superior alternative to ethylene-vinyl acetate (EVA) for crystalline-silicon and bifacial photovoltaic (PV) solar modules. This paper synthesizes peer-reviewed studies, laboratory scorecards, and standards guidance to examine POE's advantages in potential-induced degradation (PID) mitigation, damp heat test (DHT), moisture barrier, acetic-acid-free chemistry, UV stability, and compatibility with advanced cell architectures (TOPCon, HJT). We further discuss bankability links via durability testing beyond IEC 61215/61730, impacts on levelized cost of energy (LCOE), and environmental, social and governance (ESG) considerations including recyclability.

Organizational Employee Directory, Role Assignment and HR Record Maintenance

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Abstract

The Organizational Employee Directory, Role Assignment, and HR Records Maintenance Application is a web-based system designed to manage employee-related activities in a structured and efficient way. It provides a single platform to store and update employee information, assign roles, and maintain HR records, reducing manual work and improving accuracy. The system includes an AI-based chat bot that reviews applicants' resumes, identifies relevant skills, and conducts virtual pre-interviews to assist recruiters in the initial screening process. A visual organizational hierarchy displays managers, teams, and members, making reporting relationships easy to understand. This application also tracks project performance by recording daily work updates from team members and monitoring overall progress. Secure access control protects sensitive data, while the flexible design supports future expansion. The system reduces dependency on multiple tools by integrating HR, recruitment, and project monitoring features into one platform. It also promotes better coordination between teams by providing real-time access to structured organizational and project data. Overall, the application improves transparency, productivity, and decision-making in organizational and human resource management.

Keywords

Employee Management System, AI Chat bot, Organizational Hierarchy, Project Performance Tracking.

Design and Implementation of a Business Intelligence Dashboard for Personal Finance Monitoring

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Abstract

The extensive adoption of digital payment platforms has led to significant amounts of personal financial data being produced every day. Even with the presence of organized transaction records, many people do not possess analytical tools capable of translating raw data into valuable financial insights. This research discusses the creation and execution of a Decision Support System (DSS) grounded in Business Intelligence (BI) aimed at facilitating real-time expense tracking and personal financial monitoring.

The suggested system arranges transactional data through a structured data model and calculates financial metrics including total revenue, total spending, savings percentage, and month-over-month increase. A dynamic dashboard setting is employed to illustrate financial trends across categories, vendors, and time-frames. The system enables users to investigate spending patterns interactively via filtering and detailed examination features.

The findings indicate that organized visualization and KPI-focused tracking enhance financial clarity and facilitate better personal finance choices. The framework offers a scalable method for individual-level financial analysis and can be expanded to include predictive modeling in subsequent efforts.

Keywords

Business Intelligence, Decision Support System, Personal Finance Analytics, Visual Analytics, Expense Tracking, Financial KPIs.

Machine Learning-Based Directional Forecasting of NIFTY50 Using Technical Indicators and Ensemble Models

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Abstract

In this paper, the author explored the issue regarding directional prediction of the Indian stock index NIFTY50 using machine learning models on technical indicators which have been optimized on daily OHCLVs between 2015 and 2025. The statistical techniques that have been used are classical statistical techniques, stacking ensemble models and tree based ensemble models to forecast the next day movement of the index (high or low). The technical indicators include trend, momentum, volatility and volume based indicators are obtained to reflect market conditions. The findings show that ensemble models in general and stacking models in particular, can be used to derive predictive accuracies of about 54% which is the standard on predictability of equity indexes in financial markets. The feature importance analysis is focused on the predictive nature of the relative strength index, lagged returns, true average range measured using moving average, the measures of deviation and the MACD. Predictive edge is low due to several factors such as underlying market noise, the results support that market index movements have weak but exploitable patterns. Some of the weaknesses are class imbalance, no backtests on trading activities and lack of sentiment and macroeconomic characteristics. Future studies are focused on combining effects of reinforcement, economic backtesting and other areas in which features are related in order to improve the trading strategy.

Keywords

Machine Learning, NIFTY50, Directional Forecasting, Ensemble Learning, Technical Indicators, Stacking.

ChurnNet: Deep Learning Enhanced Customer Churn Prediction in the Telecommunication Industry Using Federated Learning

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Abstract

Customer churn is a longstanding issue in the telecommunication industry, as the market competition is quite high, the customer mobility is also on the increase, and the expectations towards the services vary. Predictable churn is thus needed in order to enhance customer retention, enhance profitability and sustainability in the sustainability of operations. Although more recent deep learning models like ChurnNet have good predictive accuracy, most of them have a centralized training model, which creates data privacy issues and lowers interpretability, making them less acceptable in the real world. In order to overcome these shortcomings, this paper presents Federated ChurnNet, a new privacy-regulated interpretable deep learning architecture that integrates Federated Learning and Explainable Artificial Intelligence methods. The federated learning system facilitates distributed learning between distributed telecom data sets without disclosing raw data about customers, so as to ensure confidentiality, scalability, and regulations. Moreover, SHAP and LIME techniques are also added which are used to not only give a global feature importance analysis but also offer instance-level prediction explanations which enhance model transparency and trust among the stakeholders. The experimental analysis based on several telecom benchmark datasets demonstrates that the proposed method provides the prediction accuracy exceeding 96% as well as high ability to generalize and good churn classification results. These results indicate that Federated ChurnNet is a scalable, secure, and interpretable system that can be used in practice in telecom churn analytics and other privacy sensitive predictive models.

Keywords

Customer churn, federated learning, deep learning, explainable ai, telecom analytics.

Development of Smart Hydraulic Robot Arm for Industrial Application

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Abstract

This study presents the design and development of a smart hydraulic robotic arm that integrates hydraulic actuation with advanced control mechanisms to achieve high load capacity, precision, safety, and energy efficiency. Based on Pascal's Law, the system employs hydraulic cylinders, control valves, and optimized fluid circuits to enable multi-degree-of-freedom motion, including lifting, rotation, extension, and gripping. The integration of position and pressure sensors enhances motion accuracy and operational safety under varying load conditions. Experimental results demonstrate superior load-handling performance compared to conventional electric and pneumatic systems, along with reduced power consumption and heat loss. The developed prototype validates the feasibility of hydraulic-based robotic systems for heavy-duty industrial and field applications requiring strength, precision, and reliability.

Keywords

Hydraulic robotic arm, Pascal's Law, hydraulic actuation, smart control system, load capacity, energy efficiency, industrial automation, Servo and hydraulics integration & silicon gripper.

BookBridge: AI-Powered Peer-to-Peer Book Rental and Exchange Platform

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Abstract

To overcome the issues of trust and condition transparency in book exchange systems, BookBridge has come up with an intelligent system that generates greater reliability in shared book dealings. The current book sharing systems use self reported descriptions, which can be quite controversial and decrease the confidence of the user. The proposed system will combine automated book condition detection with a deep learning based image analysis model, identity identification by means of optical character recognition of uploaded identification documents, and a hybrid recommendation mechanism that is a combination of content similarity and user interaction behavior. Also, it uses a confirmation mechanism using quick response codes to make sure that there is security and verifiability in the handovers between the users of the book. The system examines images of books to categorize physical conditions levels, authenticate user identity information to foster accountability and provides customized book recommendations depending on past usage history. Through experimental testing, there are better performance in the classification of book conditions and that the number of fraudulent transactions and user conflicts is reduced quantitatively compared to traditional methods. The unified workflow also improves transparency, trust and reliability in academic and community based book sharing setting and thus facilitating sustainable access to learning materials as well as open exchange of knowledge.

Keywords

Artificial intelligence, book exchange platforms, book rental systems, trust management, identity verification, recommendation systems.

An IoT-Based Smart Bed System for Patient Presence and Pressure Monitoring with Instant Alert

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Abstract

In hospitals, continuous monitoring of hospitalized and elderly patients is essential to prevent falls, pressure ulcers, and bed exits, especially in the context of inadequate nurse-to-patient ratios. Traditional monitoring methods heavily depend on manual observation, which may cause delays in response and increase patient risk. This project aims to develop an IoT-based smart bed system capable of detecting patient bed presence and monitoring pressure in real time while providing instant alerts to caregivers. This system integrates a load cell to detect patient presence and a pressure sensor to detect pressure variations. A microcontroller processes the data and transmits the data via Wi-Fi using IoT protocols to a cloud platform. A threshold-based algorithm is used to analyze the abnormal pressure patterns and bed-exit attempts. When the uneven patterns are detected, instant notifications are sent to caregivers through a mobile application. The developed prototype successfully detected patient presence, absence, and uneven pressure distribution. Real-time alerts were generated with minimal delay to reduce false alarms, improving response time and ensuring effective monitoring. The proposed IoT-based solution enhances patient safety by providing real-time alerts, and it is suitable for hospital, home-care, and elderly care applications, contributing to healthcare efficiency and reduced patient risk.

An AI-Driven Multi-Chain Blockchain Framework for Latency-Optimized Academic Credential Verification

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Abstract

Blockchain-based academic credential systems guarantee integrity and decentralization; however, performance degradation due to sequential consensus and network congestion remains a significant limitation. This study introduces an artificial intelligence-driven multi-chain blockchain framework designed to minimize transaction latency while preserving decentralization properties. A controlled experimental evaluation was conducted using 500 independent transaction samples per configuration. Comparative statistical analysis between a baseline single-chain model and the proposed parallel multi-chain architecture revealed a substantial latency reduction from 250.21 ms to 180.80 ms. Welch's two-sample t-test confirmed statistical significance ($t(966)=40.56$, $p<0.001$), with a large practical effect (Cohen's $d=2.6$). The findings validate the architectural efficiency and demonstrate the suitability of the framework for scalable inter-institutional credential verification ecosystems.

Keywords

Blockchain Scalability, Multi-Chain Architecture, Artificial Intelligence Routing, Latency Optimization, Statistical Validation, Credential Verification.

Lightweight Custom CNN with Integration for Simultaneous Detection of Diabetic Retinopathy and Glaucoma

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Abstract

Diabetic retinopathy and glaucoma are among the leading causes of preventable blindness worldwide, requiring early and accurate screening for effective treatment. Traditional diagnostic procedures rely heavily on manual examination by ophthalmologists, which limits large-scale screening in resource-constrained environments. This research proposes a lightweight custom convolutional neural network (CNN) integrated with clinically interpretable biomarkers for simultaneous detection of diabetic retinopathy and glaucoma using fundus images. The proposed framework performs image preprocessing, optic disc and cup segmentation, and lesion analysis to extract clinical indicators such as cup-to-disc ratio (CDR) and rim-to-disc ratio (RDR). Unlike transfer learning approaches that require large computational resources, the designed CNN contains approximately 500,000 parameters, enabling faster inference and reduced memory usage while maintaining high diagnostic performance. Experimental evaluation demonstrates a validation accuracy of 99.75%, sensitivity of 98.65%, and specificity of 98.60%, achieving performance comparable to VGG16 while being significantly more computationally efficient. The integration of explainable clinical biomarkers improves interpretability and clinical reliability of predictions. The proposed system supports scalable and cost-effective ophthalmic screening and can assist healthcare professionals in early disease detection, especially in low-resource clinical settings.

Secure Voting System by Aadhaar Verification and Iris Detection Using Deep Learning

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Abstract

Secure and transparent voting systems are essential for maintaining the integrity of democratic processes. Traditional voting methods and existing biometric-based electronic voting systems are often vulnerable to impersonation, duplicate voting, and various security threats. This paper presents a secure electronic voting system that integrates Aadhaar-based identity verification with deep learning-based iris recognition using a pre-collected iris dataset. The proposed system adopts a multi-factor authentication approach to ensure that only legitimate and eligible voters are permitted to participate in the voting process. A convolutional neural network (CNN)-based Siamese architecture is employed for effective iris feature extraction and matching, enabling reliable biometric authentication with high accuracy. Aadhaar verification serves as an additional authentication layer, strengthening identity validation and preventing unauthorized access. To protect sensitive voter information and voting records, the system utilizes Advanced Encryption Standard (AES) encryption, and all encrypted data are securely stored in a MongoDB database. The proposed system strictly enforces a one-person-one-vote policy by continuously monitoring voter activity and rejecting duplicate voting attempts. Experimental evaluation conducted using the iris dataset demonstrates improved authentication accuracy, enhanced security, and reliable system performance when compared to conventional biometric voting approaches. The results confirm that the integration of Aadhaar verification, deep learning-based iris recognition, and secure data storage significantly enhances the robustness and trustworthiness of the electronic voting process. Overall, the proposed multi-factor authentication framework provides a secure, scalable, and practical solution for modern electronic voting systems.

Keywords

Secure voting system, Aadhaar authentication, Iris recognition, Deep learning, Biometric authentication.

E-Commerce Platform with Personalized Recommendations

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Abstract

Online shopping has become an essential and rapidly growing part of modern digital life. With the expansion of internet access and mobile usage, customers now prefer purchasing products through online platforms instead of traditional physical stores. However, as e-commerce platforms continue to grow, the number of available products has increased to an overwhelming level. Users often face difficulty in finding items that truly match their interests, needs, and preferences. Searching through thousands of products leads to confusion, decision fatigue, and dissatisfaction. Most traditional e-commerce systems still rely on generic product listings, popularity rankings, or simple category-based suggestions, which do not accurately represent individual user behavior.

Because of this limitation, users frequently spend more time browsing without making purchases, which reduces engagement and affects business performance. A personalized recommendation approach can significantly improve this experience by showing users products that are more relevant to them. Personalized systems analyze user behavior patterns and provide intelligent suggestions rather than one-size-fits-all results.

This project proposes the design and development of an E-Commerce Platform with Personalized Recommendations that provides smarter and more meaningful product suggestions using user behavior analytics and machine learning techniques. The system collects and analyzes multiple forms of user interaction data, including browsing history, click patterns, purchase records, product ratings, time spent on items, and search queries. Based on this data, the recommendation engine generates customized product suggestions in real time.

The recommendation module applies advanced techniques such as collaborative filtering, which identifies similarities between users, and content-based filtering, which matches product attributes with user interests. A hybrid approach can also be used to further improve accuracy and reduce recommendation errors. The system continuously learns and updates its suggestions as user behavior changes over time, making it adaptive and dynamic.

The proposed platform aims to enhance user experience, reduce search time, increase customer satisfaction, and improve conversion rates. It also supports scalability to handle large product catalogs and multiple user interactions efficiently. By integrating personalization into the shopping workflow, the system helps both customers and businesses achieve better outcomes. This research demonstrates how intelligent recommendation systems can transform traditional e-commerce platforms into user-centric smart commerce solutions.

An Automated IoT and Computer Vision Based Hydroponic System

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Abstract

This paper presents an automated plant monitoring system that integrates Internet of Things (IoT) sensing, Computer Vision (CV), and cloud-based computation for continuous assessment of controlled environment agriculture. This study demonstrates that the fully automated monitoring system was successfully designed, built, and tested using hydroponically grown spinach cultivated in a Nutrient Film Technique (NFT) setup. An electronic sensor module paired with an automated imaging module captured continuous environmental and morphological data throughout the growth cycle, forming a unified dataset for analysis. The system integrates all sensor and visual inputs into a unified processing workflow, where an AI driven pipeline executes end-to-end automation including data acquisition, cloud inference, pixel to centimeter conversion, and real time data monitoring without requiring human intervention. A dashboard provides real-time visualization and an AI Chatbot feature, enabling remote monitoring of plant status and system behavior with ease. This system demonstrates a fully autonomous sensing-to-analytics pipeline, thereby exhibiting its potential as a scalable and robust framework for smart hydroponic management and high-frequency plant phenotyping.

Keywords

Hydroponic, Artificial Intelligence, Smart Agriculture, Internet of Things (IoT), Plant Phenotyping, Computer Vision.

ChemCheck-Ingredient Safety Analyzer

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Abstract

The increasing availability of consumer products in the food and cosmetic industries has raised concerns about the safety of chemical ingredients used in everyday items. Although ingredient lists are commonly provided on product labels, interpreting complex chemical names and understanding their potential health implications can be difficult for consumers. To address this challenge, this study presents ChemCheck, an artificial intelligence-based system designed to automatically analyze product ingredient lists and evaluate possible safety risks. The proposed framework integrates Optical Character Recognition (OCR) to extract ingredient information from product labels and Natural Language Processing (NLP) techniques to identify and normalize chemical compounds. The identified ingredients are then cross-referenced with chemical records available in the PubChem database, enabling access to detailed chemical structures and properties. Toxicity evaluation is performed using data from the Tox21 screening dataset, which contains extensive biological assay results used to identify potential toxicological effects such as carcinogenicity, endocrine disruption, and reproductive toxicity. Based on this analysis, the system generates an easy-to-understand safety report by assigning a normalized safety score on a 10-point scale and providing precautionary notes related to identified risk factors. The user interface is implemented using React for the web application and Streamlit for rapid experimental deployment, allowing accessible interaction for both end users and developers. Experimental evaluation was conducted on a dataset of 2,500 labeled product samples, achieving an overall classification accuracy of 94.3% and an F1-score of 0.92 for identifying high-risk compounds. The results demonstrate that integrating artificial intelligence techniques with established chemical and toxicology databases can support automated ingredient safety assessment and improve consumer awareness regarding potentially harmful substances.

Keywords

Ingredient Safety Analysis, Optical Character Recognition (OCR), Natural Language Processing (NLP), PubChem Database, Tox21 Dataset, Consumer Product Safety, Artificial Intelligence.

Rumor Reality Engine: Real-Time Misinformation Refuter

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Abstract

Social media platforms enable misinformation to circulate more quickly than traditional fact-checking methods can verify the information. The Rumour Reality Engine is an AI-powered system designed to detect viral claims and generate real-time, evidence-based rebuttals. The system uses three processing stages which start with the Large Language Model (Llama 3.3 via Groq) to extract the main factual claim and then uses Google Fact Check Tools API to obtain verified information before it creates a structured rebuttal through Retrieval-Augmented Generation (RAG) method [1]. The output presents a decision which consists of an explanation and references trustworthy sources. The pipeline operates as a web application which uses Flask to create a system that allows users to submit claims and receive immediate fact-checking results through its interactive frontend. The system combines quick cloud-based LLM inference with verified source retrieval to produce explainable outcomes which take between 2 and 4 seconds to complete. The system testing shows successful performance in detecting and disproving typical misinformation patterns. This work builds a usable automated fact-checking system which delivers transparent results and fast operations with user-friendly features.

Keywords

Misinformation Detection, Fact-Checking, Retrieval-Augmented Generation (RAG), Large Language Models, Natural Language Processing, Explainable AI.

Multimodal Psychodermatological Disorder Prediction Using Gemini-Augmented CNN with Transfer Learning

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Abstract

Psychodermatology is an emerging field that focuses on the close relationship between psychological health and skin conditions. Research has shown that long-term stress, anxiety, and depression can worsen several dermatological disorders such as psoriasis, acne, urticaria, and eczema. Although artificial intelligence and machine learning have made significant progress in healthcare, most existing diagnostic systems focus only on either mental health assessment or skin disease detection individually. This separation makes it difficult to identify psychodermatological disorders at an early stage and highlights the need for integrated solutions that consider both psychological and dermatological factors together. This study proposes a hybrid framework that combines advanced AI techniques with multimodal analysis to improve the detection of psychodermatological conditions. The system uses deep learning models such as convolutional neural networks (CNNs), including ResNet and EfficientNet, for accurate skin disease classification from images. At the same time, natural language processing (NLP) and questionnaire-based assessments are used to evaluate psychological factors like stress and depression. In addition, large language models (LLMs) help integrate and interpret information from both sources, providing a more comprehensive and reliable approach for early detection and better management of psychodermatological disorders. The integration of multimodal data enables the system to analyze both dermatological images and psychological indicators simultaneously, improving diagnostic accuracy and contextual understanding of psychodermatological disorders.

Deployable Convolutional Transfer Architecture for Interactive MRI-Based Brain Tumor Analysis

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Abstract

Brain tumors are among the most life-threatening malignant forms of cancer, accounting for 320,000 new cases each year and approximately 248,000 deaths every year around the world. There are various forms of brain tumors, and detecting and classifying them is very crucial and helpful in clinical decisions. This study proposes a deep learning model that will assist the clinicians in classifying the brain tumor based on Magnetic Resonance Image (MRI) data by classifying them into glioma, meningioma, pituitary, and the negative case of no tumor. This model uses a transfer learning architecture that applies the previously learned knowledge and adapts itself for a new problem, a VGG16 feature extractor. The system is optimized with a customized convolutional neural network (CNN) and connected layers to improve accuracy. The preprocessing pipeline includes intensity normalization, scaling, and augmentation methods like rotation, horizontal flipping, vertical flipping, scaling, and added noise for better generalization. The accuracy of the system in classifying the test group reached 99%. An Adam optimizer helped the model learn stably and quickly with the learning rate of 10^{-4} . In addition to classification, this model also helps in estimating the size of the tumor to enhance the clinical usefulness of the system.

Keywords

Brain tumor detection, Convolutional Neural Networks (CNN), Transfer Learning, VGG16, MRI classification, Deep learning, medical image analysis, Tumor size estimation.

Random Forest-Based Machine Learning Framework for Security Enhancement in Software Defined Networks

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Abstract

Networks are flexible and centrally controlled in contemporary networks using Software Defined Networking (SDN). However, this division of both control and data planes also brings more security risks. We propose an SDN security architecture, which implements machine learning (ML) classifiers into the SDN controller to examine traffic flows in real-time. It is a composite framework in a rule-based filter procedure that recognizes threat signatures, whilst a supervised ML model (e.g. a Random Forest classifier) learns more complex designs to detect new abnormalities. The traffic and network structure workflows are designed in such a way that they gather flow statistics, obtain features (packet size, rate, duration, etc.), and apply the ML model within the controller. After detecting the malicious flows, dynamic adjustment of flow tables by the controller is made to reject or isolate them and continue the legitimate traffic flow. The results of the simulation indicate that the proposed ML-enhanced SDN framework can achieve a detection accuracy exceeding 99 percent, provisioning the low false-positive rate and still ensuring normal network throughput. It demonstrates that SDN security and network performance can be enhanced by using ML-based decision-making. The results of the simulation indicate that Random Forest-based SDN security framework achieves over 99% detection accuracy with efficient real-time mitigation of application-layer attacks.

Keywords

Software Defined Networking (SDN), Intrusion Detection, Network Security, Machine Learning (ML), Network Traffic Analysis, Random Forest.

A Retrieval-Based Semantic Framework for Automated Code Debugging and Explanation

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Abstract

New programmers face significant obstacles with debugging because they struggle to decode compiler messages and follow program execution. Standard development environments only show users which parts of their code contain errors but fail to provide them with additional context or solutions to those problems. The research introduces an AI-powered debugging tool that retrieves code errors submitted by users through a matching system which uses cosine similarity to link their specific errors with existing debugging records. The system takes error information from user code input and transforms it into vector-based representations before finding the most applicable debugging reference in its organized knowledge database. The system backend uses Python FastAPI for its implementation which runs on an ASGI-based Uvicorn server while the frontend implements interactive output visualization through React. The system creates organized output which contains two main components: error detection results and program logic details with algorithm steps plus recommended code improvements. The testing process used a specially selected debugging dataset which contained 1,000 cases to reach a Top-1 retrieval accuracy of 89.2% while response time averaged 230 milliseconds. The framework offers novice programmers debugging assistance that follows the principles of deterministic operation explainability and educational value.

Keywords

AI Debugging, Retrieval-Based Systems, Cosine Similarity, Code Error Analysis, Educational Technology, FastAPI, Semantic Matching, Code Correction.

A Comprehensive Multimodal Framework for Early Depression Detection Using Machine and Deep Learning Techniques

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Abstract

This research presents a comprehensive multimodal framework that integrates textual content analysis with facial expression interpretation to create an advanced system for detecting stress indicators and emotional states. The framework employs state-of-the-art natural language processing through BERT-based embeddings combined with Logistic Regression models, alongside traditional machine learning approaches, including Multinomial Naive Bayes with TF-IDF vectorisation, to identify stress patterns within textual inputs. For visual analysis, the system incorporates convolutional neural network architectures, including custom-designed CNNs and XCEPTION model variants, which process real-time video streams from webcams after detecting facial regions using Haar Cascade algorithms. Model performance evaluation utilises standard metrics including accuracy rates and F1-scores throughout the training and validation phases. The optimal models are deployed within an interactive Streamlit-based application interface. This application enables users to perform real-time emotion detection through webcam feeds and text-based stress evaluation, providing detailed emotion classifications along with associated confidence metrics. The integrated system demonstrates significant potential for practical applications in emotional well-being monitoring and mental health assessment scenarios, highlighting the advantages of combining multiple data modalities.

Keywords

Integrated Emotion Recognition, Mental Stress Detection, Transformer-based Text Embeddings, Visual Emotion Analysis.

Performance Analysis of Traditional Machine Learning Classifiers for Binary Fake News Detection

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Abstract

The swift spread of fake information on the internet presents serious problems regarding the confidence of the people and the reliability of information, creating the need to establish a strong and efficient method of identifying cases of fraudulent data. This paper is a complete analysis of the classic machine learning approaches in binary fake news detectors based on a well-filtered leakage-free set of features. In order to achieve methodological rigor, label-based and proxy features were carefully filtered, and experimental procedures were performed in the framework of rigorous train to test partitions.

Accuracy, precision, recall and F1-score were used to systematically assess the six popular classifiers, including: Logistic Regression, Support Vector Machine (SVM), Naive Bayes, Decision Tree, Random Forest and XGBoost. Results of the experiments prove that the methods based on ensembles are more accurate than individual learners with highest accuracy equal to 70.15 per cent, then SVM (69.38 per cent) and XGBoost (67.32 per cent). Logistic Regression achieved an accuracy of 63.93 with Naive Bayes and Decision Tree achieving relatively low accuracy of 57.98 and 58.34, respectively. It is important to note that the Naive Bayes gave high levels of recall which is its sensitivity to positive cases at the cost of accuracy.

The results highlight the usefulness of ensemble learning methods in detecting misinformation and defining, nonetheless, sound and realistic baselines against which to compare them with complex deep learning and graph-based. It is an open and replicable reference, which can be used to base other studies in hybrid, graph-based, and large language model-based fake news detectors.

Keywords

Machine Learning Models, Logistic Regression, Support Vector Machine (SVM), Naïve Bayes, Decision Tree, Random Forest, and XG Boost, Fake News Detection, Social Media.

Explainable Edge-Optimized ConvNeXt for Mango Leaf Disease Detection

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Abstract

Mango is one of the most economically important fruit crops in tropical and subtropical regions. However, mango production is significantly affected by leaf diseases such as anthracnose, powdery mildew, and bacterial canker, which reduce yield and fruit quality. Early and accurate disease detection is essential for effective crop management. This project proposes an automated mango leaf disease detection system using a deep learning-based ConvNeXt framework. The model is trained on a labeled dataset of mango leaf images to classify healthy and diseased leaves with high accuracy. Image preprocessing techniques such as resizing, normalization, and augmentation are applied to improve model performance and generalization. To enhance reliability, explainable AI techniques are incorporated to visualize important regions influencing predictions. The system is also optimized for edge deployment, enabling real-time disease detection using mobile or low-cost devices. Experimental results demonstrate high classification accuracy and robustness under varying environmental conditions. The proposed framework provides a practical and scalable solution for precision agriculture, assisting farmers in timely disease identification and improving overall crop productivity.

Keywords

Mango Leaf Disease Detection, Deep Learning, ConvNeXt, Explainable AI, Edge AI, Precision Agriculture.

Image -Based Multilingual Text Recognition and Voice Output System

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Abstract

Multilingual text recognition with voice generation is a vital research domain involving the use of images to enhance the digital accessibility and multilingual exchanges. Images in the real- world are often subject to distortions due to uneven light sources, scanning artifacts, cluttering in the background and low-quality resolutions, posing significant problems in preventing distortion and achieving proper Optical Character Recognition. The given research article proposes a combined procedure that can be used to extract textual data out of intricate images, convert identified objects into various languages and generate the speech as a whole that can be understood better and improved by adding the Noise suppressing, the morphological processing of images and the Non-Local Means filtering of images. The Tesseract OCR engine is used to improve images and allows multilingual character recognition in a variety of scripts and fonts. The information in the extracted text is then automatically recognized and translated into multiple languages using Googletrans translation framework. A speech synthesis element translates text to natural audio, which supports assistive reading capability, and is implemented using a Streamlit- based interactive interface that allows uploading of images, selecting the language of translation, extracting text, translating it and generating speech in a single environment. According to experimental analysis, the accuracy of recognition is 92.4% when using the model with multilingual text extraction, and the general implemented model is 94.1% output after preprocessing and translation integration. Enhanced recognition performance indicates the efficiency of preprocessing and multilingual processing modules. Possible applications are in document digitization, multilingual access of information and support of reading .

Keywords

Multilingual Image Text Extraction, Optical Character Recognition, Non-Local Means Image Filters, Morphological Image Processing, Cross-Language Text Transfer, Googletrans package, Text-to-Speech, Streamlit, Image Restoration, Face for Speech Synthesis, Document Scanning, recovery performance.

RF Assisted Intelligent Traffic Signal Control System for Ambulance Priority

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Abstract

Efficient ambulance mobility through congested

urban traffic is essential for reducing emergency response time and improving patient survival rates. Conventional traffic signal systems operate on fixed schedules and lack the intelligence required to dynamically prioritize emergency vehicles. This paper presents an RF assisted intelligent traffic signal control framework that integrates AI based ambulance detection with wireless emergency confirmation. The proposed system extends a baseline architecture using ResNet18 for visual detection and LSTM for siren recognition by incorporating an ambulance mounted RF transmitter and an intersection side RF receiver connected to a microcontroller-based traffic controller. Upon receiving authenticated emergency signals, the controller initiates signal pre-emption to establish a green corridor for approaching ambulances. Experimental evaluation and prototype level validation demonstrate the feasibility and effectiveness of the proposed system for real time smart traffic management.

Keywords

Emergency vehicle detection, intelligent traffic signal control, RF communication, traffic signal pre-emption, multimodal detection, smart transportation systems.

AI-Enabled Drone System for Real-Time Disaster Loss Assessment and Damage Detection

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Abstract

Natural disasters like earthquakes, floods, cyclones, landslides, and wildfires can cause significant damage to infrastructure. They also lead to severe human, environmental, and economic losses. Quick and reliable damage assessment is crucial for emergency response, rescue planning, and recovering after a disaster. Traditional disaster assessment methods rely heavily on manual ground surveys, satellite images that arrive late, or subjective visual checks. These approaches tend to be slow, costly, unsafe, and not ideal for large-scale disasters.

This paper introduces a drone system powered by AI that is designed for real-time disaster loss assessment and automated damage detection. The system combines unmanned aerial vehicles (UAVs) with deep learning-based computer vision techniques to analyze high-resolution aerial images. We develop a modular system architecture to support real-time image acquisition, preprocessing, damage classification, spatial analysis, and loss estimation. The system provides quick situational awareness by automatically detecting damaged structures and classifying the severity of the damage. Tests using established disaster datasets show that this approach achieves high classification accuracy and greatly cuts down assessment time compared to traditional manual methods. The findings confirm that AI-driven UAV systems can be an effective and scalable solution for modern disaster management.

Keywords

Unmanned aerial vehicle, disaster management, artificial intelligence, deep learning, computer vision, damage detection, loss assessment, real-time analysis.

Real-Time Driver Assistance System for Pothole and Vehicle Hazard Detection

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Abstract

Urban traffic is growing quickly, and road conditions are getting worse, especially with the increasing number of potholes. Together, these issues create serious safety risks for drivers and can cause long-term damage to vehicles. This project introduces a portable, high-performance, real-time driver assistance system that uses deep learning to detect road hazards and nearby vehicles. A mobile device acts as a high-quality visual sensor and connects through a low-latency wired link to a central processing unit that handles data analysis. Built on the YOLOv8 architecture, the system analyzes live video feeds using two models running at the same time: one focused on identifying vehicles and another custom-trained specifically to detect potholes. To maintain real-time responsiveness, the software is optimized with hardware-specific GPU acceleration, allowing fast processing directly on the host machine. Drivers access a modern web-based dashboard that displays visual bounding boxes and provides audio alerts when hazards are detected within a critical distance. Overall, this solution delivers a cost-effective alternative to expensive automotive hardware while significantly improving road safety through accessible and practical technology.

Keywords

Artificial Intelligence (AI), Real-Time Object Detection, YOLOv8 Architecture, Driver Assistance System (DAS), Pothole Detection, Computer Vision, Edge Computing, Low-Latency Streaming, Graphical User Interface (GUI), Road Infrastructure Monitoring.

Non-Invasive Cancer Diagnosis

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Abstract

Background: Early and non-invasive cancer screening is a critical priority for improving clinical prognoses. Human sweat is a biomarker-rich fluid that contains vital physiological and metabolic data, making it a highly promising medium for the development of non-invasive point-of-care diagnostic devices. Furthermore, physiological parameters such as localized temperature serve as highly sensitive properties for early disease detection. This study proposes a novel, low-cost, multiparametric biosensing platform that evaluates manually applied offline sweat samples to screen for metabolic anomalies associated with early-stage cancer.

Methods: The diagnostic system integrates three distinct sensing modalities. First, an electrochemical pH sensor is developed utilizing a screen-printed graphite working electrode. To achieve high sensitivity to metabolic pH shifts, the electrode is modified with a polyaniline (PANI) sensing layer, which is synthesized directly via chemical oxidative polymerization using aniline monomer, ammonium persulphate (APS) as the oxidizing agent, and hydrochloric acid (HCl). **Carbon-based electrodes are specifically selected over conventional silver electrodes because carbon remains mostly inert in the diverse salt concentrations found in biological fluids, thereby avoiding the interfering faradaic and non-faradaic responses that silver exhibits.** The electrochemical current is captured using a miniaturized potentiostat circuit featuring a transimpedance amplifier. Second, a dedicated optical detection well paired with a color sensor quantifies sweat protein concentrations via a Bradford reagent colorimetric assay. Third, an integrated temperature sensor continuously tracks thermal variations to provide localized physiological data and allow for the thermal compensation of the sensors.

Results and System Operation: The raw analog voltages from the sensing transducers are fed into a central microcontroller unit (such as a NodeMCU ESP8266) equipped with an onboard analog-to-digital converter (ADC). **Bypassing the need for complex machine learning algorithms, the microcontroller relies entirely on deterministic, threshold-based logic.** It applies pre-calibrated mathematical formulas to calculate exact pH levels, protein concentrations, and temperature. These real-time values are instantly compared against predefined physiological thresholds to flag metabolic anomalies indicative of underlying systemic stressors or tumor microenvironments.

Conclusion: By synergizing PANI-modified graphite for electrochemical pH sensing, colorimetric protein profiling, and precise thermal tracking, this device establishes a robust and comprehensive analytical framework. The localized, threshold-based microcontroller architecture offers a highly practical, low-cost, and completely non-invasive screening tool that bypasses the need for complex external computing or invasive biopsies, paving the way for highly accessible early oncological diagnostics.

Uncovering New Insights for Accurate Age Related Macular Degeneration Detection Using Xgboost

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Abstract

Age-Related Macular Degeneration (AMD) is a leading cause of vision loss in adults over 50, and early detection is vital to prevent irreversible damage. Conventional diagnosis using fundus images is slow, costly, and prone to human error. To address these limitations, this study presents a MATLAB-based automated screening system for AMD detection. This system preprocesses retinal images to enhance quality and extract informative features—including color, texture, and edge descriptors—that are subsequently used to train and evaluate two machine learning models: a baseline classifier and XGBoost. These models are assessed using performance metrics such as accuracy, precision, recall, and F1-score. Preliminary results demonstrate that the automated approach significantly reduces diagnosis time while maintaining diagnostic reliability; the comparative analysis reveals XGBoost provides superior performance over the baseline model. The proposed system aims to deliver a real-time, cost-effective, and accessible solution for AMD screening, particularly suited to resource-limited settings. By facilitating earlier and more reliable detection, the system holds promise for reducing AMD-related vision loss and enhancing patient outcomes globally.

AI - Driven Electricity Demand Forecasting and Explainable Anomalies Detection for Smart Power Distribution

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Abstract

Electricity demand forecasting and real-time anomaly detection is very important for the efficient functioning of Distribution Companies (DISCOMs) all over India. Traditional methods of energy management rely on static threshold checks and heuristic rules that can not cope up with the complex, changeable load profiles caused by industrial processes, seasonal elements or increased shares of renewable sources. This project focuses on an AI-driven experimental framework DISCOM AI, which is able to detect and indicate electricity anomalies using N-BEATS inspired forecasting of time-series data coupled with adaptive quantile is used as the center with anomaly detection pipeline and an Explainable AI(XAI) Classification layer. The system generates 48-h load forecasts when fed feeder-level data from eight major Indian cities, models deviations using a rolling window of residual analysis over the previous 12 h of data as features in a supervised learning framework, and then predicts anomalies into interpretable groups (5) namely Load Spike, Load Drop, Meter Fault, Communication Loss and Demand Drift. An interactive real-time dashboard powered by Streamlit enables distribution engineers to access visualizations like actual-vs-forecast charts, residual plots, 12-hour ahead bar forecasts and anomaly distribution.

Keywords

Artificial Intelligence (AI), N-BEATS Model, Explainable AI (XAI), DISCOM, Smart Grid, Adaptive Quantile Thresholding, Time-Series Analysis, Streamlit Dashboard, Load Forecasting, Power Distribution, Residual Analysis, Feeder Monitoring, and Precision Energy Management.

Experimental Investigation on Mechanical Properties of Abutilon Indicum & Flax Natural Fiber Hybrid Composite for Lightweight Application

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Abstract

Aim: The impact of materials on the environment is an enormous concern nowadays. The investigation of sustainable composite materials that blend natural and manmade fibers has resulted from this. The benefits of adopting natural fibers for the environment have emphasized their significance even more.

Materials and Methods: **Group 1:** The natural fiber is eco-friendly natural fibers that are cellulose-rich and biodegradable, thermally stable natural fibers that are potential materials for sustainable polymer composite materials. **Group 2:** Introduction of Abutilon indicum and flax fiber to enhance the mechanical properties of polymer matrix composite.

Result: A composite with an equal weight ratio of flax and Abutilon indicum fibers (R3 ratio) exhibits superior tensile impact and flexural strength according to research on composites containing these fibers. The independent samples t-test showed that the t value was 5.96 with 24 degrees of freedom and a two-tailed significance value of 0.0016.

Conclusion: This investigation further demonstrated that the employment of a higher volume of Abutilon indicum fiber in Ratio 1 resulted in increased compressive strength and decreased water absorption qualities.

Keywords

Composite material, Compression moulding, Tensile strength, Impact strength, and Water absorption, Reinforcement.

Diabetic Retinopathy Prediction Using Deep Learning

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Abstract

Diabetes-related diabetic retinopathy (DR) causes damage to blood vessels in the retina's light-sensitive region at the back, which has an effect on the eye. When diabetes is not effectively managed, this condition, which is a leading cause of blindness in working-age individuals, is more likely to develop. Although DR may be identified by physical inspection by an ophthalmologist, an automated method utilizing Deep Learning has been suggested in this research. Automating DR detection can significantly minimize the amount of manual work needed for diagnosis, especially given the shortage of physicians. The Deep Convolutional Neural Network (CNN) model provided here gives a comprehensive approach to DR detection, relying less on human feature extraction. This system's goal is to diagnose the user and assign them to one of the five DR classifications according to their severity. The 35126 retinal photos made available by eyePACS on Kaggle were used to train the suggested model using a GPU. Given the complexity of the dataset, evaluation of the model using several criteria reveals that it is sufficient. Around 97.3% accuracy was attained. By expanding the dataset and retraining the neural network with fresh retinal pictures, accuracy may be increased even more.

Keywords

Diabetic retinopathy, prediction, deep learning, convolutional neural networks, feature extraction, classification, medical imaging.

A Logistic Regression Based Software System for Breast Cancer Diagnosis Using Clinical Data Analysis

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Abstract

Prompt detection of breast cancer is most important to increase patient survival and reduce the fatality rates. The conventional diagnostic techniques such as clinical assessment and imaging result analysis require professional interpretation and can sometimes lead to a delay in diagnosis. In the recent past, machine learning approaches have increasingly been applied to the analysis of medical data in order to make possible a more accurate and effective prediction of diseases. This study presents a system of breast cancer diagnosis which is based on a logistic regression classification model. The suggested methodology will utilize the Breast Cancer Wisconsin data set, a collection of diagnostic parameters as a result of digitalizing the pictures of tumor specimens of the skin. To prepare the data to be trained and evaluated by the model data preprocessing techniques, e.g., data normalization and data segmentation, are used. The logistic regression classifier is informed to learn the distinction between benign and malignant tumor using the relevant clinical attributes. This experimental evaluation shows that the proposed model achieves accuracy of classification equal to 97.2% with high values of precision, recall, and F1-score. Results show that logistic regression is a reliable and easy-to-understand tool that can be used in the category of breast cancer. The suggested software model will enable the effective realization of the model as a decision support model in clinical practice to help healthcare professionals in the early detection of breast cancer.

Keywords

Breast cancer diagnosis, logistic regression, machine learning, tumor classification, medical data analysis, clinical decision support, healthcare analytics.

Non-Invasive Microwave Antenna Sensor for Blood Glucose Monitoring

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Abstract

The work contains the design and analysis of an Ultra-Wideband (UWB) antenna to make use of the non-invasive glucose monitoring. The proposed antenna has a broad frequency range and has been designed to have good impedance matching, constant gain, and constant radiation. Such antenna parameters as S11 (return loss), VSWR, total gain, and radiation patterns of the antennas are examined to assess the performance of the antennas. Radiation performance is considered at 3GHz, 5GHz and 8.2GHz, in E-plane and H-plane so as to guarantee a stable signal transmission throughout the UWB spectrum. The first part is the evaluation of antenna performance without biology model to determine the baseline characteristics. After that, a finger phantom model is presented to mimic realistic human tissue contact. Dielectric properties of blood are diversified to portray the glucose level in 50 mg/dL up to 500 mg/dL. The resulting relative-permittivity variation gives significant changes in the S11 response of the antenna. The findings confirm the previously stated hypothesis stating that the suggested UWB antenna will be able to detect changes in permittivity that correlate with changes in the glucose level, which means that the device will be applicable in non-invasive biomedical sensing.

Keywords

Ultra-Wideband Sensing, Non-Invasive Glucose Monitoring, Biomedical Antenna Sensing, Electromagnetic Tissue Interaction, Dielectric Permittivity Variation, Biomedical Microwave Diagnostics, UWB Biomedical Detection.

Experimental Investigation of Light Weight Concrete Blocks using Rise Husk and Fly Ash for Structural Application

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Abstract

The main objectives is to the design of lightweight geopolymer concrete blocks using Rice Husk Ash (RHA) and Fly Ash with different levels of alkaline molarity (8M, 10M, and 12M) to reduce weight while preserving strength. A total of 162 cube samples (70.6 mm × 70.6 mm × 70.6 mm) were made with varying levels of RHA replacement (0-100%) while maintaining a consistent alkaline ratio ($\text{NaOH}:\text{Na}_2\text{SiO}_3 = 1:5.1$) and water-binder ratio of 0.45. The samples were allowed to cure in natural conditions and underwent compressive strength tests at 3, 7, and 28 days. The maximum compressive strength of 41 MPa was attained by all molarity and RHA combinations at 28 days, with an average strength of 35.72 MPa and a standard deviation of 4.23 MPa. The results showed that there was no significant difference between the 8M and 12M molarity values, which indicated that moderate molarity is sufficient for geopolymerization. Finally, the weight loss of 10% approximately did not impact the strength. The results validate the use of RHA-Fly Ash geopolymer concrete as a sustainable, economical, and reliable alternative to conventional concrete in sustainable construction.

Keywords

Geopolymer Concrete, Rice Husk Ash, Fly Ash, Alkaline Activator, Compressive Strength, Molarity, lightweight Geopolymer Concrete.

SAFECIPHER - Secure Web-Based Messaging Platform with Ransomware Detection

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Abstract

The rising popularity of online messaging websites has increased the vulnerability to cybersecurity attacks, especially ransomware that targets sensitive information about its users. Although the current secure messaging systems are mainly concerned with the provision of confidentiality, they do not have in place the characteristic mechanisms to detect the malicious acts in the process of communication. The current paper introduces the SafeCipher online messaging platform, which consists of a secure transmission of messages and a ransomware detector. The system maintains the integrity of messages during communication by ensuring that only authorized users have access to messages. Besides encryption, SafeCipher also tracks user activity and file transfers in order to reveal abnormal behavior patterns. A hybrid detection model is used to uncover suspicious activities, such as high-speed file encryption and unauthorized access, which is also based on signature-based and behavior-based methods. On detecting such activities, the system blocks the process and gives the user a warning to avoid additional harm. Through experimental testing, it is shown that the offered solution can be successfully used to identify the ransomware-related behavior with appropriate stability of the system performance and minimum overhead.

Keywords

Secure Messaging, Ransomware Detection, End-to-End Encryption, Web-Based Security, Anomaly Detection, Signature-Based Detection, Cybersecurity, Secure Communication Systems.

Perspectron - AI Driven Meeting Perspective Analyzer

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Abstract

Perspectron is an AI-powered meeting perspective analysis tool that aims to identify hidden biases, sentiment flows, and unbalanced participation in discussions, debates, and organizational meetings. Collaborative decision-making in the modern context is subject to cognitive bias, speaker dominance, and imbalance in the presentation of ideas. The proposed tool relies on the analysis of the text of the conversation, which can be performed during the conversation or afterwards based on the meeting's protocol. For this purpose, the tool examines the presence of emotional polarization, confirmation bias, a change in sentiment, and an unbalanced amount of ideas' contributions. Fairness and Inclusiveness of Communication are then measured based on the participants' engagement, the tone of the discussion, as well as responsiveness to different ideas using a new measure, the Perspective Index. Functionality of the tool includes the processing of unstructured conversational data into meaningful insights, which are then represented in the form of dashboards to help moderators and teams enhance the quality of discussions and decision-making. The system comprises a combination of transformer models for sentiment analysis, topic modeling, and text summarization developed using Python machine learning libraries. The system is designed to be modular and to be extended to real-time communication tools and to multimodal sources of data, including audio and video, in the future. This paper demonstrates the potential of AI-powered communication analytics to enhance collaboration transparency, inclusiveness, and organizational effectiveness.

Keywords

Artificial Intelligence, Natural Language Processing, Bias Detection, Sentiment Analysis, Meeting Analytics, Explainable AI, Perspective Index, Text Mining, Collaborative Decision-Making, Communication Analysis.

Agri-Neuro: A Context-Aware Plant Disease Diagnosis Framework Utilizing Hybrid Deep Learning and IoT-Driven Environmental Sensing

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Abstract

Plant diseases represent a critical threat to global food security, often necessitating early intervention to prevent catastrophic yield losses. Conventional diagnostic methods, relying heavily on manual expert inspection or standalone computer vision systems, are plagued by subjectivity, high latency, and an inability to distinguish between visually similar pathologies that thrive in disparate environments. This paper proposes *Agri-Neuro*, a novel, integrated framework that synergizes Deep Learning (DL) with the Internet of Things (IoT) for real-time, precision disease diagnosis. Unlike existing solutions that treat visual and environmental data in isolation, our system employs a unique *Context-Aware Weighted Fusion Algorithm*. This mechanism correlates visual symptoms detected via a finetuned ResNet-50 Convolutional Neural Network (CNN) with real-time environmental telemetry (soil moisture, temperature, humidity) to calculate a comprehensive Disease Risk Probabilistic Score (DRPS). Evaluated on a hybrid dataset comprising 54,306 images and 500 field-verified samples, our fusion-based approach achieves a classification accuracy of 96.4%, outperforming standalone EfficientNet-B0 and ResNet-50 models by 2.1% and 4.2% respectively. Furthermore, the system successfully predicts latent infection risks in 89% of test cases where visual symptoms were non-manifest, proving the efficacy of integrating environmental context into disease diagnosis. The proposed architecture offers a scalable, low-cost solution for precision agriculture in resource-constrained settings.

Keywords

Precision Agriculture, Convolutional Neural Networks, Internet of Things, Data Fusion, Plant Disease Detection, Sustainable Farming, ResNet-50, Environmental Sensing.

Real-Time Driver Assistance System for Pot-Hole and Vehicle Hazard Detection

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Abstract

Urban traffic is growing quickly, and road conditions are getting worse, especially with the increasing number of potholes. Together, these issues create serious safety risks for drivers and can cause long-term damage to vehicles. This project introduces a portable, high-performance, real-time driver assistance system that uses deep learning to detect road hazards and nearby vehicles. A mobile device acts as a high-quality visual sensor and connects through a low-latency wired link to a central processing unit that handles data analysis. Built on the YOLOv8 architecture, the system analyzes live video feeds using two models running at the same time: one focused on identifying vehicles and another custom-trained specifically to detect potholes. To maintain real-time responsiveness, the software is optimized with hardware-specific GPU acceleration, allowing fast processing directly on the host machine. Drivers access a modern web-based dashboard that displays visual bounding boxes and provides audio alerts when hazards are detected within a critical distance. Overall, this solution delivers a cost-effective alternative to expensive automotive hardware while significantly improving road safety through accessible and practical technology.

Keywords

Artificial Intelligence (AI), Real-Time Object Detection, YOLOv8 Architecture, Driver Assistance System (DAS), Pothole Detection, Computer Vision, Edge Computing, Low-Latency Streaming, Graphical User Interface (GUI), Road Infrastructure Monitoring.

Digital Society Collaboration Hub – Unified Audio, Video, Chat and Messaging for Education, HealthCare, Governance and Enterprise

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Abstract

The rapid advancement of digital technologies has transformed communication across education, healthcare, governance, and enterprise sectors, increasing the demand for secure and scalable remote collaboration platforms. However, existing systems operate independently within each sector, using separate applications for online classes, telemedicine, government communication, and enterprise collaboration. This fragmentation creates data silos, inconsistent security policies, higher operational costs, limited interoperability, and reduced efficiency, making communication management complex and less effective. To address these limitations, the Digital Society Collaboration Hub is proposed as a comprehensive, unified, and cloud-based communication platform that consolidates audio conferencing, video conferencing, real-time chat, secure messaging, and document sharing into a single integrated ecosystem. Unlike traditional isolated systems, the proposed platform centralizes communication services under one secure infrastructure, enabling seamless interaction across multiple domains without the need for separate applications. The system incorporates advanced role-based access control (RBAC) to ensure that users such as administrators, educators, doctors, government officials, enterprise managers, students, patients, citizens, and employees can access only authorized features and data. The platform is designed with a modular and scalable architecture, allowing sector-specific customization while maintaining a unified backend framework. This modular approach ensures that features required for virtual classrooms, telemedicine consultations, e-governance communication, and enterprise collaboration can be deployed efficiently without compromising system performance.

Keywords

Digital Transformation, Remote Collaboration, Secure & Scalable Platform, Fragmented Systems, Data Silos, Interoperability, Unified Communication, Cloud-Based Platform, Audio & Video Conferencing, Real-Time Chat, Secure Messaging, Document Sharing, Centralized Infrastructure, Role-Based Access Control (RBAC), Modular Architecture, Scalable System, Virtual Classrooms, Telemedicine, E-Governance, Enterprise Collaboration.

Blockchain-Powered Diabetic Retinopathy Detection Using Deep Learning

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Abstract

Diabetic Retinopathy (DR) is considered to be one of the most severe microvascular complications associated with diabetes mellitus as well as a major cause of preventable blindness in people all over the world. Early identification and classification of DR is very important for effective treatment and management of the condition. Unfortunately, current manual screening methods are very labour-intensive, subjective and hard to implement; particularly in low-resource settings. This research describes a new method for detecting diabetic retinopathy that uses blockchain technology, convolutional neural networks (CNNs) trained on public datasets, and generative artificial intelligence (GAI). This method provides secure, explainable, and intelligent support for healthcare decisions. Images of the retina—a type of image used to classify different stages of DR according to the ETDRS scale (Early Treatment Diabetic Retinopathy Study)—are classified into No DR, Mild, Moderate, Severe, or Proliferative DR. Resizing, normalizing, and augmenting the image dataset are the main methods of improving CNN performance on this dataset. The outcomes of each individual image prediction and metadata about the individual patient are recorded on the blockchain using Ganache and smart contracts on a private Ethereum-based blockchain; providing for immutability, transparency, and tamper-proofing of these medical records. The GAI algorithm will also provide each patient with personalized nutrition/lifestyle/prevention recommendations tailored to their predicted DR stage. The purpose of the Flask-supported online application is to integrate the various components so that they work together seamlessly as one complete clinical workflow. The accuracy of an experimental assessment of the overall classification is 92.1% (classification accuracy) and a very high precision/recall/F1-score for all diabetic retinopathy (DR) levels. These findings show that the proposed software increases the accuracy of diagnosing DR, provides secure access to data, and offers patient-centered clinical support and therefore is applicable to routine clinical screening.

Keywords

Diabetic Retinopathy, Deep Learning, Convolutional Neural Networks, Blockchain in Healthcare, Medical Image Analysis, Generative Artificial Intelligence, Secure Medical Records, Clinical Decision Support Systems.

AI-Based Climate Migration Predictor

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Abstract

Climate change has emerged as a major driver of deadly displacement, which has intensified relegation owing to the excessive rainfall, ocean- position increase, famines and cataracts. To the extent that climate-convinced migration patterns can be predicted, the efficient articulation of policies, disaster preparedness, and philanthropic response is pivotal. In this paper, an AI- based climate migration vaticination frame developed using machine literacy modal ways to unpack the linkage between climatic variables and mortal mobility patterns, that is, literal climate data, such as temperature changes, rush scenarios, and extreme rainfall indicators, are being applied together with migration datasets to reveal high-risk regions and vulnerable groups. The suggested model uses the preprocessing of data, point birth, and supervised learning algorithms to read implicit migration flows in different climatic scripts. The findings of the experiments reveal that the model is capable of recording complex and non- linear interdependence among climate variables and migration, which provides reliable prognostications. These problems of this exploration cease to assist policymakers, itineraries and relief agencies in visionary making choices, resource distributions and protracted adaptation solutions in reducing the effects of climate- mediated relegation.

Keywords

Artificial Intelligence, Climate Change, Human Migration, Machine Learning, Predictive Modeling, Climate- Induced Displacement, Data Analytics.

AI-Based Agricultural Waste Management System Using YOLO-Based Deep Learning

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Abstract

Agricultural waste generation has increased significantly with the expansion of modern farming activities, creating serious environmental, economic, and sustainability challenges. Improper disposal practices such as open burning contribute to pollution, health risks, and loss of valuable biomass resources. Farmers often lack access to intelligent tools that help them identify waste categories and determine suitable reuse pathways.

This paper presents an AI-enabled agricultural waste identification and management system that utilizes computer vision and deep learning to automate detection from real-world farm images. The proposed framework employs a YOLO-based object detection model capable of recognizing multiple waste types in complex and mixed scenarios. The model outputs bounding box coordinates, class labels, and confidence values that support accurate interpretation and decision-making.

In addition to detection, the system provides a dual-channel workflow in which farmers receive utilization suggestions and administrators verify requests for collection or resale. By combining artificial intelligence with structured operational coordination, the platform reduces manual effort, improves classification reliability, and promotes sustainable agricultural waste valorisation. The architecture is scalable and suitable for real-world deployment in smart farming ecosystems.

Keywords

Agricultural waste, YOLO, deep learning, object detection, sustainability.

Medibot - A Smart Medication Reminder and Dispensor System

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Abstract

This article introduces Medibot, a smart medication expert system variant, as an example of how Internet of Things (IoT) technology can make healthcare not only more accessible but also more reliable. The very first aim of the system is to administer the correct amount of medication at the right time, thus eliminating the possibility of the user forgetting to take a dose or taking the wrong amount. The first feature that comes to one's mind with Medibot is its user-friendly and easy-to-understand interface which makes it accessible to people of different age groups, a characteristic that is missing in the majority of other intelligent medicine dispensers. Moreover, Medibot provides an Android app that is free of charge and does not require any subscription, or payment for features. Through this application, users can oversee their medication schedules. Set up reminder alerts. As soon as the medicine is dispensed, notifications or SMS alerts are sent without delay. These features enable patients to follow their treatment plans without any feeling of being overwhelmed or confused. The device's design has been heavily concentrated on the aspect of prevention, in particular, a great deal of the product's design focus has been on prevention. Medibot, by limiting medicine access during the preset intervals, facilitates the avoidance of overdose thus helps users to stay away from dangerous side effects. To ensure the system's dependability, testing is carried out daily, and detailed records are maintained for each test. These uninterrupted tests prove that Medibot is capable of executing doses correctly and efficiently while being trustworthy in the long run.

Predictive Analytics for Liver Disease: Enhancing Patient Care Using Data Science

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Abstract

Liver diseases are an issue of significant concern at the global scale and the promptness of the detection and correct diagnosis is crucial in obtaining proper treatment. Conventional approaches to diagnosing are usually intrusive, slow, and subject to human error. This paper presents a solution grounded in evidence, based on the concept of machine learning, and deep learning, to improve the process of liver disease diagnosis and management. Clinical data is structured, as the liver functions study, patient demographics, medical history, and lifestyle are gathered, and then preprocessed and incorporated to train predictive algorithms, such as KNN, Extra Trees, CatBoost, and ShuffleNet. The methods of feature selection find important clinical parameters enhancing the efficiency and interpretability of models. The discussed system is expected to reach high diagnostic accuracy, help in making a timely clinical decision, and minimize the utilization of invasive procedures. The last model has been implemented in simple interface that allows scalable real-time liver health of the patient, allowing healthcare providers to identify patients at an early stage, prioritize risks, and better manage patients.

Detection of Cyberbullying on Social Media using Machine Learning

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Abstract

Social media has greatly impacted the way users communicate and share information globally [1]. Platforms like Twitter and Wikipedia have given users the ability to share comments, opinions, and discussions in real time. Although these have given users a lot of benefits, users of these platforms have become vulnerable to cyberbullying, harassment, and hate speech. Cyberbullying is defined as repeated hurtful behaviors carried out through digital channels to intimidate or emotionally injure an individual. With the production of millions of posts every minute, the traditional approach to addressing these issues manually has become inadequate. Manually, the moderators would be unable to keep up with the huge volume of content, which has led to a delay in the actions taken against these issues, exposing users to more harm. Recent developments in machine learning and natural language processing have given us the ability to automate the detection of hate speech using these technologies, which have proven to be effective in the detection of hate speech. This research aims to develop a real-time automated system that can detect and prevent cyberbullying before it is posted online.

ThreatLens: AI-Based Cyber Threat Detection and Analysis

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Abstract

With increasingly advanced cyber threats, smart security systems are necessary to analyze large volumes of unstructured data generated by security systems. In this paper, we present ThreatLens, an AI-based cyber threat detection and investigation system using Machine Learning (ML) and Natural Language Processing (NLP) techniques for early and proactive cyber threat monitoring. This system uses network logs, system events and textual security reports to detect in real-time anomalous and malicious computer network activities. ThreatLens employs a model-driven approach implemented in a structured analytical pipeline comprising data preprocessing, feature extraction and threat analysis. ML is used to discover behavioral patterns, detect anomalies, improve threat classification accuracy, and reduce false positive rates. NLP is applied to unstructured textual data sources like log messages and security alerts to allow for contextual understanding and semantic analysis of threats and attacks. Our research establishes that ML and NLP methods can lead to a better understanding of attack behavior and aid in decision making. The experimental results show improved threat detection, reduced time taken in threat analysis, and enhanced situational awareness, thus validating the effectiveness of AI-based techniques in the field of cybersecurity.

Keywords

Cybersecurity, Machine Learning, Natural Language Processing, Threat Detection, Anomaly Detection, Security Analytics, Artificial Intelligence.

Expenso: Voice-Based AI-Powered Expense Tracker

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Abstract

Effective expense management has been a challenge despite the availability of many digital tools for the purpose. Most digital tools for expense management are based on manual inputs, inflexible interfaces, and menu-driven systems, which can be non-engaging and non-finance-conscious for users. In order to overcome the limitations of the existing systems, the paper proposes a voice-based AI-powered expense tracking tool called Expenso, which can be used for natural interaction with personal financial information.

The project involves a feature called SpendVoice, which will be a “voice assistant for expenses using AI,” enabling users to access their expenditure data using natural statements. This will be made possible using the capabilities of “Speech Recognition,” which will be used for text extraction, “NLP,” which will be used for the interpretation of users’ statements, and “Text-to-SQL,” which will be used for forming the correct SQL queries to extract all the data as per the users’ statements.

The voice commands are tested in the system for various voice queries, voice accents, and conditions. From the obtained results, it is evident that the accuracy of transcribing voice commands into words for proper intention recognition and SQL query formation is high in the proposed system, thereby enabling fast outputs. The integration of voice-interaction functionality and intelligent financial analysis offered by the Expenso system reduces the effort required to monitor expenses. The paper outlines the capability of voice-controlled systems to make the management of financial transactions of the account simpler.

Keywords

Speech Recognition, Text-to-SQL, Expense Tracking, NLP, Conversational AI, Personal Finance Analytics.

Semantic-Metadata Fusion for Fake News Detection Using SBERT and Multi-Layer Perceptron Models

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Abstract

News articles are published on the internet at an astonishing rate and as a result there is a need for systems to automate the identification of fake news. Most attempts to detect fake news today rely heavily on either handcrafted textual features or metadata-only based methods. Both of these approaches have limitations. Handcrafted textual features are time-consuming to generate and usually do not take into account the underlying semantic structure of the article (i.e., its context), while metadata-based methods often do not have complete contextual representation of the articles. To overcome these issues this study proposes a hybrid approach that uses both an automated method of generating a sentence-level semantic representation of each news article using a Sentence-BERT (SBERT) model and an auxiliary metadata-based representation generated by a Multi-layer Perceptron (MLP). This newly created SBERT-Meta-MLP model was designed to provide both semantic-level content data (from the Sentence-BERT model) and contextual metadata data (from the auxiliary MLP) to improve the ability of an algorithm to discriminate between accurate and inaccurate news articles. The authors evaluated the SBERT-Meta-MLP approach using an extensive test set containing 1,34,198 labelled instances; results show that the SBERT-Meta-MLP method was able to achieve accuracy rates of 83.96% on average, overall accuracy rates were 69.12% and 69.67% respectively for each individual type of MLP (Baseline/Metadata-only). These findings suggest that using a semantic-level contextual representation of news articles significantly improves an algorithm's ability to detect false news articles. The ability of the model to be applied in a variety of resource-intensive situations, and its ability to provide a solid platform on which to build future applications including cross-domain, cross-lingua, and graph based analysis, is made possible by its lightweight architecture and strong feature fusion methodology.

Keywords

Fake News Detection, Sentence-BERT, Metadata Fusion, Multi-Layer Perceptron, Semantic Representation, Misinformation.

Multimodal Detection and Tympanic Cavity Segmentation from Otoscope Images

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Abstract

Otitis Media is a widespread health concern, yet its early detection remains a significant hurdle. When identified incorrectly, it doesn't just linger—it can lead to life-altering hearing loss. The challenge lies in the "look-alike" nature of ear conditions; at first glance, the inflammation of Myringitis can mirror Acute Otitis Media, yet each requires a unique medical response.

In this study, we move away from traditional image processing and introduce a Vision Transformer-based approach to automate ear health assessment. By breaking down otoscopic images into meaningful patches, the model "learns" to see the tympanic membrane much like a specialist does—focusing on global shape and local texture simultaneously. We trained the system to distinguish between five specific classes, ranging from healthy ears and wax obstructions to complex chronic and acute infections. Ultimately, this AI-driven methodology is designed to act as a diagnostic safeguard, helping healthcare providers pin down the exact nature of the disease and intervene before complications arise.

Keywords

Chronic Otitis Media Vision Transformer, Data Efficient Image Transformer, Wideband Tympanometry, High- Resolution Computed Tomography, Medical Segment Anything Model, Multi Layer Perceptron ,Compute Unified Device Architecture.

IntelliGrocer: An AI-Driven Smart Grocery Retail Platform Using Machine Learning

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Abstract

Snackly is a customer-focused app that makes it easier and better to order snacks from local restaurants/family-owned businesses using an online ordering platform. It provides an all-inclusive customer navigation pathway from onboarding & signing into the app, via selecting a store, browsing through their menu, adding items to their cart, checking out, tracking an order, and managing their profile all in one app; therefore, delivering a complete shopping experience from start to finish for customers. Furthermore, the app contains a complete admin backend system to provide business owners with access to real-time order processing, inventory counts, sales analysis, and overall business performance tracking via a role-based access control system. In addition to providing multiple methods for customers to pay for their order (i.e., UPI, debit/credit card, digital wallet, net banking, or cash on delivery), tools are also included that allow the app creators to monitor the applications overall health & performance, including database connections, as well as any performance issues from APIs. Overall, Snackly is a scalable, trustworthy & user-friendly solution designed to connect customers & local vendors while improving overall operational efficiency & facilitating data driven decision making by using data analytic insight.

Keywords

Snack Ordering System, Mobile Application, Online Payment, Inventory Management.

AI-Powered Skin Disease Classifier

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Abstract

Early diagnosis and treatment are important to prevent serious complications, especially in countries with a shortage of dermatologists. In this study, we proposed an artificial intelligence-based, multi-class skin disease classification system using deep learning and transfer learning techniques for different skin diseases in the general population. MobileNetV2 and ResNet50 are pre-trained Convolutional Neural Network (CNN) architectures in this proposed model. They were retrained using publicly available databases of dermatoscopic images such as the ISIC Archive and the HAM10000 datasets. Pre-processing techniques such as resizing, normalization, and data augmentation are applied to the images to build a strong model and overcome the class imbalance problem in dermatoscopic images. For remaining most common dermatological diseases in addition to melanoma classification, the Grad-CAM based visualization demonstrated its capability to explain the predictions and highlight the diseased regions in predicted areas. The model evaluation showed that the classification performance from the scientific model performed better in terms of precision, recall, and F1-score. The trained model is made available as a web application for preliminary screening and teledermatology. The findings may support the development of explainable and reliable AI-assisted dermatological evaluation tools that can aid in diagnosis and decision making.

Keywords

Skin Disease Classification, Deep Learning, Transfer Learning, CNN, Explainable AI, Grad-CAM, Melanoma Detection, Medical Image Analysis.

Fuel Consumption Prediction for Urban Driving in Almaty Using Machine Learning

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Abstract

Correct prediction of fuel consumption is a pillar of sustainable urban logistics but topography condition within a region usually compromises the topology of generalized models. This paper compares the four machine learning models, namely Linear Regression, Random Forest, XGBoost, and Multilayer Perceptron (MLP) in predicting fuel consumption based on vehicle sensor data in Almaty, Kazakhstan. Having a big height gradient in the city, the research incorporates such engineered features as the road gradient and peak-hour indicators. Findings show that XGBoost has the best predictive accuracy ($R^2 = 0.91$) which is a long way better than the predictive accuracy of the linear model. Synthetic Minority Over-sampling Technique (SMOTE) was important, as the Mean Absolute Error (MAE) of high-consumption events was decreased to 1.45 L/100 km (compared to 3.21). Feature importance analysis indicated that the most crucial parameter is the road gradient, which is significant in determining fuel demand in Almaty, as high-consumption events occur. These results offer a guideline to designing localized and energy efficient routing systems in urban areas that have topography challenges.

Keywords

Fuel consumption prediction, machine learning, XGBoost, urban topography, road gradient, vehicle telemetry, SMOTE, sustainable transportation, Almaty, gradient-aware modeling.

DNA-Based Cryptography Model for Lung Cancer Data Security and Biomedical Image Authentication

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Abstract

With the increasing use of digital healthcare systems, the secure storage and transmission of medical images have become a major concern. Lung cancer diagnosis mainly relies on biomedical imaging techniques such as CT scans and X-ray images, which contain highly sensitive patient information. Protecting these medical images from unauthorized access, tampering, and cyber threats is essential for maintaining patient privacy and data integrity. This paper proposes a DNA-based cryptography model to enhance the security of lung cancer biomedical data and image authentication. In the proposed approach, lung cancer images are first converted into binary form and then encoded into DNA sequences using nucleotide representations. DNA-based operations such as complement, XOR, and permutation are applied to encrypt the image data, improving randomness and security. In addition, a hash-based authentication mechanism is integrated to verify the integrity of the transmitted biomedical images and detect any modification during communication. The proposed model aims to provide a secure and efficient framework for protecting lung cancer medical images in healthcare systems. Experimental analysis demonstrates that the method offers strong resistance against common cryptographic attacks while maintaining high data confidentiality and reliability. This approach can support secure medical image sharing in telemedicine and healthcare data management systems.

Keywords

DNA cryptography, lung cancer, Data security, DNA biomedical data encryption, bioinformatics security, DNA encoding, secure image transmission, healthcare data privacy.

Actionable Risk Stratification: A Counterfactual XAI Approach to Lifestyle-Induced NCD Management via Probabilistic Multimodal Fusion

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Abstract

Non-communicable diseases (NCDs), particularly diabetes, cardiovascular disorders, and chronic kidney disease, contribute to nearly 74% of global mortality, presenting a formidable challenge to public health systems. The transition from reactive treatment models to proactive preventive care is currently hindered by the limitations of existing diagnostic frameworks, which often fail to integrate heterogeneous lifestyle data effectively and lack the necessary interpretability for clinical adoption. This paper presents a novel Integrated Explainable AI (XAI) Framework designed for the early risk stratification of lifestyle-induced NCDs. We propose a Probabilistic Multimodal Data Synthesis architecture that synergizes clinical biomarkers (e.g., glucose levels, blood pressure) with behavioral metrics (e.g., physical activity, dietary habits) to construct comprehensive patient profiles. To enhance predictive performance, we introduce an Adaptive Ensemble Inference Engine that dynamically weights base classifiers—XGBoost, Random Forest, and Logistic Regression—based on their confidence intervals for specific patient profiles. Furthermore, addressing the “black-box” nature of advanced AI, we implement a Counterfactual Actionability Module. This module utilizes SHAP (SHapley Additive exPlanations) values not merely for feature attribution, but to generate personalized, actionable lifestyle recommendations (e.g., “Reducing BMI by 2.5 points lowers risk probability by 15%”). Experimental validation on a synthetically stratified dataset demonstrates a state-of-the-art accuracy of 96.2% and an F1-score of 96.1%, significantly outperforming standalone baseline models. This framework effectively bridges the gap between high-precision predictive analytics and practical clinical utility.

Keywords

Explainable AI, Multimodal Data Fusion, Ensemble Learning, SHAP, Counterfactual Analysis, Preventive Healthcare, Risk Stratification.

Intelligent Forest Fire Detection and Spread Prediction Using Spatio-Temporal Models Learning Techniques

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Abstract

Forest fires have become a global emergency due to the environmental effects on the planet and the socio-economic implications for its inhabitants. Furthermore, the risk to human life is also increased in parallel with the environmental devastation that these types of fires create. To respond and mitigate this threat effectively, early detection and proper forecasting of how the fire will spread are necessary.

In this paper, we provide a framework that integrates intelligent approaches to detect Wildfires and forecast their spread using data obtained from various types of sensors and Advanced Spatio-Temporal Deep Learning Models. The proposed method takes advantage of the advanced capabilities of a Ground Based Network of Internet of Things (IoT) Sensors and Satellite/Unmanned Aerial Vehicle (UAV) images to provide a comprehensive real-time monitoring system of the Potential Terrain for the detection and rapid spread of Forest Fire.

For the purpose of fire detection, we designed a Convolutional Neural Network (CNN) architecture capable of identifying fire ignitions with high accuracy based on the Spatial Features extracted from multispectral images. For the prediction of how quickly the fire will spread over time and Space, we created a method of forecasting using a Convolutional Long Short-Term Memory (ConvLSTM) neural network that models both the Spatial and Temporal Characteristics Associated With the Flame Front of Wildfires.

With the information contained in the Multi Source Datasets processed by our system, it generates ongoing Alerts for Immediate fire management agencies and creates Hazard Map Predictive Models for proactive deployment of resources and evacuation planning.

The results obtained from the Experimental Evaluation of both Historical Datasets and Simulated datasets using our System indicate its Robustness and Assuredly Superior Ability to Predict Wildfires and Provide Recommended Actions for Wildfire Management Agencies compared to Traditional Approaches to Wildfire Management. Therefore, this Paper demonstrates the potential of significantly improving the management of Disasters related to Wildfires.

Keywords

Wildfire Detection, Fire Spread Prediction, Spatio-Temporal Deep Learning, ConvLSTM, Internet of Things (IoT), Remote Sensing, Early Warning System.

Smart Helmet with Alcohol Detection and Vehicle Ignition Control

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Abstract

Vehicle safety is a major issue in developing countries, where many accidents happen because of drunk drivers and lack of helmets. This article proposes a Smart Helmet System with alcohol detection and vehicle ignition control to help solve these problems. The proposed system ensures that a vehicle cannot operate if the rider does not have on a helmet or has consumed alcohol. The alcohol detector MQ-3 is installed within the helmet to determine by analyzing the riders breathing alcohol levels. At the same time, the rider wearing the helmet is detected through an IR pressure sensor. The sensor inputs are analyzed by a microprocessor located in the control unit, the processor sends data wirelessly to the vehicle. If the alcohol level is greater than a predetermined amount or the helmet is not being worn, the system prevents the vehicle from igniting, thus eliminating the possibility of operating a vehicle while intoxicated or without a helmet. If the vehicle is in safe conditions the ignition is allowed to function normally, as such providing a smooth, simple operation for the rider. In addition, the proposed Smart Helmet provides enhanced rider safety through real-time monitoring, automatic intervention and failsafe communication between the helmet and vehicle. Additionally, the proposed smart helmet represents a better integrated, less expensive, safer method for reducing incidents related to drunk driving and enforcing helmet use compared to existing methods of safety solutions. The prototype shows high accuracy in detecting alcohol and a fast reaction time to enable ignition control and provide effective, practical applications for two wheel vehicles.

Keywords

Alcohol Sensor, MQ-3, Helmet Detection, Ignition Control, Smart Helmet, Rider Safety, Drunk Driving Prevention, IoT.

AI Driven Sugar Cane Bacterial Wilt Disease Prediction and Management System

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Abstract

Sugarcane is an important agricultural crop, but bacterial wilt disease severely affects its yield and farmers' income. Early detection is difficult because visible symptoms appear only at later stages. This project proposes an AI-driven sugarcane bacterial wilt disease prediction and management system using drone-based multispectral imaging. Drones capture high-resolution images of sugarcane fields in visible and near-infrared bands to identify early plant stress. The collected images are preprocessed and relevant features are extracted. Machine learning and deep learning algorithms, such as Convolutional Neural Networks (CNN), are implemented using Python to classify healthy and infected plants accurately. The trained model predicts disease presence at an early stage and highlights affected regions. Based on the prediction results, the system supports timely disease management actions. The proposed approach reduces manual field inspection, minimizes crop loss, improves yield, and promotes efficient, smart, and precision agriculture practices.

Keywords

AI, Drone, Multi-spectral, Wavelengths, Infrared.

A Deep Learning Approach for Accurate Detection of Epileptic Seizures Using EEG Signals

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Abstract

Epilepsy is one of the most common neurological disorders affecting millions of people worldwide and is characterized by recurrent and unprovoked seizures caused by abnormal electrical activity in the brain. Electroencephalography (EEG) is widely used for monitoring brain activity and plays an important role in the diagnosis of epilepsy. However, manual analysis of long-duration EEG recordings by neurologists is time-consuming and prone to human error. Therefore, developing an automated and reliable seizure detection system has become an important research area in medical signal processing and artificial intelligence. In this work, a deep learning-based framework is proposed for accurate detection of epileptic seizures using EEG signals from the CHB-MIT Scalp EEG dataset. The raw EEG signals are first preprocessed to remove noise using a bandpass filter and are then segmented into fixedlength windows for analysis. The segmented signals are normalized and provided as input to a deep neural network model. The proposed model utilizes a hybrid architecture combining Convolutional Neural Networks (CNN) and Bidirectional Long Short-Term Memory (BiLSTM) networks to capture both spatial patterns and temporal dependencies present in EEG signals. Regularization techniques such as dropout are applied in the network to improve generalization and reduce overfitting. The model is trained using focal loss to address the class imbalance between seizure and non-seizure segments, and the Adam optimizer is used for efficient training. Performance evaluation is carried out using standard metrics including accuracy, precision, recall, F1-score, and confusion matrix. Experimental results demonstrate that the proposed deep learning model can effectively distinguish between seizure and nonseizure EEG segments with high reliability. The developed system has the potential to assist neurologists in automated EEG analysis and contribute toward faster and more accurate detection of epileptic seizures.

Analysis of Business Indicators of an Organization and Development of Interactive Data Visualizations

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Abstract

Contemporary organizations operate within complex data environments characterized by exponential growth in information volume and velocity. The effective utilization of business indicators coupled with sophisticated visualization systems has emerged as a critical differentiator for organizational competitiveness and strategic decision-making efficacy. This research presents a comprehensive analysis of business performance indicators across five organizational dimensions: financial, operational, customer, employee, and market-oriented metrics. Through systematic methodology integrating literature review with practical case study analysis, this study develops an integrated framework for business indicator management and interactive visualization system design. The research demonstrates that organizations implementing comprehensive indicator analysis with modern visualization platforms achieve measurable improvements in decision-making velocity (40%), regulatory compliance efficiency (35%), and operational performance metrics (18-25%). This paper contributes to business informatics and organizational performance management literature by providing both theoretical foundations and practical implementation guidelines for integrated business intelligence systems.

Keywords

Business Performance Indicators, Key Performance Indicators (KPIs), Interactive Data Visualization, Business Intelligence Systems, Decision Support, Data Analytics, Organizational Performance Management, Real-time Dashboards.

UPI Fraud Detection System Using Machine Learning and Deep Learning

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Abstract

Today's world is characterized by the huge prevalence of online transactions—and as such, India's new Unified Payments Interface (UPI) allows for rapid and easy transfers of money via the use of smartphones. This new convenient way to send money provides users with an easy, quick way to send/receive money; however, it has also increased the prevalence of fraud. This research presents a fraud detection system that utilizes deep learning through a Transformer to detect whether or not a UPI transaction is fraudulent. The dataset for this research consists of 2,667 transactions; of the transactions, 80% will be used to train the system and the remaining 20% will be used to test the system. The implementation details of this workflow include loading the data from file, resampling the dataset, one hot encoding, feature scaling, and training the model. The method will also be able to deploy in real-time through the utilization of a Flask-based backend that connects to an API, coupled with the JavaScript frontend. The fraud detection system will take in a set of transaction detail and classify the transaction as either legitimate or fraudulent, alerting the user if the transaction is, in fact, a fraudulent attempt, thereby preventing fraud before it ever occurs.

Optimizing Underwater Acoustic Sensors with Kalman Filtering and Deep Learning for Mining, Fuel, and Marine Applications

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Abstract

Underwater acoustic sensors play a significant role in a variety of marine applications such as environmental monitoring and underwater communication. The paper compares signal processing techniques used to improve the performance of these sensors. We will propose an advanced processing technique using Kalman Filtering and Deep Learning algorithms, namely CNN and LSTM. The Kalman Filter is used for state estimation in noisy environments, while CNN and LSTM are used for feature extraction and sequence modelling, respectively. Our experiments show an improvement of up to 25% in the accuracy of the signal and 30% reduction in noise compared to traditional techniques like Butterworth and Moving Average filters. The results indicate that these advanced techniques significantly enhance the quality of underwater acoustic signals and give robust performance under varying conditions. To extend the study's relevance to mining and fuel industries, we evaluate the proposed techniques on a simulated dataset of seabed mineral acoustic signals, reflecting applications in offshore mineral exploration and oil/gas pipeline monitoring. Results show the CNN-LSTM method maintains its superior performance, achieving 15 dB SNR and 90.2% prediction accuracy, highlighting its potential for enhancing acoustic sensing in underwater mining operations. These findings underscore the applicability of advanced signal processing in both marine and mining/fuel contexts, offering insights for optimizing resource exploration and infrastructure monitoring. This work contributes to optimizing underwater sensor systems and provides valuable insights into the application of modern machine learning techniques in acoustic signal processing.

Major Findings or Key Findings:

- Kalman Filtering with CNN-LSTM enhances underwater acoustic sensors, improving signal accuracy by 25% and reducing noise by 30%.
- The CNN-LSTM method achieves a 15 dB SNR and 90.2% prediction accuracy.

Keywords

CNN, Kalman Filtering, LSTM, Noise Reduction, Signal Processing, Underwater acoustic sensors, Seabed Mineral Mapping, Offshore Mining, Pipeline Monitoring, Acoustic Sensing in Mining, Fuel Explorationg.

EcoTrack: A Smart, User-Centric Platform for Efficient Waste Management

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Abstract

Ineffective waste collection, inadequate waste sorting, and minimal citizen involvement persist in obstructing sustainable waste management in fast urbanizing areas. This document presents EcoTrack, an intelligent and accessible digital platform aimed at transforming waste management with cohesive technological approaches. EcoTrack allows users to arrange waste collection, monitor live status updates, and sort waste into biodegradable, recyclable, and hazardous categories. The system employs smart bins equipped with fill-level sensors and uses geolocation-driven route optimization to improve operational efficiency for waste management agencies. Additionally, EcoTrack delivers analytical dashboards that present insights into waste generation trends, peak disposal periods, and resource distribution, while also encouraging user participation through alerts, awareness functionalities, and community reporting tools. EcoTrack integrates IoT features with data-based decision support, offering a scalable and sustainable framework that decreases operational delays, minimizes overflow occurrences, lowers expenses, and encourages eco-friendly actions among residents—ultimately aiding in cleaner, healthier urban landscapes.

Keywords

Smart Waste Management, Internet of Things (IoT), Smart Bins, Fill-Level Monitoring, Dynamic Route Optimization, Geographic Information System (GIS), Waste Segregation, Cloud Computing, Sensor Networks, Real-Time Data Analytics.

Physics-Informed Bayesian Emulator for Smartphone Product Carbon Footprint Estimation

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Abstract

Smartphone manufacturing accounts for 75–85% of device lifetime greenhouse gas (GHG) emissions, yet manufacturer-verified Product Carbon Footprints (PCFs) remain scarce globally. A complete life cycle assessment typically requires months of supply-chain data preparation, leaving design teams without actionable carbon data. This paper presents a three-layer hybrid emulator combining a physics-based additive baseline, hierarchical Bayesian calibration with literature-anchored priors, and distribution-free Jackknife+ conformal prediction. Calibrated on 23 verified devices, the framework achieves MAE = 5.04 kg CO₂e (LOOCV), R² = 0.848, and 91.3% empirical coverage at a nominal 90% target, while correcting an 8.26 kg CO₂e systematic underbias in the uncalibrated physics factors on the calibration set. Grid decarbonization reduces fleet emissions by 5.3%, whereas increasing device lifetime from 3 to 5 years increases emissions by 12.2% under today's average grid—a rebound effect with direct implications for EU Digital Product Passport longevity policy. Prospective testing on 2024–2025 flagships reveals a 5× MAE increase from supply-chain decarbonization drift, establishing periodic retraining as a necessary operational requirement.

Keywords

Product Carbon Footprint, Bayesian Hierarchical Modeling, Conformal Prediction, Smartphone Lifecycle Assessment, EU Digital Product Passport, SDG 12, SDG 13.

SkillSync: A Smart Student Collaborative Ecosystem for Academic Connectivity Using Flutter and Firebase

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Abstract

SkillSync is an innovative student collaboration platform that combines academic networking, technical knowledge sharing, and project-based collaboration into a single mobile app. While existing platforms separate networking, Q&A support, and project sharing, SkillSync provides a unified ecosystem that is specially tailored for college settings. Therefore, through this platform, juniors can contact seniors, join domain-based technical communities, Q&A support programming-related questions, and collaborate on real-time academic projects. The app is developed cross-platform and is responsive (i.e. it can work on different platforms without having to develop a separate version for each platform) with the help of Flutter and uses Firebase for backend operations that are secure and scalable. Hence, the system can offer real-time synchronization without interruption, cloud storage, and efficient data management. The core functionalities include secure authentication, domain-specific communities, discussion forums, project repositories with version control, and personalized user profiles. Community-driven chat environment is the peer-to-peer learning platform that users may benefit from by asking for clarification of their doubts, involving in collaborative discussions, and furthering their learning. By encrypting data and allowing only controlled access, among other security measures, SkillSync takes care of data security and user privacy. The platform has successfully undergone various tests—unit, integration, and user experience testing—and this is one of its strong points in terms of not only reliability and performance but also usability. Through real-time notifications, the users can always be in sync with the community posts, answers, collaboration invites, and project activities. Giving the students opportunities for interaction, knowledge exchange, and project sharing through its services, SkillSync is here to make the learning process more effective, academic growth more promotable, and collaborative technical culture more buildable in educational institutions. Holistic strategy of student engagement and technical collaboration can greatly influence and transform the academic communication landscape, thereby opening up possibilities for a long-lasting skill-driven learning environment.

Keywords

Student Collaboration, Academic Networking, Flutter, Firebase, Real-time Sync, Q&A Forum, Project Repository, Cross-Platform App, Secure Authentication.

TaskWeave – AI Powered Smart Task Allocation & Workload Balancer

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Abstract

In organizations, task allocation is mostly done manually by the managers and this may lead to skills mismatch, lopsidedness of workload and decreased productivity. The following paper describes the TaskWeave, a smart task management, and workload balancing system that will enhance the efficiency of task assignment in the team. This system takes into account the skills of the employees and the needs of the task along with the present workload prior to suggesting the appropriate team members to be assigned. TaskWeave has a layered architecture that comprises of web-based interface, backend services, and a database layer. The system comes with a secure authentication and role-based access control of the managers and team members. Manager is able to create, assign, and schedule tasks, and a team member is able to see the assigned tasks and update on their progress. The system also takes into account the description of tasks in order to identify the skills that are necessary, and it has a recommendation system to choose the best suited team member. The level of workloads is observed to avoid overloading and equitable distribution of workloads. The system suggested is better at planning tasks, making resources a more valuable use of them, and making decisions that are based on data. The proper work of the authentication, role restriction, task creation and recommendation modules is proved by the experimental validation based on the API testing and the database verification. TaskWeave offers an intelligent and scaled-up means of allocating tasks in an organization.

Keywords

Task Allocation, Workload Balancing, Role-Based Access Control, Task Scheduling, Skill Matching, Recommendation System, Web Application, Backend Architecture, MongoDB, Node.js, Natural Language processing (NLP).

Integrated Logistics Optimization: A Machine Learning Approach to Route Planning and Carbon Footprint Estimation

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Abstract

Courier Route Optimization is a Nationwide Delivery Route Optimization Web Application built to improve the efficiency, accuracy, and intelligence of large-scale logistics and transportation systems. Its main objective is to optimize delivery routes by considering real-time factors such as weather, traffic, accidents, and terrain difficulty, which directly affect delivery time and operational costs. The system is developed using a Flask backend for efficient server-side processing and a MySQL database for secure and scalable data storage. An XGBoost machine learning model is trained on fused datasets to predict delivery efficiency and travel time, enabling optimal route sequencing and reduced delays. To adapt to real-world changes, live APIs provide continuous updates on traffic, weather, and road incidents, allowing dynamic route adjustments. The inter-face includes interactive map visualizations for easy monitoring of optimized routes and key metrics. By combining predictive analytics, real-time intelligence, and interactive visualization, this project delivers a robust and scalable solution for nationwide logistics.

It enables faster and more reliable deliveries, reduces costs and fuel usage, and can be effectively used by logistics companies, e-commerce platforms, and courier services to modernize and streamline their delivery operations.

Keywords

Route Optimization, Random Forest, Carbon Footprint, Traveling Salesman Problem (TSP), Eco-Routing, Green Logistics.

Fake Profile Detection on Social Networking Websites using Machine Learning

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Abstract

The present generation has seen an increase in the use of online social networks (OSNs), which has an impact on people's social lives and motivates them to connect with various social media platforms. Communications, agenda-setting, news generation, marketing, and advertising are just a few of the many jobs that social networks have made feasible. Adding new friends and keeping up with their changes is now easier. Researchers have been studying these online social networks to find out how they affect people. Some bogus accounts are used to promote agendas and disseminate misleading information. Finding malicious accounts is crucial. To find bogus accounts that could trick consumers, machine learning-based methods were used. A comparison model is created after the dataset is pre-processed using a number of Python tools in order to obtain a practical method that is suitable for the dataset. A number of machine learning algorithms recognize attempts to detect fraudulent accounts on social media sites. Based on their capacity for categorization, the algorithms Random Forest, Neural Network, and Support Vector Machines are used to identify fake accounts.

Deep Learning-Based Real-Time Identification of Medicinal Plants Using Plant Parts

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Abstract

This project introduces an AI-Enhanced System for Identifying Medicinal Plants Through Deep Learning techniques supported by AI for generating the information. The AI models are trained to recognise and classify leaf images into medicinal or non-medicinal. A convolutional neural network has been trained on an EfficientNetV2-S with Transfer Learning (fine-tuning) for identification of eight (8) species of plants based on image classification; Aloe vera, Amla, Eucalyptus, Neem, Nelavembu, Rose, Tomato and Tulsi. The dataset used for training includes labelled images of the leaves from these plants. The images were enhanced using data augmentation techniques, such as resizing, rotating and horizontal flipping to improve the generalization of the model. The resultant model yielded a high validation accuracy and has been deployed on a web-based platform developed using the Flask Framework to provide real-time prediction of newly uploaded images. The application is designed to identify if a particular plant is medicinal or not through image classification and to provide the user with additional information about the respective latent characteristics of the specified plants. This includes a medicinal identification with a scientific name, method of objection (intake), pros and cons of use; while for any medicine, once identified as non-medicinal, the application will provide detailed information about any negative or hazardous effects of the leaves from that type of plant that may pose a health risk if consumed. The result of the new system fully demonstrates the success of integrating deep learning models, including Transfer Learning models and intelligent text generation within a web-based framework as a complete system for the user.

Keywords

Medicinal plant identification, deep learning, CNN, Classification.

Plantshield AI: An Integrated Deep Learning and Predictive Analytics Framework for Smart Pest Management and Data-Driven Crop Disease Optimization

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Abstract

Plant diseases and pests ruthlessly impact agricultural production, providing a major dilemma to farmers and overall food security in the world. This paper introduces the approach to smart pest detection and crop disease control called PlantShield AI, which is a deep learning framework. This system uses Convolutional Neural Networks (CNNs) and assesses the architectures, including Manual CNN, XceptionNet, and DenseNet, to run a visual examination of the plant leaf images to detect disease or an infestation. PlantShield AI is also more than just a visual observation identification tool, as it also offers a set of recommendations applicable to enhancing crop health when taking into account environmental and growth conditions. The Django application will provide a convenient platform that allows farmers and other agricultural professionals to post leaf images, get the correct disease name, and be advised on specific prevention and treatment measures. The outcomes of experimental works prove the ability of the model to identify various pests and diseases, which promotes the process of precision farming. The framework helps to minimize losses of crops, promote sustainable agriculture, and allow data-driven choices in contemporary farming.

Keywords

Pest Identification, Plant Disease Detection, Deep Learning, Crop Health Monitoring, Image-based Diagnosis, Smart Farming.

AI-Enabled Online Election Result Dashboard

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Abstract

There is an increased need for the provision of more informed and elaborate analysis whenever the dissemination of election result information takes place. Election result information plays a crucial role in the democratic process. Real-time, AI-assisted tools that support the process of analyzing, interpreting, and understanding information are required. These platforms that are in place currently are mainly descriptive, static, and fragmented. Thus, analyzing the dynamic, contextual, and comprehensive dimensions of the process becomes difficult. This paper presents an innovative idea of creating an AI-driven Online Election Result Dashboard. The idea focuses on giving timely visualization, predicting trends, and providing contextual analysis for the outcome of elections. The platform incorporates information from different data inputs, such as past elections, constituency-based electoral trends, and even data from ongoing counting processes. Dynamic predictive models facilitate decisions and comprehension at different geographical scales and time horizons. This dashboard can keep updating results, observe trend changes over time, and alert against potential results under different electoral scenarios. The proposed model remains based on prevailing theories in electoral and political science studies, thus providing patterns observed from the behavior of real-world citizens during elections. Performance is determined relative to traditional result reporting methods. It is also validated relative to the history of election data. The research findings indicate clear sensitivity to trends, transparency, understandability, lack of ambiguity, and alignment with ethical and responsible AI practices. It shows that the dashboard is indeed feasible in such a way that multiple electoral methods are effective in encouraging well-informed citizen engagement along with the democratic procedure.

Keywords

Election Result, Artificial Intelligence, Predictive Analytics, Real-Time Dashboards, Electoral Trend Analysis, Explainable Artificial Intelligence, Democratic Transparency.

Neighbor Overlay-Induced Graph Attention Network-Driven Battery Management System for Electric Vehicles

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Abstract

Battery Management (BM) in Electric Vehicles (EVs) plays a vital role in ensuring safe operation, extending battery life, and improving overall performance. However, challenges such as inaccurate prediction of battery health, inefficient charge-discharge management, and voltage and temperature fluctuations often result in reduced battery efficiency and reliability. To address these issues, this manuscript suggests an efficient technique for intelligent BM in EVs. The suggested method is termed the Neighbor Overlay-Induced Graph Attention Network (NOIGAN). The primary objective of the suggested technique is to optimize battery performance and extend lifespan while enhancing the reliability and stability of EV battery systems. NOIGAN effectively predicts battery State of Health (SoH), State of Charge (SoC), voltage, and temperature variations, ensuring safe and balanced operation. The algorithm dynamically manages charging and discharging patterns, mitigates thermal and voltage risks, and maintains cell-level balance throughout the battery pack. The method is developed and tested using MATLAB and compared with several existing approaches such as Artificial Neural Network (ANN), Support Vector Machine (SVM), and Spider Swarm Monkey Optimization (SSMO). The suggested NOIGAN demonstrates superior performance, with the lowest SoC Root Mean Squared Error (RMSE) of 0.008, extended battery life by 23.8%, and an improved efficiency of 99.1%, outperforming other existing methods. These outcomes confirm that the NOIGAN-based BM technique provides an intelligent and reliable solution for achieving accurate battery state prediction, safe and balanced operation, and enhanced longevity and performance in EV battery systems.

Panoptivue: An Intelligent Offline Intrusion Detection System Using the BioSentry Facial Recognition Algorithm

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Abstract

As the uses of biometric surveillance systems are becoming more and more crucial in enhancing personal and business security, the conventional facial recognition systems continue to experience issues relating to accuracy, flexibility and ease of use. In order to overcome these costs we introduce Panoptivue, the intelligent and offline system of facial intrusion detection aimed at real-time security and user privacy. The real breakthrough here is our new algorithm: BioSentry, a bespoke facial recognition system that takes the old stand-by of Local Binary Patterns Histograms (LBPH) and up-and-enhances using adaptive multi-frame feature strengthening, and anomaly-mapped comparison principles. BioSentry advancements in intruder differentiation is a significant one, in low-light and diverse-angle usage, providing increased accuracy at lower computational cost.

It will be a Python-based (and OpenCV-based) Panoptivue system that has a friendly GUI developed with Tkinter. It has a one-click face registration, automatic dataset generation, real-time monitoring, logs of snapshot of an intruder, and more sophisticated use (optional enterprise alerting via email). Panoptivue works completely offline, in comparison with the cloud-based models, which guarantees absolute data privacy. In this paper we will explain the design, implementation and evaluation of the system and discuss the performance metrics of BioSentry in comparison with the available open-source approaches. The findings in the paper indicated that Panoptivue (constructed on BioSentry) is a strong, lightweight and viable tool to the needs of security in modern bio metrics-particularly in stand alone set ups with limited resources like homesteads, purely incursive companies or learning institution.

Keywords

Biometric surveillance, facial recognition, intrusion detection, BioSentry, Local Binary Patterns Histograms (LBPH), adaptive multi-frame feature strengthening, anomaly-mapped comparison, real-time security, low-light performance, diverse-angle detection, Python, OpenCV, Tkinter GUI, face registration, dataset generation, real-time monitoring, intruder snapshot logging, offline system, data privacy, enterprise alerting, performance evaluation, lightweight security system, stand-alone setups.

Automatic Attendance Logging Using Face Recognition Technology

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Abstract

Manual attendance methods take a lot of time and often lead to mistakes, including proxy attendance. To avoid these issues, this project introduces an AI-powered system that automatically marks attendance using facial recognition. The system uses MTCNN to detect faces accurately and FaceNet to convert each face into a unique numerical pattern called an embedding. Because of this, it works well even if lighting, angle, or distance change. To make the system more reliable, a threshold-tuning method and a minimum detection rule were added. These help reduce wrong identifications and improve overall accuracy. The system analyses classroom videos, identifies students automatically, and prepares a final attendance report showing who was present and absent. By removing manual work, this solution saves time, reduces staff workload, and can easily be used in schools, colleges, and offices. The final results show that the system is dependable, secure, and practical for real-world smart attendance management.

Exploring Cloud-Based DDoS Detection through Hybrid Feature Selection and Deep Reinforcement Learning

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Abstract

Distributed Denial of Service attacks continue to trouble cloud platforms, perhaps more than many system designers initially expected. The promise of elastic resources and on-demand scaling sounds reassuring, yet in practice these same features often make detection harder rather than easier. Traffic volumes fluctuate constantly, workloads shift, and the boundary between normal and malicious behavior is rarely clean. Conventional intrusion detection systems, whether based on fixed signatures or standard supervised learning, tend to struggle once attack patterns drift away from what they were trained to recognize. Against this background, the present work explores whether deep reinforcement learning can offer a more adaptable response. The focus is on actor-critic methods, specifically TD3, DDPG, and A2C, applied to real-time DDoS traffic classification in cloud settings. Rather than feeding the models every available feature, a hybrid selection process is used. Boruta helps filter out weak signals, SHAP offers insight into what the models actually rely on, and a stability check guards against features that only work once. The framework is evaluated using CICDDoS2019 and UNSW-NB15, with cross-dataset testing to see how well the approach holds up outside familiar territory. The results lean consistently toward TD3. It reaches an accuracy of 99.12 percent and an AUC of 99.21 percent, while still responding quickly enough to matter in practice. Ablation experiments suggest that the preprocessing and feature selection steps are doing real work, not just adding complexity. Taken together, the findings suggest that actor-critic reinforcement learning, especially TD3, deserves serious consideration as a practical alternative to more static cloud intrusion detection systems, even if it is not a complete solution on its own.

Keywords

DDoS detection, Cloud security, Deep reinforcement learning, Hybrid feature selection, Actor-critic algorithms, Real-time network monitoring, Intrusion detection systems.

Device-Adaptive Secure File Deletion for HDD and SSD Storage Systems

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Abstract

Secure erasure of digital data remains a major challenge in light of continuous advances in storage technology and forensic recovery methods. Conventional file deletion fails to ensure true removal from both hard disk drives (HDDs) and solid-state drives (SSDs), leaving confidential information at risk of unauthorized recovery. Recent research underscores the effectiveness of multi-pass overwriting for HDDs but highlights significant limitations for SSD sanitization, recommending the use of cryptographic erasure, TRIM, ATA Secure Erase, and adaptive, workload-aware techniques. In this work, we present the design, implementation, and validation of a Secure File Deletion Tool for Windows that integrates automated storage type detection and best-practice adaptive sanitization based on the latest literature. Our tool conducts rigorous, workflow-tailored erasure validated with comprehensive logging and forensic analysis, thereby achieving compliance with modern standards and guaranteeing practical, reliable unrecoverability of deleted data across diverse storage devices.

Keywords

Secure deletion, HDD, SSD, data sanitization, cryptographic erasure, TRIM, overwriting, ATA Secure Erase, forensics.

Reliability and Calibration Analysis of Bayesian Models under Extreme Low-Resource Tabular Learning

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Abstract

Reliable uncertainty estimation is critical for tabular machine learning systems when they are used under data scarcity. However, most existing evaluations focus primarily on predictive accuracy and assume access to large labeled datasets, leaving model reliability in low-resource settings insufficiently understood. In this work, we study predictive calibration and uncertainty behavior in extreme low-resource tabular learning scenarios, where models are trained using only 25–100 labeled samples.

A controlled subsampling-based evaluation protocol is employed on large real-world tabular datasets to ensure stable and representative test distributions. Deterministic Logistic Regression is compared with Bayesian Logistic Regression trained via variational inference across multiple random low-resource training subsets. Our results show that predictive accuracy saturates quickly and is largely insensitive to both training set size and modeling choice. In contrast, Expected Calibration Error remains consistently high and varies substantially across different training subsets. Although Bayesian inference reliably reduces overconfidence compared to deterministic models, the improvement is modest and unstable, and well-calibrated predictions are not achieved even with 100 labeled samples.

These findings indicate that accuracy alone is an inadequate evaluation criterion in low-resource tabular data settings and that Bayesian modeling by itself does not ensure reliable uncertainty estimation under extreme data scarcity.

Keywords

Bayesian learning, calibration, low-resource learning, tabular data, uncertainty estimation.

A Survey on Lung Cancer Detection Using Medical Imaging and Artificial Intelligence

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Abstract

Lung cancer is a leading cause of cancer-related mortality worldwide, primarily due to late-stage diagnosis. Early detection significantly improves survival outcomes. This paper provides a comprehensive survey of lung cancer detection techniques using medical imaging and artificial intelligence from 2021 to 2025. We review conventional machine learning approaches, deep learning models, public datasets, preprocessing and feature extraction techniques, evaluation metrics, challenges, and future research directions. Deep learning-based methods have demonstrated superior performance and potential for clinical integration.

Keywords

Lung cancer, Computer-aided diagnosis, Deep learning, Medical imaging, CT, PET, PET-CT.

Design and Implementation of Monopole Wideband Antenna

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Abstract

This paper discusses the design and implementation of a monopole wideband antenna with fractal petal design for multiband wireless applications. The distinct floral pattern produces multiple resonant modes and current paths while increasing bandwidth compared to traditional rectangular patches. The proposed antenna comprises a planar structure with microstrip line feeding on a dielectric substrate. The electromagnetic simulations indicate that it can be utilized for applications involving Wi-Fi, Bluetooth, IoT, and RF energy harvesting providing compact size, low profile, and suitability for applications with portable devices.

Performance of Fresh and Stained (Delayed Casted) Fiber Reinforced Roller Compacted Concrete Partially Replaced with Processed Bagasse Ash for Different Time Lag Periods

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Abstract

Roller compacted concrete (ROCC) for pavement is a comparatively new engineering, construction material. this has potential cost/benefit advantages not identifiable with conventionally placed portland cement concrete for rural road. It is very difficult to cast the whole structure monolithically and also the construction joints are very important in the structure for the expansion and contraction of the concrete. Stained concrete is the concrete which is not cast immediately after mixing. due to open air exposure the workability and strength of concrete is reduced. Such material should be discarded and should not be used for strength purpose and considered as waste. this paper aims to evaluate comparative performance of the M40 grade freshly compacted and stained ROCC with time lag of 0, 45, 90, 135, and 180 minutes with and without the addition of retarding admixture to achieve proper compaction and desired target strength at 28 and 56 days of curing taking into account initial and final setting time of concrete by penetrometer. furthermore, a pozzolanic material, processed bagasse ash (PBA) is used as a partial replacement with variation of 15%, 30% and 45% by cement weight and polypropylene fibres (PPF) at 0.25%, 0.50%, and 0.75% by volume fraction were used. As the use of 30% processed ash along with PPF and retarders increases the setting time of concrete and partially set concrete shows good compaction and attained designed compressive and flexural strengths.

Keywords

ROCC, Retarding admixture, Stained concrete, PBA, PPF, target strengths.

Economy, People, Process, and Technology Dimensions in a Green IT Strategy Implementation

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Abstract

Green IT (Information Technology) is the study of creating and implementing strategies to reduce the carbon footprint of the Information and Communication Technology sector. It is stated that the ICT sector produces around 2% of the global carbon emissions which is approximately 730 million tons CO₂, as such enterprises must be encouraged to integrate green IT strategies; Enterprises adopting green IT strategies is not only beneficial for the environment but also for the organization itself. This paper aims to investigate the framework that organizations can use to effectively integrate environmental considerations into their IT strategies, considering four critical dimensions: economy, people, process, and technology.

Keywords

Green IT, Information Technology, carbon footprint, environmental considerations, Information and Communication Technology sector (ICT), sustainability, organizational strategy, economy, people, process, technology.

Distracted Driver Detection

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Abstract

Software-Defined Networking (SDN) offers centralized control and flexible network management by separating the control plane from the data plane. While this architecture improves scalability and programmability, it also introduces serious security challenges, as the centralized controller becomes a critical target for cyber-attacks such as Denial of Service (DoS), Distributed Denial of Service (DDoS), port scanning, and botnet activities. Traditional intrusion detection systems often fail to address these challenges effectively due to limited adaptability, high computational overhead, and lack of real-time response mechanisms.

This paper proposes a flow-based intrusion detection system for SDN environments using supervised machine learning techniques with real-time alert generation. The proposed system leverages statistical flow-level features, including packet counts, flow duration, byte rates, and protocol information, to classify network traffic as benign or malicious without relying on deep packet inspection. Multiple machine learning models are trained and evaluated, among which the Random Forest classifier demonstrates superior detection performance with high accuracy and low computational complexity.

The system is deployed as a Flask-based web application that supports both single-flow prediction and bulk traffic analysis using CSV files. Additionally, an automated real-time email alert mechanism is integrated to immediately notify network administrators upon detecting malicious activity, enabling prompt incident response. Experimental results indicate that the proposed approach achieves reliable intrusion detection while maintaining low overhead, making it suitable for real-world SDN security deployment.

Accuracy is Not Stability: An Empirical Robustness Study of Learning-To-Rank Models

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Abstract

Learning-to-rank (LTR) models are commonly evaluated using relevance-based metrics such as Normalized Discounted Cumulative Gain (NDCG) and Mean Average Precision (MAP). While these metrics capture aggregate ranking quality, they provide limited insight into the stability of document ordering under small feature perturbations. In this work, we present a systematic empirical robustness study of tree-based LTR models under controlled feature perturbations. Using two standard benchmarks, MSLR-WEB10K and MQ2008, and two widely adopted models- LambdaMART and XGBoost Ranker-we analyze how relevance metrics and ranking stability respond to additive Gaussian noise. Across datasets, folds, and models, we consistently observe an accuracy-stability mismatch: relevance metrics degrade gradually, while ranking order exhibits substantial instability even under small perturbations. These findings highlight limitations of conventional evaluation practices and motivate stability-aware analysis for learning-to-rank systems.

Keywords

Learning to Rank, Robustness, Ranking Stability, LambdaMART, XGBoost, NDCG.

Transplant Track: A Life Link for Real-Time Organ and Blood Availability Intelligence Monitoring System

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Abstract

The Speed is a necessity in emergency cases, but patients and family members tend to waste so much time trying to find hospitals in which they can get the necessary blood units or transplant organs. This can be life threatening given that critical situations can be transformed into life threatening situations by this delay that is brought about by fragmented and unreliable systems. We propose to solve this problem by introducing Life Link, a Real-Time Organ & Blood Availability System, which will serve the purpose of filling the gap that exists between the hospitals and the patients to provide them with timely and trusted information when it is required the most. Under this system, hospitals can safely replenish their existing stock of necessary materials like blood, kidney, liver and corneas and an authorizer verifies every hospital to have authenticity and reliability. Within seconds, patients and relatives can check availability, check only certified hospitals and place the most pressing requests.

Keywords

AI Life Link, Hospitals, Blood, Organs, Transplant, Health Care, Availability, Verification, Real-time Tracking.

Lightweight Ensemble Based Intrusion Detection Model for Smart IoT Systems

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Abstract

The “internet of things (IoT)” devices are widely used in various industries, which is very convenient to the lives of people. The use of IoT equipment on a large scale has made safeguarding of these systems against cyber-attacks a priority issue to lecturers. The IoT platforms possess limited computing capabilities and storage, which comes with inadequate security and with enhanced vulnerability to malwares and tools attacks. The existing IoT-based intrusion detection systems either identify specific malicious intentions best or require complex models and massive processing capacity to attain high detection rates. The datasets used in this have a look are BoT-IoT, MedBIoT, and MQTT-IoT-IDS 2020. We use a fairly large number of algorithms, such as DT, RF, KNN, XGBoost, DNN, CNN, advanced methods of ensemble, such as Stacking Classifier (DT + RF with LightGBM) and CNN + LSTM. The Stacking Classifier had the highest overall performance, more accuracy, more precision, more recall and higher F1 score. The Stacking Classifier achieved 100 per cent accuracy in BoT-IoT and MedBIoT and 92.3 per cent accuracy in MQTT-IoT-IDS 2020, which is a significant advance in overcoming the resource limitations of IoT intrusion detection. The method provides a simplified and efficient way of improving the security measures of IoT devices.

Keywords

Attack process analysis, Internet of Things (IoT) malware, machine learning (ML) algorithms, network traffic classification, semantic-level features.

Intelligent IoT-Based Secure Monitoring and Alert System

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Abstract

The Internet of Things (IoT) has become a crucial technology for real-time monitoring and automation in smart environments. However, most IoT systems are vulnerable to weak authentication, insecure communication, and unauthorized access. This paper presents an Intelligent IoT-Based Secure Monitoring and Alert System designed to ensure continuous surveillance, secure data transmission, and instant alert generation. The system integrates ESP32 microcontrollers with various sensors (PIR motion, temperature, gas, and smoke) and uses MQTT over SSL/TLS for encrypted communication. The data collected are transmitted to Firebase Cloud and visualized in a React-based web dashboard. The dashboard provides role-based authentication, real-time alerts via SMS and email, and an interactive interface to monitor device logs and anomalies. The proposed solution significantly improves the integrity of the IoT data, enables real-time situational awareness, and supports scalability in smart homes, industries, and healthcare environments.

Deep Learning-Based Pre-Manufacturing Feature Recognition of Splined Shafts Using CAD-Rendered Images

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Abstract

Early identification of manufacturing features at the design stage plays a vital role in improving process planning and reducing downstream production errors. This paper presents a pre-manufacturing feature recognition framework for splined shaft components using deep convolutional neural networks, namely ResNet-18 and EfficientNet-B0, trained on CAD-rendered images. The proposed approach focuses exclusively on the design phase and does not rely on shop-floor measurements or sensor data. A representative splined shaft geometry incorporating key manufacturing features external splines, threaded end sections, cylindrical shafts, shoulders, and central bores was parametrically modeled. A dataset of 1500 synthetic CAD-rendered images were generated under controlled conditions using uniform metallic appearance, diffuse lighting, plain backgrounds, and blur-free settings to emphasize geometric characteristics. The dataset was divided into 70% training, 15% validation, and 15% testing sets. All experiments were implemented using MATLAB R2021a with the Deep Learning Toolbox. The images were resized to 224×224 pixels, and the networks were fine-tuned using the Adam optimizer with a learning rate of 0.001, a mini-batch size of 32, and 30 training epochs. Experimental results indicate that ResNet-18 achieved an average feature recognition accuracy of 94.2%, while EfficientNet-B0 achieved 95.6% accuracy with reduced computational complexity. The proposed framework enables reliable recognition of manufacturing-relevant features prior to physical production, supporting computer-aided process planning (CAPP) and Industry 4.0-oriented pre-manufacturing intelligence.

Keywords

Feature Recognition, CAD-Rendered Images, Convolutional Neural Networks, Computer-Aided Process Planning (CAPP).

Rear-End Collision Safety Detection Using Air Bag System

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Abstract

The safety of roads has become a pressing concern with increasing numbers of accidents occurring everywhere throughout the world. Among those, rear-end collisions form a notable percentage of accidents and tend to cause serious injuries among passengers. Conventional airbag systems are primarily designed for frontal impact safety, and hence passengers are exposed in case of rear-end crashes. To combat this issue, the current project introduces a Rear-End Collision Safety Detection System on the basis of an Airbag Mechanism. Piezoelectric sensors are mounted on the rear seatbacks in the system and employed to sense sudden impact forces due to rear-end collisions. The output of the sensors is fed into an Arduino Uno microcontroller, which serves as the controller. The controller, upon detection of an impact that exceeds a specified threshold value, deploys an airbag deployment system installed inside the seatbacks. A stepper motor system has been incorporated to simulate and exhibit the inflation and operation of airbags. The innovative design has the capability of minimizing injuries to passengers through the support of an additional rear-protection airbag, which further enhances existing frontal safety features. Unlike conventional airbags, that only come in handy for frontal crashes, this system enables overall passenger safety during rear crashes. The proposed model also focuses on low-cost implementation of hardware and real-time collision detection, hence can be employed in the use of current-day cars. With the improved rear-end crash safety system, the project contributes to enhanced passenger safety and reduced road accident fatalities.

Keywords

Arduino Uno, Piezoelectric Sensor, Stepper Motor, Airbag System, Rear-End Collision Detection.

Zenith Enrollment Navigation for Integrated Experience (ZENIX): An Advanced Attendance and Assessment Monitoring System

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Abstract

The Zenix Attendance System is an advanced, multi-layered attendance management platform designed for educational institutions, integrating biometric authentication, GPS and WiFi based location validation and AI- driven analytics. Zenix addresses the critical challenge of proxy attendance and fraud, which accounts for up to 85% of attendance disputes in traditional systems by implementing a robust security architecture that combines 4 phase liveness detection, device specific WebAuthn, and dual mode location checks. In comparative studies across 20+ existing solutions Zenix achieved a 99.7% attendance accuracy rate, reduced proxy attendance by 85% and improved administrative efficiency by 78%. The system supports seamless integration with LMS and SIS platforms, delivering real time analytics and automated compliance reporting. User adoption rates reached 99.3% among students and 98.7% among faculty, with a satisfaction score of 9.2/10. Zenix's multi factor authentication and AI powered anomaly detection set new standards for security, reliability and user experience in attendance management. The platform's paperless operations and energyefficient design contribute to a 95% reduction in paper usage and a 78% decrease in carbon footprint. These results demonstrate Zenix's transformative impact on educational administration, establishing it as a benchmark for secure, scalable and data driven attendance solutions.

Keywords

Attendance management, biometric authentication, liveness detection, GPS validation, WiFi validation, AI analytics, fraud prevention, educational technology, user adoption, environmental impact.

Assessing the Potential of Blue Carbon Credits in India: Ecological, Policy, and Governance Dimensions

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Abstract

Coastal ecosystems such as mangroves, seagrass meadows, and tidal marshes store large amounts of carbon. They lock carbon in plant matter and in deep sediments, this storage gives them a huge role in climate change mitigation. Researchers often describe these systems as blue carbon ecosystems. Carbon markets now link them to blue carbon credits. These credits place monetary value on avoided emissions and long-term carbon storage. This paper studies the prospects for blue carbon credits in India, it focuses on ecological capacity, policy rules, market readiness, and governance limits. The paper reviews India's main blue carbon ecosystems and current carbon trading efforts. It also identifies gaps in law, institutions, and administration. These gaps affect project approval, monitoring, and credit claims. A case study of the Sundarbans mangrove system shows both promise and risk. The findings show strong natural and social potential for blue carbon markets in India. There are still barriers that limit progress, carbon ownership remains unclear and market actors question credit quality and trust. The paper closes by setting out policy steps for blue carbon credit development in India. These steps focus on clear standards, transparent rules, and protection for local communities.

An Efficient Deep Learning Approach for Automated Garbage Classification

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Abstract

The rapid increase in solid waste production associated with urban growth and changing consumption habits continues to place pressure on solid waste management systems, necessitating precise and automated garbage classification. Proper separation of wastes (paper, plastic, metal, carton, organic, and mixed) is also important for enhancing recycling efficiency along with sustainable waste management. Deep learning methods applied in image-based garbage classification are also promising; however, the existing methods have certain limitations, such as class imbalance, less generalization, high computational requirement, and weak interpretability. In this paper, we build an effective and interpretable Deep-learning-based garbage classification model using ConvNeXt. The model we propose utilizes the concept of transfer learning to identify discriminative visual features while providing a good trade-off between accuracy and computational complexity. To mitigate class imbalance, we used class-weighted loss with label smoothing, which in turn leads to a more stable training and better minority class recognition. The generalization of the model is partially improved by extensive data augmentation and two-stage training. The framework is tested on a combined dataset containing various waste images from different sources. Extensive experimental studies confirm the robustness of the proposed approach, achieving 98.15% accuracy and a macro F1-score of 0.9816. When evaluated against established baseline models and recent advanced techniques, the proposed method consistently delivers improved classification performance. Additionally, the decision-making process of the model is also visualized by Grad-CAM, so that the transparency and reliability of the model are enhanced. The outcomes demonstrate that the proposed method is very promising for real-world waste management and can really enhance intelligent recycling systems.

Keywords

Garbage Classification, Deep Learning, ConvNeXt, Transfer Learning, Label Smoothing, Grad-CAM, Image-Based Waste Sorting.

Electric Vehicle Charger with Interleaved Converter

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Abstract

The increasing adoption of electric vehicles (EVs) has been demanding advanced charging solutions that prioritize efficiency, reliability, and scalability. The EV charger is based on two stage power converter which include rectifier (AC – DC conversion) followed by DC-DC converter. EV chargers deploy buck, boost or buck converters. Conventional boost converters, while widely used, face limitations in high-power EV charging due to higher current ripple and efficiency degradation. This paper presents an interleaved boost converter (IBC) topology for EV charging applications, with phase-shifted parallel operation to mitigate high current ripples and improve efficiency. By distributing current across multiple phases, the IBC significantly reduces input current ripple, minimizes inductor losses and enhances thermal management. Results demonstrate a peak efficiency of 96%, as well as reduction in current ripple compared to conventional designs. Furthermore, the IBC's modular structure supports scalability for higher power demands and seamless integration with renewable energy systems. These attributes underscore the converter's suitability for fast-charging infrastructure, offering reduced electromagnetic interference, extended component lifespan and robust grid compatibility.

Integrated Logistics Optimization: A Machine Learning Approach to Route Planning and Carbon Footprint Estimation

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Abstract

Courier Route Optimization is a Nationwide Delivery Route Optimization Web Application built to improve the efficiency, accuracy, and intelligence of large-scale logistics and transportation systems. Its main objective is to optimize delivery routes by considering real-time factors such as weather, traffic, accidents, and terrain difficulty, which directly affect delivery time and operational costs. The system is developed using a Flask backend for efficient server-side processing and a MySQL database for secure and scalable data storage. An XGBoost machine learning model is trained on fused datasets to predict delivery efficiency and travel time, enabling optimal route sequencing and reduced delays. To adapt to real-world changes, live APIs provide continuous updates on traffic, weather, and road incidents, allowing dynamic route adjustments. The inter-face includes interactive map visualizations for easy monitoring of optimized routes and key metrics. By combining predictive analytics, real-time intelligence, and interactive visualization, this project delivers a robust and scalable solution for nationwide logistics.

It enables faster and more reliable deliveries, reduces costs and fuel usage, and can be effectively used by logistics companies, e-commerce platforms, and courier services to modernize and streamline their delivery operations.

Keywords

Route Optimization, Random Forest, Carbon Footprint, Traveling Salesman Problem (TSP), Eco-Routing, Green Logistics.

Thermal and Structural Analysis for Turbine Engine Blades at Maximum Temperature

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Abstract

Turbine engine blades are very critical to the gas turbine, heavily used in modern aviation and power generation. In extreme environmental conditions wherein they have to work, rotational speed conditions can run over 1500°C. It is the capability of these blades to be in a structurally sound state as well as ensure efficiency that would dictate performance, efficiency, and life in the overall gas turbine.

The advancement of technology at a faster pace is causing lots of turbulence to the turbine engines due to the rigorous demands it has on their part from the aeronautical and energy sectors. Moreover, within various industries, there is an ever-increasing pressure to make more fuel-efficient engines with a lesser rate of emission, and in so doing, it indirectly increases the thermal and mechanical load in a turbine blade. Under such conditions, it is obvious that there exists a need for comprehensive thermal and structural analysis of turbine blades under maximum temperature conditions. Understanding the response to such high temperatures provides very important means for improvement in the design and composition of material for such blades.

This research project was to further understand the thermal and structural response in a turbine engine blade, subjected to the most extreme temperature conditions. New understanding from this research would form the basis of newly developed strategies for optimization in blade designs, material selection, and cooling techniques to enhance both performance and durability.

Voice Based Biometric Authentication and AI Assistant for Secure Desktop Operations

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Abstract

As more people and businesses use desktop computers, the need for secure but easy-to-use authentication methods has grown. Passwords, PINs, and static biometric checks are common security measures, but they often have problems with usability, replay attacks, and not enough real-time protection. This paper introduces Project, a multi-modal security framework that integrates voice-based biometric authentication, facial verification, liveness detection, and an AI-driven voice assistant to facilitate secure desktop access and ongoing authentication. The suggested system uses deep neural speaker embeddings for strong voice verification, face recognition with active liveness analysis to stop presentation attacks, and adaptive score-level fusion to make authentication more reliable when the input changes. An embedded AI voice assistant also lets you interact with the device without using your hands while making sure that access control and secure command execution are based on the context. The system has performance-enhancing features like smart response caching, model warm-up strategies, and streaming-based verification to make it work in real time with low latency on desktop computers with limited resources. A thorough experimental evaluation shows that multi-modal authentication is 98.75% accurate, that response latency has been greatly reduced, and that the system is better able to withstand spoofing and replay attacks.

Keywords

Voice Biometrics, Multi-Modal Authentication, Desktop Security, AI Assistant, Liveness Detection, Secure Systems.

EYESPY: Smart Surveillance System Using AI and Computer Vision

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Abstract

The modular AI-driven surveillance framework presented in this study makes advantage of low-cost edge technology to enable real-time detection of unattended items, human intrusion, and restricted-zone infractions. The suggested system integrates a number of state of the art computer vision components, including YOLO-based object detection for recognizing persons and things, ByteTrack-style multi-object tracking for stable identification association, and polygon-based zone mapping for spatial rule enforcement. A temporal analysis module monitors object ownership and inactivity to accurately identify abandoned items while lowering false alarms. To facilitate realistic deployment and ensure efficient performance under constrained computational resources, the system is developed on a Raspberry Pi platform using lightweight optimization and edge inference techniques.

The following are keywords for the paper: Smart Surveillance System, Artificial Intelligence, Computer Vision, YOLO Object Detection, Multi-Object Tracking, Intrusion Detection, Restricted Zone Monitoring, Unattended Object Detection, Raspberry Pi, IoT Alerts, Edge Computing, Real-Time Video Processing, Deep Learning, Automated CCTV Monitoring.

Compact Deployable Turret with Autonomous Tracking

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Abstract

Security systems today must provide quick and accurate results while managing various operational environments. This project develops an automated non-lethal turret system that operates from a suitcase base, allowing for rapid deployment for smart security applications. It features a cable-based platform elevation. The system uses an ESP32-CAM as the main processing and vision unit to perform real-time motion detection and object tracking. It includes a dual servo-driven pan-tilt mechanism that keeps the target aligned once detected. A low-power laser pointer indicates safe visual targeting. The turret system features a custom briefcase design that allows manual deployment and raising of the turret platform, making it easily ready for operation. It enables autonomous operation and reduces the need for human monitoring through its operational modes. Its non-lethal and compact design makes it suitable for security, training, and crowd control applications. This project illustrates a small-scale version of the vision of the project.

Keywords

Autonomous Tracking, ESP32-CAM, Embedded Vision, Portable Turret System, Non-Lethal Surveillance, Pan-Tilt Control.

Revocable Storage Identity-Based Encryption for Secure Data Sharing in Cloud Computing: A Comprehensive Review and Analysis

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Abstract

The rapid growth of cloud computing and its wide range of services has significantly increased concerns related to data security, particularly in the areas of fine-grained access control and secure data sharing. Conventional encryption approaches, including public key-based methods, often struggle to meet the scalability and key management demands of cloud-based environments. To address these limitations, Revocable Storage Identity-Based Encryption (RS-IBE) has gained considerable attention as an effective cryptographic solution. By combining identity-based encryption with efficient revocation mechanisms, RS-IBE enables improved flexibility and stronger security guarantees for cloud storage systems.

This paper presents a comprehensive survey of existing RS-IBE schemes, examining their security models, functional characteristics, and operational constraints. The analysis highlights how RS-IBE supports fine-grained mandatory access control, reduces the complexity of user key management, and enables timely revocation of user access—features that are essential for secure data sharing in distributed cloud infrastructures. Despite these advantages, several challenges remain, including key escrow issues, protection of user privacy, and increased computational costs, particularly in environments with limited resources. In addition, a comparative evaluation of representative RS-IBE schemes is provided using performance indicators such as encryption and decryption efficiency, revocation delay, and scalability. The paper further explores current applications of RS-IBE in domains such as healthcare information systems, Internet of Things (IoT) networks, and e-governance platforms, and concludes by outlining potential research directions aimed at overcoming existing limitations and enhancing the scalability of RS-IBE solutions.

Keywords

Cloud computing, Data sharing, Encryption, Privacy, Revocation, Security.

Predicting Autism Spectrum Syndrome Employing Explainable BI-LSTM

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Abstract

Autism Spectrum Syndrome (ASS) challenges in social communication, interacting with others, where a person faces often shows repeated or fixed patterns in their behavior, interests, or daily activities. For this, publicly available dataset from Kaggle which contains details like age, answers to some basic questions, and a score based on them are used. The unique part of this work is that it combines both traditional ML models with DL models for better accuracy. The main motive of Bi-LSTM is it reads the input data in both directions from past to future and from future to past. This model understands the data better, especially when certain patterns in the data depend on what happened before and after a specific point. This is really helpful when predicting autism, where behavior patterns might not just depend on the past but also on surrounding factors.

Food Nutrition Risk Assessment Using Edge Computing

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Abstract

Food Nutrition Risk Assessment using Edge Computing Abstract Maintaining a watchful eye over our food intake is a vital part of preventive health care. This is particularly important in a country like India, where foods vary significantly in appearance even within a single food group. However, existing food recognition technology is not effective in areas where there is a high level of local specificity, as it requires constant cloud connectivity. This is not always feasible in a rural area. This paper proposes a hybrid solution to fill this void. Indian Food Counter & Detector, optimizing a YOLOv8 architecture for both edge and cloud deployments. For real-time, offline inference, the system utilizes a Quantized TensorFlow Lite model deployed on a Raspberry Pi 3 A+, featuring GPIO-based visual feedback. Simultaneously, a full-scale version of the model is deployed on Hugging Face Spaces, providing a globally accessible API for high-precision analysis. The system integrates a local nutritional database for calorie estimation and utilizes Firebase for synchronizing edge device health status. Experimental results demonstrate a detection accuracy of 92% on a custom Indian food dataset, validating the efficacy of the proposed hybrid approach.

Fault Detection in Chemical Reactor with Data-Driven Method

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Abstract

Fault detection in chemical reactors is essential for maintaining safe, stable, and efficient operation in industrial process systems. This study proposes an advanced data-driven framework based on ensemble and deep learning models to enhance fault detection performance in a continuous stirred-tank reactor (CSTR) for the liquid-phase catalytic oxidation of 3-picoline with hydrogen peroxide. Two key fault scenarios were examined: coolant inlet temperature spikes (Fault 1) and 3-picoline feed concentration decreases (Fault 2). The framework integrates ensemble learning methods, including XGBoost and Gradient Boosting, with recurrent neural network architectures such as Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) models. The results show that boosting-based algorithms provide high fault-classification accuracy, while recurrent networks effectively capture slow temporal drifts that signal emerging faults.

Keywords

Fault detection, CSTR, machine learning, ensemble methods, recurrent neural networks, process monitoring.

A Predictive Analytics Framework for Barangay-Level Crime Forecasting Using Time-Series Modeling and Intensity-Aware Classification

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Abstract

Accurate crime forecasting at the barangay level considerably strengthens decision support systems, although current approaches treat crime count forecasting and crime type classification separately, limiting both their abilities to consider context and predict consistent results. A predictive analytics framework for barangay-level crime forecasts was proposed that combined time-series modeling with intensity-aware crime classification. The two-stage process consists of predicting the future values of the crime intensities and computing time series features that capture temporal characteristics such as trend and seasonality using time series models. This is followed by training a classification algorithm to choose the most likely crime type based on the intensity forecasts. By conditioning the prediction of crime type on the predicted intensity of crime, this approach fills a methodologically relevant gap in the crime analytics literature, and produces more stable and interpretable predictions compared to a regular independent forecast or a direct classification model, which acts as a baseline. This work furthers a modular and explainable approach to localized crime prediction to support evidence-based decision-making about crime management in communities.

Keywords

Predictive analytics, Crime forecasting, Time-series modeling, Intensity-aware classification.

Interlinking of Lakes for Groundwater Recharge and Climate Resilience in Central India

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Abstract

Water scarcity, owing to climate change impacts such as the potential rise in temperature up to 4°C by the year 2100, has become an impending issue across the globe. Depletion of groundwater has emerged as one of the imminent concerns in the Indian subcontinent, especially in areas that owe maximum dependence on it for irrigation and drinking. Bhandara district in Maharashtra, which has the maximum number of lakes and ponds in region also renowned as the home of Malguzari lakes, confronted with the situation of depleting groundwater because of the improper use of it and the changing climate patterns. Consequently, through the application of the Soil & Water Assessment Tool (SWAT) model, this idea aims to interpret the potential of lake connection in achieving effective groundwater recharge against the impacts of climate change. The intention of this proposal is to connect the lakes in Bhandara District in order to boost the management of water resources, can enhance recharge by 10-20%, increase aquifer level and upsurge the lake's ability to withstand drought and floods resulting from climate change. SWAT modeling is employed to test the influence of the lakes on the groundwater recharge mechanism based on the connectivity of the lakes and the effects of climate change in the Wainganga Basin on groundwater resources.

Alzymate: Personalized Support System for Alzheimer’s Management

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Abstract

The issue facing the Alzheimer disease is that patient independence and caregiver oversight is a major problem and that needs constant supervision to ensure patient safety, daily activities, and cognitive stimulation. The paper describes the work AlzyMate, the full-fledged mobile-based assistive system, which was created to help people with Alzheimer disease and their caregivers in terms of real-time monitoring and personal assistance. The application suggested incorporates geofencing capabilities to present real-time notifications when patients leave the pre-established safe zones, and hence minimize the chances of wandering-related accidents. Location tracking in real-time would allow caregivers to constantly keep track of the movement of their patients, as well as respond promptly to any emergency incidents. AlzyMate offers the ability to set personalized medication intake, meal, and hydration reminders to improve adherence to routine and well-being on a daily basis. Also, there is a cognitive reinforcement module, which is called Memory Bites: it is a delivery of individualized photo-based and text messages that are aimed at provoking memory and emotional attachment. In-app communication is secure and prevents compromises in communication between patients and caregivers. The system focuses on access by having a simplified user interface with large and clear visual graphics to allow easy use by the elder generation and use of strong security mechanisms to safeguard sensitive health information. AlzyMate is constructed on a modern framework of mobile development, cloud-based infrastructure that supports the backend, and AI-assisted development tools, proving to be an effective and scalable solution to the problem of Alzheimer care. The proposed system will enhance the quality of life of patients and decrease the burden of caregivers by a combination of safety monitoring, regular management, and cognitive support.

Keywords

Alzheimer’s disease, mobile health application, geofencing, real-time location tracking, cognitive assistance, caregiver support, patient safety.

Feature Extraction Techniques for Computer-Aided Process Planning (CAPP) in Manufacturing Processes

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Abstract

This paper presents a novel hybrid framework for Computer-Aided Process Planning (CAPP) that effectively bridges the gap between Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) by automating the generation of manufacturing processes directly from design data. Leveraging recent advancements in feature recognition, the proposed approach utilizes Boundary Representation (B-rep) extracted from standard CAD formats (STEP/IGES) combined with advanced graph-based algorithms to accurately identify geometric features in prismatic parts. Experimental validation on benchmark datasets demonstrates a feature detection accuracy of 95%, significantly enhancing the reliability of automated process planning. Furthermore, the integration of feature-based artificial intelligence (FB-AI-CAPP) techniques enables intelligent optimization of manufacturing operations, including operation sequencing, tooling selection, and machining parameter determination, resulting in a 40% reduction in planning time compared to conventional manual methods. This research underscores the potential of combining geometric feature extraction with AI-driven planning strategies to advance the automation and efficiency of modern manufacturing workflows.

Keywords

CAPP, feature extraction, B-rep, STEP files, manufacturing features, process planning.

YOLOv8-Based AI Smart Surveillance System for Real-Time Drug Detection and Alerting in Educational Campuses

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Abstract

Increasingly more concerns are being raised across college campuses regarding drug abuse behaviours in various locations such as dormitories, stairwells, and hidden areas where suspected incidents frequently occur without discovery by authorities. Due to the limitations involving manual vigilance, it becomes apparent that manually checking every area where illicit drugs could be found will not yield a successful outcome; thus, developing a method for detecting such behaviours is necessary. With this in mind, we created an AI-Based Smart Surveillance System as part of our Mini Project; this system incorporates the use of live video feeds to detect suspected drug-related items, along with suspicious activity (such as crouching) associated with drug abuse. This is achieved by capturing still images of the object(s) after an interval of time and processing those images using a YOLOv8 model; this allows this system to detect items such as syringes, pills, or cigarettes related to drug abuse. In addition to object recognition, the system also uses Pose Estimation to determine whether objects may be positioned at certain angles indicative of crouching behaviour and could lead one to suspect drug abuse is occurring. Once an incident has been confirmed by the system to contain some form of suspected threat, the system issues a WhatsApp notification to the system administrator and stores information regarding that incident, including verification of time and date stamps, image captured, etc., within a database specifically developed for surveillance purposes. A Web Dashboard (Flask) created for use by administrators is available to view and verify all incidents recorded through the system.

Keywords

Campus Safety, Drug Monitoring System, Smart Surveillance, Artificial Intelligence (AI), Object Detection, YOLOv8, Pose Estimation, Real-time Detection, Behavioural Analysis, Automated Alerts, CCTV, Flask, Computer Vision, Machine Learning.

Blink2Speak: A Multimodal Communication Platform for Enhanced Accessibility and Adaptive Interaction

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Abstract

Communication is a basic right, but people with severe physical impairments usually face a lot of barriers in inclusive social interaction. The paper proposes Blink2Speak-a comprehensive multimodal communication platform that empowers people with a wide range of physical needs toward accessible interaction. The system integrates three main modes of communication: computer vision-based blink detection and translation into Morse code, real-time speech-to-text for hearing-impaired users, and an extensible framework that allows the addition of further sign language recognition. The basic module of the blink detection approach relies on MediaPipe facial landmark detection to detect controlled patterns of eye closure, interpreting these signals as Morse code sequences, which results in real-time decoding of characters with an empirical threshold of an eye aspect ratio of 0.035. The proposed system, developed in Python with PyQt5 and OpenCV and further enhanced with strong text-to-speech capabilities, also supports bidirectional conversation. The preliminary result proves the effectiveness of the developed system for constructing a whole sentence on the basis of the eye movement of the motor-impaired patient under control. The modular composition of the system makes it cost-effective since it involves a common hardware component called the webcam. This project will help in the development of accessible aid technology.

Keywords

Assistive Technology, Morse Code Communication, Computer Vision, Accessibility, Multimodal Interface, Eye Blink Detection, Speech Recognition, Human- Computer Interaction.

An Automated Cloud-Based ETL Framework Using Azure Data Factory for Multi-Source Data Integration

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Abstract

In today's data-driven organizations, effective perceptivity is dependent on reliable information which is extracted from multiple, heterogeneous and structurally different data sources without any errors. However, conventional manual or semi-automated data integration methods often can't scale effectively, can be easily vulnerable to fraud as data becomes more complex. This paper proposes a fully automated, cloud-based Extract, Transform, and Load (ETL) framework built using Azure Data Factory (ADF) which addresses these problems. It can extract data from Excel files, GitHub repositories and SQL server databases and loads it into a central storage location on Azure via a metadata driven workflow and a set of automated processes. By using Azure Data Factory we have provided an outcome to orchestrate the process of bringing data in from different kinds of data sources and applying the transformation logic on an on-going basis and also providing a scalable solution to shuttle data between many different kinds of data locations. It uses the native cloud capabilities to enhance scalability, security and fault-tolerance while minimizing manual input. The result achieves better automation and more data consistency at improved scale and compares favorably against previous methods in experiments. The data loaded is used to create analytical reports and interactive dashboards using Power BI.

Low-Resource Multilingual Medical Classification Using Adaptive Few-Short Transformers

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Abstract

The Abstract It is the fact that, due to the fast development of multilingual healthcare data in India, there is a high demand of language-comprehensive and precise clinical decision-support systems. The majority of existing models are based on high-resource languages, which does not contribute to their applicability in a multilingual Indian context. Actually this study will introduce a multilingual medical subject classification system which will be based on the adaptive few-shot learning, to deal with low-resource languages such as Hindi, Tamil, and Kannada. The system is able to increase the robustness of the system over subjects by refining the MuRIL transformer on a subset of the MedMCQA-Indic data using language-balanced and class-balanced sampling. The model is both competitive being accurate with limited annotated data and it is lightweight and modular to adapt to clinical workflows. This framework will help us to adapt to the new languages or also to new topics in a scalable manner and it also improves the medical education and retrieval of information within multilingual settings.

Keywords

Multilingual Medical NLP, MuRIL, Few- Shot Learning, MedMCQA-Indic, Subject Classification, Low-Resource Languages, Clinical Text Classification, Transfer Learning, Indian Languages, Healthcare AI.

Integrating AI and IIoT for ISO-Aligned Safety, Health, and Environmental Management: A Techno-Economic Assessment of Continuous Monitoring Systems and Their Impact on Occupational Health Outcomes

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Abstract

The combination of Artificial Intelligence (AI) and the Industrial Internet of Things (IIoT) can change the character of Safety, Health, and Environmental (SHE) management as a one-time, ad hoc compliance to preventative guarantees. This paper introduces a secondary-research synthesis and techno-economic evaluation of AI-IIoT systems to satisfy the ISO-structured SHE needs and optimise occupational health benefits beyond the industrial calcination industry conditions. Undertaken by systematic review, regulatory mapping, and comparative cost benefit modelling approaches, the paper analyses architectures that integrate stationary continuous emission monitoring systems and wearable worker sensors, edge-to-cloud analytics, and explainable machine-learning decision support. The main outcome measurements are estimated growth of benefits in terms of hazardous exposure cuts, the risk of an incident, and lost working days attributable to the incident, capital budget, and operating budgets, payback time, and net present value in various deployments. Based on results, calibrated AI IIoT configurations when combined with ISO 45001 / ISO 14001 management systems and operated on clarifiable AI practices can potentially lead to quantifiable improvements in occupational health and positive techno-economic payoffs within medium to large facilities, depending on sensor infidelity and interoperable platforms as well as enabling regulation. The paper maps the enablers (alignment of standards, regulatory incentives, standards data architecture) and barriers (initial capital, labour skills gaps, data privacy) where one of the prescriptive, standards mapped evaluation models is recommended to the managers of plant and regulators. It has been reported that its contributions include an ROI-oriented evidence synthesis of sustained SHE monitoring, a standards-conformant implementation checklist, and policy recommendations to hasten worker-centred and scalable implementation of AI-IIoT monitoring.

Keywords

IIoT, Artificial-Intelligence, ISO45001, Techno-Economics, Occupational-Health.

Driver Fatigue Detection via Eye Aspect Ratio

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Abstract

Driver fatigue is one of the main causes of traffic accidents worldwide, resulting in a terrible number of deaths every year. This paper presents a system to identify driver drowsiness in real-time using computer vision and facial landmark analysis. The system applies the Eye Aspect Ratio (EAR) method to measure how long the eyes are closed, using a facial landmark detection model that has been pre-trained. The system captures facial features with a live camera feed and analyses them through the dlib landmark predictor and OpenCV. If it detects prolonged eye closure, the system sounds an alarm through an audio subsystem (pygame). This proposed solution is lightweight, doesn't need special equipment, and operates effectively in real-time. Experimental results show that it can identify eye closure and provide early warnings, which enhances driver safety and lowers the risk of accidents.

AI-Assisted Diagnostics from Medical Imaging

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Abstract

This project presents an AI-based medical disease prediction system developed using Deep Learning, Machine Learning, and the Flask web framework to support early disease detection and clinical decision-making. The system integrates four diagnostic modules into a single platform. The Lung Disease Prediction module analyzes X-ray or CT images to detect lung abnormalities and generate heatmap visualizations highlighting affected regions. The Brain Tumor Detection module uses deep learning models to identify tumor presence from brain scans and localize abnormal tissues using heatmaps. The Heart Disease Prediction module applies machine learning algorithms to clinical parameters to predict disease risk with a probability score. The Bone Fracture Detection module analyzes bone images to detect fracture regions. All modules are deployed through a Flask-based web application, providing a user-friendly interface for uploading medical data and viewing results, thereby improving diagnostic efficiency and supporting healthcare professionals.

Experimental Study on Self Healing Concrete Using Bacteria Ingrowth

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Abstract

Self-induced cracking in concrete adversely affects durability and long-term structural performance. Self-healing concrete offers a sustainable alternative by enabling autonomous crack repair mechanisms. This research examines the self-healing behavior of M30 grade concrete ingrowth *Bacillus subtilis* and *Bacillus megaterium* in combination with fly ash (20%) and nano clay (5%). Ordinary Portland Cement (OPC) was used in all concrete mixes. Early-age cracks were deliberately introduced at 3 days, and the healing efficiency was evaluated after 28 days of curing. Ultrasonic Pulse Velocity (UPV) and water permeability tests were employed to assess crack closure and durability enhancement. The results reveal that bacterial concrete containing nano clay exhibits significantly improved healing performance compared to bacterial concrete with fly ash, as reflected by increased UPV values and reduced permeability. The improved behavior is attributed to microbial-induced calcium carbonate precipitation coupled with nano-scale pore refinement. The outcomes confirm that the synergistic use of bacteria and nano clay enhances self-healing efficiency and durability, demonstrating strong potential for sustainable concrete applications.

Keywords

Self-healing concrete, fly ash, Nano clay, Bacteria, *Bacillus subtilis*, *Bacillus megaterium*.

3D Ordinary Differential Equation Network for Continuous Time Modelling and Compression of Three-Dimensional LiDAR Point Cloud Data

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Abstract

LiDAR (Light Detection and Ranging) is a remote sensing technology that measures the Earth's surface in three dimensions using laser pulses that provides high-resolution point cloud data (pcd) for uses such as environmental monitoring, mapping, and driverless cars. In these domains, controlling data size and storage requires effective compression. In this paper, the proposed work uses 3DODE-Net, a novel method that leverages 3D LiDAR pcd using Neural Ordinary Differential Equations (Neural ODE) network for high-accuracy with lossless compression. Using a continuous-time dynamical system to simulate the transformation of 3D pcd, 3DODE-Net efficiently lowers the dimensionality of pcd data while maintaining granular spatial information. For efficient 3D pcd compression, the proposed framework makes use of two datasets: the Sydney Urban dataset which is the Urban Planning dataset, and the Tihan dataset from IIT Hyderabad. The proposed method 3DODE-Net uses the Scan10974.pcd file from the Sydney Urban dataset shows a reduction in file size from 1089 KB original file size to 13.05 KB compressed file size attaining a about 83.7 compression ratio with an MSE (Mean Squared Error) loss of 0.0040, Chamfer Distance of 2.4, and an Earth Mover's Distance (EMD) of 1.6. The approach produced a 73.6 compression ratio on the 0.0081.pcd file of TiHAN IIT Hyderabad Dataset, with an MSE of 0.0014, a Chamfer Distance of 1.7, and an EMD of 0.0. The 3DODE-Net model accuracy in preserving data fidelity. In both reconstruction accuracy and compression ratio, the outcomes show that proposed framework performs better than both conventional and state-of-the-art compression methods. Extensive experiments on real-world 3D LiDAR pcd datasets demonstrate that 3DODE-Net provides a large reduction in storage requirements without sacrificing data integrity, while maintaining the precision of the original pcd. The proposed 3DODE-Net findings imply that neural ODE can be an effective method for compressing 3D data, with possible uses in robotics, remote sensing, and geographic data processing.

Keywords

LiDAR, 3D point cloud data, Neural Network, Compression Ratio, Mean Squared Error, Lossless.

Blockchain Based Blue Carbon Registry using MRV System

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Abstract

To ensure and tamper proof carbon accounting, this paper proposed a blockchain-based carbon registry system that is integrated with a robust measurement, reporting and verification (MRV) System and an automated carbon credit issuance process. In a conventional carbon market, there are challenges such as data tampering, double counting of carbon credits, the absence of real time verification and a lack of trust among the stakeholders. With the use of blockchain technology, the proposed system will ensure that all carbon transactions are stored on a decentralized and immutable ledger that is secure, traceable, and tamper proof. The integrated MRV Systems allow for the accurate collection of data from credible sources such as IoT technology, satellite images and accredited auditors. After the validation of emissions reductions or removals through the MRV process, smart contracts are triggered to automatically generate carbon credits proportionate to the verified reductions or removals, smart contracts are programmable contracts that operate under predetermined rules, thus reducing the need for human involvement and the potential for fraud of errors.

The transparency of blockchain technology enables regulators developers, investors and buyers to view the real time status. In this way the system reduces transactions costs and processing time by removing intermediaries and performing verification and credit issuance automatically. It further eliminates double counting by giving a unique digital identity to each carbon credit and monitoring to entire life cycle from issuance to retirement. Finally the proposed blockchain based carbon registry system improves the integrity and trustworthiness of carbon markets, thus encouraging more participation in carbon markets and helping to achieve global climate changed objectives.

Deep Learning Framework of Transparent and Accountable Generative AI Systems

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Abstract

GenAI systems have proved themselves as excellent in language comprehension and content generation. Their application in the human-critical applications is also plagued by issues like hallucinations, absence of transparency, poor calibration, and limited accountability. In this paper, a Human-Centric and Transparent Generative AI framework, which combines deep learning and Hybrid Transparent Retrieval-Augmented Generation (HTRAG) is proposed. This method is based on human control, interpretability, factual basis and quantifiable reliability. The experimental findings prove that retrieval-augmented systems are much more faithful and have fewer hallucinations than vanilla GPT-2. HTRAG also promotes transparency and calibration when performing on a competitive level.

Keywords

Generative Artificial Intelligence, Human-Centric Artificial Intelligence, Retrieval-Augmented Generation, Trustworthy Artificial Intelligence, Hallucination Reduction, Faithfulness Assessment, Model Calibration, Explainable Artificial Intelligence, Deep Learning.

Machine Learning Framework for the Industrial Machine Sound Classification in Predictive Maintenance

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Abstract

The "Machine Learning Framework for Industrial Machine Sound Classification in Predictive Maintenance" project aims to develop an advanced system for the classification of industrial machine sounds. The system analyzes audio data from industrial pumps to detect anomalies that may indicate mechanical issues or failures. By leveraging machine learning algorithms such as CNN+LSTM, AST, CRNN, Inception and AE, the framework efficiently processes and classifies sound data into normal and faulty categories. The framework supports predictive maintenance by identifying potential problems before they become critical, thus reducing downtime and improving the longevity of industrial machinery. The project employs a dataset of audio recordings representing different machine states and uses various feature extraction and classification techniques to ensure accurate predictions. The backend of the system is built using Python and Flask, while the frontend is developed using HTML, CSS, and JavaScript. The system also includes modules for user registration, login, sound classification, and model comparison.

Keywords

Industrial machines, sound classification, machine learning, predictive maintenance, CNN+LSTM, AST, CRNN, AE.

From Waste to Wonder: Remodeling and Recycling of Flex Banners Using IoT and Image Processing Techniques Through Sustainability Environment Methods

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Abstract

Flex banner waste generation has increased significantly due to the extensive use of banners in advertisements, events, and promotional activities, creating serious environmental, economic, and sustainability challenges. Improper disposal practices such as open dumping and burning contribute to environmental pollution, health risks, and long-term accumulation of non-biodegradable plastic waste. Currently, there is a lack of intelligent and automated systems to identify, classify, and process discarded flex banner materials efficiently.

This project presents an IoT-enabled flex banner identification and recycling management system that utilizes computer vision and image processing techniques to automate the detection and classification of flex banner waste. The proposed framework uses camera modules to capture real-time images and applies image processing algorithms such as OpenCV to detect material type, breakages, and component characteristics. Temperature sensors are used to monitor and control the heating process during recycling, ensuring safe and efficient conversion into reusable plastic chips.

In addition to detection, the system integrates microcontroller-based automation to support sorting, processing, and recycling operations. This improves system efficiency, reduces manual effort, and enhances processing accuracy. By combining IoT, automation, and image processing with structured operational workflow, the platform promotes sustainable waste management and supports environmental protection. The architecture is scalable and suitable for real-world deployment in smart recycling and sustainable manufacturing systems.

Keywords

Flex banner waste, IoT, image processing, OpenCV, recycling, sustainability.

HealthGuard - FL: A Privacy - First Federated Intelligence Framework for Cross - Institutional Sepsis Prevention and Mortality Reduction

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Abstract

Detecting sepsis early is vital for lowering hospital mortality rates, but building effective predictive models is difficult due to strict privacy laws (e.g., HIPAA, GDPR) and the fragmented nature of Electronic Health Records (EHR). Centralized machine learning is often unfeasible because hospitals cannot easily share raw patient data, and models trained on single-site data rarely generalize well to other institutions. To solve this, we developed HealthGuard-FL, an end-to-end Federated Learning (FL) system for cross-institutional sepsis prediction. Unlike standard FL setups, HealthGuard-FL incorporates a custom Differential Privacy (DP) engine. We use Gaussian noise injection and Renyi Differential Privacy (RDP) accounting to strictly bound privacy loss ($\epsilon \approx 0.11$) without destroying model utility. We also address the issue of trust in medical AI by integrating a Clinical Validation Suite to test calibration, temporal leakage, and feature importance (SHAP) before deployment. We implemented a lightweight, clinician-focused interface for real-time risk scoring. Our experiments show that HealthGuard FL matches the predictive performance of centralized baselines while keeping raw patient data secure within the local hospital, effectively bridging the gap between theoretical privacy research and real-world clinical application.

Keywords

Federated Learning, Sepsis Prediction, Differential Privacy, Explainable AI (XAI), Electronic Health Records (EHR), Clinical Decision Support Systems, Renyi Differential Privacy, HIPAA Compliance.

Pneumonia Detection from MRI Scans Using Swin Transformer Architectures

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Abstract

Pneumonia is a serious respiratory infection that is responsible to millions of hospitalization and deaths annually across the globe. Timely treatment and prevention of complications should start with early and reliable detection. Although chest X-ray and CT scan are commonly used in diagnosis, Magnetic Resonance Imaging (MRI) has better soft-tissue contrast, better visualization of lesions and the benefit that it is not ionizing, thus being particularly appropriate with vulnerable groups. The interpretation of MRI scans is however time consuming and has inter-observer variability when done manually. In order to overcome this obstacle, the current study proposes an automated pneumonia detection system based on deep learning and utilization of the modern Swin Transformer structures. Hierarchical and shifted-window attention, Swin Transformers are better at capturing local and global contextual information than traditional convolutional neural networks, and thus can be used to perform complex medical imaging tasks. The offered methodology will consist of thorough data gathering in the form of annotated MRI scans, preprocessing of images (normalization, resizing and augmentation), Swin Transformer models training and validation, and the assessment of the results based on the level of accuracy, precision, recall, F1-score, and AUC. The project will enhance the accuracy of detection and diagnostic turnaround time by incorporating advanced architectures based on transformers into the diagnostic pipeline, and help the radiologists in clinical decision-making in a significant way. Moreover, the system will be scalable and can be deployed in the healthcare environment with low resources, thereby facilitating early diagnoses, enhancing patient outcomes, and developing AI-based medical imaging solutions.

Pneumonia is a severe pulmonary infection which requires timely and precise diagnosis. The given project creates an automated system to identify pneumonia based on MRI scans with Swin Transformer models. The model is trained to absorb significant patterns based on MRI images and categorize them more precisely than the standard CNN methods.

Keywords

Pneumonia Detection, MRI Scans, Swin Transformer, Deep Learning, Medical Image Analysis, Computer Aided Diagnosis, Transformer Architecture, Shifted Window Attention, Automated Screening, Healthcare AI.

AI and IoT Integrated Intelligent Travel Assistant for Personalized Trip Planning

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Abstract

Travel planning is often complex and requires a lot of hands-on effort; the user needs to find destinations, places to visit, or activities for themselves. Classic travel platforms usually use static filtering algorithms with predefined datasets, so they often do not do personalised and context-aware travel recommendations. This work will combine an AI with an IoT, Integrated Intelligent Travel Assistant based on the hybrid recommendation framework, and automate the itinerary generation process, as part of personalized trip planning. The system combines structured user preference modeling with rule-based recommendation logic and dynamic attraction retrieval from open knowledge sources. The system converts the city into geographic coordinates for destination and trip time and fetches nearby tourist attractions through knowledge graphs such as Wikidata. Once retrieved, the attractions are aggregated and organized into a day-oriented itinerary via a weighted scoring algorithm that evaluates the visitor needs by comparing them to various travel factors such as location preferences, interests in the respective activity, budget setting, and relevant conditions. The system is implemented using a cloud-based architecture with a web application interface, FastAPI backend, and external data integration services. Our experimental testing shows that the proposed framework can generate real travel itineraries for cities around the world, keeping computation efficiency and scaling.

Keywords

Artificial Intelligence, Travel Recommendation System, Intelligent Travel Assistant, IoT-based Context Awareness, Personalized Trip Planning, Knowledge Graph, Travel Itinerary Generation.

Next Generation Inventory Management Software

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Abstract

An advanced and intelligent system named "Next Gen Inventory Management Software" has been developed to make the process of inventory management easier and more effective for businesses. The traditional inventory management system is often less predictive, provides delayed updates, and may generate misleading information. To make the process of inventory management more efficient and effective, this project has been initiated to provide a clever, scalable, and automated solution that uses data analytics, cloud storage, and real-time tracking.

The system has features such as barcode/QR code scanning, supplier management, low stock alerts, automated stock tracking, and dynamic reporting dashboards. The system uses predictive analytics to forecast demand trends and avoid stockout or overstock situations.

The proposed system will improve the accuracy of decision-making, minimize operational costs, and reduce the chances of human error through automation and intelligent data analysis. The improved usability and real-time analysis features of the proposed system are expected to contribute to the digitalization of inventory management.

Keywords

Inventory Management, Predictive Analytics, Real-Time Tracking, Cloud-Based System, Automation, Stock Monitoring, Demand Forecasting.

Inception Net-Driven Classification System for Early Esophageal Cancer Diagnosis

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Abstract

Esophageal cancer is still one of the main reasons people die from cancer globally, and finding it early greatly increases the chances of surviving. However, current methods for diagnosing it, like endoscopy and looking at tissue samples under a microscope, can take a lot of time, are not very comfortable for patients, and can give different results depending on who is doing the test. New developments in deep learning have made it possible to analyze medical images more efficiently and accurately. In this study, we suggest using a Convolutional Neural Network (CNN) to detect esophageal cancer from images taken during endoscopies and from tissue samples. To improve the quality of the images and deal with the fact that some types of data are less common, we use techniques like normalization and image enhancement. CNNs are good at identifying patterns, so they can spot small changes in texture and structure that may indicate cancer. Our tests show that the model performs very well in terms of accuracy, sensitivity, and specificity, and it works better than traditional machine learning methods. This research shows that using CNNs as part of a diagnostic tool can be a reliable way to help find esophageal cancer early and accurately.

Keywords

Esophageal Cancer Detection, Convolutional Neural Networks, Medical Image Analysis, Deep Learning, Endoscopy Imaging, Histopathology Classification, Transfer Learning, Multimodal Fusion, Grad-CAM Explainability, Computer-Aided Diagnosis.

Smart Virtual Mouse Using Real Time Hand Tracking

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Abstract

Issues including reliance on physical devices, limited accessibility, and the constraints of traditional input methods have frequently arisen in human-computer interaction. The growing need for more hygienic and user-friendly engagement methods has spurred innovation in this field. Physical mice are useful, but they have disadvantages such as maintenance, space limitations, and usability issues for those with disabilities. Numerous techniques, including as voice commands and touchscreens, have been studied to increase user involvement. Never the less, these are often costly or have compatibility issues. This project aims to eliminate the need for hardware attachments by introducing a virtual mouse that can be controlled with hand gestures. The proposed system uses real-time image processing via cameras and computer vision algorithms to identify and interpret hand gestures. With methods including backdrop reduction, HSV segmentation, and gesture identification, the system ensures accurate mouse control and click operations. This approach is particularly useful in environments that require touchless operations since it provides enhanced accessibility, affordability, and hygiene. Strong hand gesture detection technology that ensures intuitive control enables applications in augmented reality, gaming, and accessibility.

Keywords

Virtual mouse, hand gesture recognition, computer vision, human-computer interaction, real-time processing, touchless interface, accessibility, OpenCV.

Multimodal AI-Augmented Crowdsourced Disaster Response: A Mobile-First Framework for Real-Time Incident Verification, Alert Dissemination, and Shelter Routing

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Abstract

The Indian disaster response systems are still struggling to attain prompt situational awareness, coordinate response by the multiple stakeholders, and facilitate organized citizen involvement. Although mobile crowdsourcing has been proven to enhance fast speed of reporting, the available systems do not have well developed verification procedures to differentiate between real incidents and misinformation without delay by humans. A mobile-first disaster coordination scheme is discussed in this paper and it comprises (1) thorough real-time citizen reporting and multimedia evidence integration; (2) a novel two-phase multimodal AI-aided verification pipeline involving the use of large language models (LLM) to conduct semantic consistency checks across the visual representations of images, textual descriptions, and geospatial metadata; (3) lightweight human-in-the-loop validation mechanisms using authorized stakeholders; (4) coordination among multiple stakeholders with role-based access; (5) dynamic routing of shelters. The multimodal AI element employs Google Gemini series of models to interpret images and descriptions posted by citizens thus identifying semantic discrepancies (such as a text that states that there is fire, but the image shows a car) and suspicious artifacts or metadata discrepancies and decreasing verification latency and human moderation costs without loss of information credibility. An experimental mobile prototype in Flutter was made and tested on controlled scenario-based simulation of flood and industrial incident scenarios. Controlled scenario assessment shows that AI-enhanced verification is nearly 90 percent accurate in discriminating between real incidents and false claims or reports and amounts to the cost of verifying submissions somewhat 80 per cent higher rating of high-confidence submissions, speeding up the incident-to-alert channel and preserving the integrity of verification. The combined system shows that multimodal AI can be implemented, as a first-stage filter to crowd-sourced disaster-response systems, in order to facilitate timely dissemination of trusted alerts and evacuation-related assistance to the population in resource-constrained settings.

Keywords

Disaster Management, Multimodal AI, Large Language Models, Crowdsourced Reporting, Image-Text Verification, Mobile-First Disaster Response, Layered Verification, Shelter Routing.

Fake News Detection Using BERT with Comparative Analysis of Traditional Machine Learning Models

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Abstract

The online media and social networking sites have rapidly developed, which has enhanced the dissemination of fake news to a great extent, hence automated detection of misinformation has become a major problem in the context of natural language processing. Misleading information spread systematically may affect the opinion of the population, foster social instability, and adversely affect decision-making in both politics, the health of the population, and economy. Conventional fake news detection algorithms are based on machine learning models trained on handcrafted textual features, including TF-IDF with classifiers, including Logistic Regression, Naive Bayes, and Support Vector Machines. These methods are however restricted to internalising profound contextual associations in text. To overcome this shortcoming, this paper suggests a transformer-based detecting fake news using RoBERTa model. The model uses contextual embeddings to represent semantic relationship in news articles. The experimental findings indicate that the proposed RoBERTa model has greatly surpassed the previous machine learning methods and the accuracy and F1-score are 0.986. In general, the suggested solution is an efficient and scalable solution to automated fake news detection and demonstrates the possibility of transformer architecture implementation to real-life misinformation detection systems.

Keywords

Bert, TF-IDF, Logistic Regression, Natural Language Processing, Deep Learning, Transformer Models, Streamlit.

The Root: AI Awakening Indigenous Voices

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Abstract

This is a project created to support and uplift tribal communities by giving them a digital space where they can share their culture, products, and skills with a wider audience. The ROOT application functions as an e-commerce platform designed specifically to address the challenges many indigenous groups face, especially barriers related to language and limited exposure to technology. To make the platform truly accessible, it uses artificial intelligence to provide real-time translation, voice-based interactions, and simple guided steps that help users who may not be comfortable reading or navigating traditional online interfaces. This allows tribal artisans, farmers, and local creators to upload their products, manage their small businesses, and communicate with buyers in their own languages, making the experience more natural and confidence-building. Beyond its focus on accessibility, ROOT includes secure payment systems, clear product listings, and a user-friendly design that helps ensure safety, trust, and ease of use for both sellers and buyers. More importantly, the platform helps preserve indigenous languages and cultural practices by giving them a place to be expressed and shared in a digital environment. Feedback from community interactions shows that providing a technology tool that respects cultural identity and simplifies communication can significantly widen economic opportunities for tribes and reduce their dependence on middlemen. In essence, the root demonstrates how technology—when thoughtfully designed—can become a powerful tool for empowerment, cultural preservation, and inclusive growth, helping indigenous communities participate confidently in the modern digital economy.

Intelligent Vehicle Monitoring System with Automatic License Plate Recognition (ALPR) using Deep Learning

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Abstract

Automatic License Plate Recognition (ALPR) has emerged as a critical component in Intelligent Transportation Systems (ITS), enabling automated vehicle monitoring for applications such as traffic management, law enforcement, toll collection, and parking control. In this work, we present a robust ALPR system designed to detect and recognize vehicle license plates in real time under diverse environmental conditions. The proposed model integrates deep learning-based object detection using You Only Look Once (YOLO) for precise license plate localization, followed by character recognition using Tesseract OCR. The system is trained on a custom annotated dataset consisting of Indian vehicle license plates from Kaggle with variations in illumination, background clutter, viewing angles, and motion blur. Experimental evaluation demonstrates efficient detection and recognition accuracy, achieving reliable performance in complex traffic scenarios. The system is lightweight, scalable, and suitable for deployment in smart surveillance applications.

Keywords

ALPR, YOLO, Tesseract OCR, Deep Learning, Vehicle Monitoring, Intelligent Transportation Systems.

Plant Disease Detection Using Vision Transformers (ViT) and Swin Transformers (Shifted Window)

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Abstract

The Paper work describes a highly precise and efficient system to detect and categorize plant diseases utilizing Graph Antibodies (ViT) and the most recent Swin Transformer architecture. Unlike typical Convolutional Neural Networks (CNNs) that rely on local receptive fields and cannot efficiently capture long-range dependencies and global contextual information in leaf images, the proposed transformer-based models break down images into a sequence of patches and use multi-head self-attention mechanisms to create both local and global relations from the entire visual field. Further, the Swin Transformer changes this model with shifted-window hierarchical attention, thereby giving better computational efficiency, easy scalability to high-resolution field-captured images, and great resistance to even very difficult real-world scenarios like slight symptom variations, overlapping disease patterns, and complex natural backgrounds.

The comprehensive experiments on standard plant disease datasets (e.g., PlantVillage and new plant diseases datasets) reveal that the proposed Swin Transformer model is always at the forefront of accuracy, has better generalization, and less overfitting as compared to the top CNN architectures (ResNet, EfficientNet) and standard ViT variants. The comprehensive ablation experiments verify the significant contributions of hierarchical feature construction, shifted-window attention, and patch merging components. The results set transformer-based methods as the new benchmark for precision agriculture tasks requiring fine-grained symptom recognition and large-scale crop monitoring that is reliable.

This work is a great step towards the paradigm shift from convolution-centric to attention-centric computer vision approaches in agricultural applications and makes the Swin Transformer a reliable base for the development of future automated plant pathology systems and smart farming solutions.

Keywords

Vision Transformer, Swin Transformer, Crop Disease Detection, Plant Disease Classification, Self-Attention, Precision Agriculture, Computer Vision, Transformer Models, Hierarchical Attention.

RNN-LSTM-Based Detection of Integrity of Online Review Content for Automating Moderate vs. Extreme Reviews

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Abstract

With eCommerce expanding rapidly, online reviews of products play a very important role for consumers in deciding to purchase. However, due to the increased prevalence of deception and extremist content, the integrity of platforms that host reviews is compromised. Most of the existing counterfeit review detection techniques are designed to evaluate counterfeited reviews at the individual level and therefore cannot observe the complex coordination between groups of reviews or detect repeated behavior patterns of manipulation. To address this gap, this research project involves developing an automated review classification engine based on RNN- LSTM architecture that is capable of separating reviews into "Moderate" or "Extreme" classifications. The method begins with preprocessing of review text, which includes lemmatization, removal of non-useful words (i.e., stop-words), followed by tokenizing the review text and padding each text sequence for input into the model. An embedding layer along with LSTM units are employed in order for the model to be able to identify and understand long-term dependencies of review text, as well as to consider the context of each consecutive piece of review text. Preliminary results of this research suggest that this deep learning model will reduce the amount of manual monitoring necessary for ensuring online review system safety while simultaneously increasing the credibility of online review processes. Ultimately, the overall goal of this research is to create a prototype for monitoring review content to ensure the integrity of reviews in the context of large-scale, global digital environments in real-time.

Keywords

Fake Review Detection, RNN-LSTM, Natural Language Processing, Text Classification, Online Reviews, Deep Learning.

Smart IOT-Based Inventory Monitoring System

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Abstract

Traditional Inventory Management system often suffers from manual errors and a lack of real-time Clarity, leading to the stock-outs or overstocking. This research proposes a Smart IoT-Based Inventory Monitoring System to designed automate stock tracking System and enhance the operational efficiency. The system utilizes the Load Cell and HX711 amplifier to measure the product weight, also which is then processed by an ESP8266 Wi-Fi module to provide the real-time updates to a cloud-based platform. May Users can monitor stock levels remotely through a dedicated interface Using mobile Application and receiving automated alerts when inventory falls below a specified threshold. For Experimental results and demonstrate that the system provides the accurate, reliable data and effectively reducing human involvement and optimizing for supply chain management for small to medium-scale enterprises.

Keywords

Smart Inventory Management, Internet of Things (IoT), Real-Time Stock Monitoring, Cloud-Based Inventory System, Automated Alerts, Supply Chain Optimization.

AI-Powered Medical Report Simplification and Analysis System Using OCR and Explainable Intelligence

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Abstract

The diagnostic reports are provided to patients in electronic formats more and more in the fast-moving digital healthcare environment. But even medical reports like blood test, pathology reports, radiology reports, etc are mostly written with complex medical terms, abbreviations, or numerical reference ranges that are not easy to read by non-medical people. This may be confounding, frightening, and misdirected choices in health. The available digital health platforms are mostly centered on checking symptoms or clinical documentation and frequently do not involve simplification of patient-centered clarification and well-organized validation processes. The paper describes an AI-driven simplification and analysis system of medical reports that would simplify the intricate medical reports using a format that is easy to understand. It allows uploading reports both in image and PDF format and uses the Optical Character Recognition (OCR) to extract the text. The hybrid method of intelligence that involves the combination of Large Language Models (LLM) and the use of rules to verify the medical parameters is adopted to make sure that the medical parameters are correctly interpreted, abnormalities are detected, and simple explanations are generated.

The site includes the classification of the severity of abnormalities, confidence scoring to minimize the likelihood of hallucinations, clarified reasoning behind every insight, and interactive visualization dashboard. The system is created based on FastAPI, Python, and modern web technologies, prioritizing transparent and reliable and easily accessible web technologies. The proposed solution can improve healthcare literacy and facilitate informed decision-making because it helps to bridge the communication gap between clinicians and patients.

Keywords

Medical Report Analysis, Optical Character Recognition (OCR), Explainable Artificial Intelligence (XAI), Healthcare Informatics, Natural Language Processing (NLP), FastAPI, Medical Data Extraction, Abnormality Detection.

Development of Interior Design Using Agentic AI

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Abstract

Interior design is often expensive and time consuming, with users struggling to imagine the final result before spending money. This paper presents an AI powered interior design system that solves these issues by generating photorealistic room redesigns automatically. Users upload a room photo and choose a preferred style, and the system produces realistic designs while preserving the original layout. The system uses MiDaS for depth estimation, for furniture detection, and OpenCV for color and scene understanding. Stable Diffusion with ControlNet generates style-accurate designs that fit the existing space. Multiple AI agents handle design generation, product recommendation, and price comparison across Indian platforms like Amazon and Flipkart. Built with FastAPI and React, the web app enables real time interaction and direct product purchasing, making interior design more accessible, affordable, and precise.

Keywords

AI Powered Interior Design, Room Image Analysis, Depth Estimation, MiDaS, Object Detection, SAM, Style Transfer, Stable Diffusion, ControlNet, Product Recommendation System, Price Comparison.

Sustainable Energy Transition Pathways for Hospitality Buildings in Hot&Arid Climates

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Abstract

The hospitality sector is among the most energy-intensive segments of the building industry due to its continuous operation, high occupancy rates, and significant demand for thermal comfort. Hotels located in hot and dry climatic regions face particularly high cooling loads because of extreme temperatures, intense solar radiation, and prolonged summer seasons. This research investigates energy transition strategies that can support the development of low-energy and climate-responsive hotels in India's hot and dry climatic zones, including regions of Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, and Telangana. The study aligns with global sustainability agendas such as the United Nations Sustainable Development Goals, particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).

A mixed-methods research approach is adopted to evaluate the potential of integrating passive architectural design strategies and renewable energy systems within hotel infrastructure. The study focuses on four- and five-star hotel buildings due to their high operational energy demand and greater capacity for implementing energy-efficient technologies. Data collection involves quantitative analysis of energy consumption patterns and qualitative assessment of architectural design elements, including building orientation, shading devices, thermal mass, ventilation systems, and envelope characteristics. Case studies from selected cities in hot and dry regions are analyzed to identify patterns in cooling loads, energy use intensity, and the effectiveness of passive design interventions. The feasibility of solar photovoltaic (PV) systems and solar thermal technologies is also assessed to determine their contribution toward reducing reliance on fossil fuel-based grid electricity.

The findings are expected to demonstrate that climate-responsive design strategies—such as optimized orientation, improved building envelope performance, natural ventilation, and shading systems—can significantly reduce cooling energy demand in hotel buildings. Additionally, the integration of rooftop solar energy systems has the potential to offset a considerable portion of operational energy consumption. Based on the analysis, the study proposes a comprehensive energy transition framework that combines passive architectural strategies, renewable energy integration, and retrofit interventions tailored for hotels in hot-dry climates.

Brain Tumor Detection and Classification in MRI Using Deep Learning

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Abstract

The detection of brain tumors using Magnetic Resonance Imaging (MRI) is a significant area of research in the field of medical image processing and artificial intelligence, where deep learning algorithms can be utilized to enhance the accuracy of diagnosis and automation. The current manual process of analyzing MRI images is a time-consuming task that requires expert knowledge from radiologists, resulting in potential delays in diagnosis and inconsistencies in clinical outputs, making the early detection of brain tumors a difficult task. The current state of the art is based on traditional image processing and machine learning algorithms with manual feature extraction and classifiers such as Support Vector Machines (SVM) and K-Nearest Neighbors (KNN). Although these algorithms are very helpful, they have difficulties in dealing with the complex and non-linear patterns of brain tumors. These algorithms have problems generalizing, are prone to noise, and tend to lose accuracy when the MRI images come from similar classes of tumors. In order to address these issues, this research project aims to develop a brain tumor detection and classification system using a Convolutional Neural Network (CNN) with transfer learning from the MobileNetV2 model. This system will be able to automatically identify and classify the MRI images into four classes: Glioma, Meningioma, Pituitary Tumor, and No Tumor. In addition, basic image processing operations are performed to provide tumor segmentation overlays and estimate tumor area for enhanced interpretability. The proposed system has the capability to provide higher accuracy, robustness, and fast real-time predictions with a user-friendly web interface. Future enhancements of the proposed system can be achieved by incorporating larger clinical datasets, 3D MRI analysis, and advanced deep learning-based segmentation models.

Keywords

Brain Tumor Detection, Magnetic Resonance Imaging (MRI), Convolutional Neural Networks (CNN), Transfer Learning, MobileNetV2.

Multi Disease Detection System Using Deep Learning Approach: Identifying Three Diseases with One Platform

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Abstract

The high rate of development of medical imaging has led to a demand of automated systems that can assist clinicians to diagnose various diseases in a more efficient and accurate manner. The given paper proposes a Multi-Disease Detection System that combines the ideas of deep learning and medical image processing to detect and draw the attention to three main disease groups, i.e. chest X-ray abnormalities (pneumonia), skin lesions (melanoma, BCC, SCC), and kidney diseases (cysts, tumors, stones), within one common system. To manage the wide range of imaging modalities (X-ray, dermoscopic, and CT images), the proposed framework uses the Convolutional Neural Networks (CNNs), Vision Transformers (ViT), and transfer learning with optimized feature extraction. The methods of class-weighted loss, data augmentation and balanced sampling are also included to cope with the issue of imbalance in the dataset, as well as to enhance the performance of multi-class prediction. The outcomes of the experiments indicate that the model has a high accuracy rate in all three types of diseases, which proves its feasibility as a clinical decision support system to diagnose diseases at the early stage and minimize diagnostic errors. The system is a scalable and efficient multi-disease detection methodology, which is of substantial importance in automation of healthcare and AI-based medical diagnostics into the real world.

More to the point, the suggested system is developed to be scalable and have real-world application so that it can be integrated into clinical workflow seamlessly. The model will decrease the computational cost and remove the use of disease-specific diagnostic tools by processing various imaging modalities through a single architecture. Performance improvement has been shown across the publicly available benchmarks, and datasets of skin lesions (HAM10000), chest X-ray pneumonia datasets and CT-based kidney disease datasets, and human experimentation shows consistent performance gains over the traditional machine learning and single-task deep learning baselines. The achieved results support the ability of the system to generalize to diverse medical imaging tasks, as it can become a viable framework to use AI-assisted early diagnosis and multi-disease classification in contemporary healthcare settings.

Keywords

Multi-disease detection, medical image analysis, machine learning, deep learning, healthcare automation, diagnostic system, disease classification, multi- class prediction.

From Waste to Worth: Role of Social Media in Promoting Coconut-Based Decorative Products

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Abstract

In addition to posing serious environmental problems, the growing amount of agricultural waste being produced also presents chances for technologically advanced and sustainable innovation. Coconut shells, which are frequently thrown away as garbage, can be made into environmentally friendly ornamental items that promote circular economy principles. The purpose of this study is to investigate how social media, as a digital technology, can be used to promote decorative products made from coconuts and affect customer knowledge, perception, and intention to buy.

A structured online questionnaire was used to gather primary data from 121 active social media users between the ages of 18 and 40. According to the results, social media is the main way that people learn about decorative things made from coconuts. Results also prove that social media advertisements positively influence consumers' purchase intentions if sustainability, attractive design, and uniqueness of the product are well communicated. This study brings to a close that the social media-inspired digital marketing approach is one of the basic connectors between consumer markets and sustainable production. From these findings, it can be deduced that digital technology has to take part with sustainable entrepreneurship when it comes to eco-friendly product promotion.

An AI-Enhanced Framework for Smart Policing Using Large Language Models

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Abstract

Because crime rates are rising quickly, processing crime data is becoming more complicated, and there are problems with public safety, the need for more advanced police solutions has grown. This has led to the development of smart policing systems and predictive policing methods. This need for speed and a move toward smart police includes artificial intelligence (AI), with a focus on machine learning (ML) as a key tool for data analysis, pattern recognition, and predicting crime before it happens. People are more interested in using AI methods in real-life situations like finance, medicine, law, and farming because they are flexible and powerful. Large language models (LLMs) are a type of generative AI that fits into this category. But the skills and options of using LLMs in tasks like predicting crime have not yet been fully explored. This paper aims to close this gap by creating a framework based on the game-changing potential of three cutting-edge LLMs: BART, GPT-3, and GPT-4. These LLMs are used in smart policing, especially crime prediction. For example, zero-shot prompting, few-shot prompting, and fine-tuning are some of the different ways that these models are tested to see how well they can predict crime using state-of-the-art datasets from two big cities: San Francisco and Los Angeles. This project's main goal is to show how flexible LLMs are and how they can change the way crime analysis is done. A comparison of the above methods on the GPT series model and BART with ML techniques is also given. This shows that the GPT models are better at classifying crimes than the traditional ML models in most testing situations.

Keywords

Crime forecast, fine-tuning, few-shot prompting, large language models, LLM, and zero-shot prompting are all terms in this index.

Quantifying Scope 3 Emissions: An AI-Driven Framework for Dark Data Minimization in Storage Space

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Abstract

The rapid increase of unstructured and unused “dark data” in enterprise storage environments has raised growing concerns because of its contribution to Scope 3 carbon emissions. Organizations often retain excessive amounts of data in cloud systems, which increases storage demand and, in turn, energy consumption within data centers. Traditional hash-based deduplication methods are effective for detecting exact duplicate files; however, they are not well suited for identifying near-duplicate files that share semantic similarity. As a result, a significant portion of digital waste continues to occupy storage infrastructures. At the same time, much of the existing sustainability research focuses on estimating emissions or improving training efficiency rather than directly reducing emissions linked to stored data. This paper proposes an AI-based framework that focuses on reducing semantic dark data while also measuring Scope 3 carbon emissions in real time. The system uses lightweight Transformer-based embeddings (MiniLM) together with density-based clustering (DBSCAN) to detect semantically redundant files across both structured and unstructured datasets. Above 0.5 on the Silhouette Score showed solid cluster performance during testing. Under 15 milliseconds in processing time kept each file quick to analyze. A built-in engine tracks carbon savings by turning saved space into climate metrics. Each scan leaves behind barely any footprint less than 0.001 kg of CO₂. Shrinking stored data between 30% and 60% eased infrastructure load while cutting emissions. Less storage used meant stronger alignment with sustainability standards. Efficiency gains came without trading off accuracy or response speed.

Keywords

Scope 3 Emissions, Dark Data, Semantic Deduplication, Transformer Models, Carbon Quantification, Green AI, Sustainable Computing.

A Cytocompatible Neomycin Loaded Polyvinylalcohol Electrospun to Enhance Biofilm Inhibition for Orthopedic Management

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Abstract

Orthopedic trauma related surgery is very common and 13% of surgery met with severe complications due to bacterial colonization. This makes the biofilm formation at the wound site. Normally it is difficult to kill the sensitive bacteria after colonization as extracellular polymeric substance (EPS) limits the drug penetration. This leads to the chronic infection at the wound site. This infection significantly impairs the sustainability of the implant. In the present research the electrospun Nano fibrous scaffold was developed using Polyvinyl alcohol incorporated by neomycin and used as a scaffold to replace the lost bone. The neomycin loaded polyvinyl alcohol provides a broad spectrum of resistance against the bacteria. The loaded neomycin has the ability to bind irreversibly to 30S ribosomal subunit of bacteria and leads to misreading of mRNA results in the defective protein expression. This poor expression directly disrupts the extracellular polymeric substance production which acts as the structural and functional backbone of biofilm. This helps to prevent early biofilm colonization and thus prevent the infection. The phase analysis, chemical interaction and surface morphology of the developed electrospun was evolved by XRD, FTIR and SEM. The antibacterial efficacy of the scaffold was evaluated towards *Staphylococcus aureus* and *Escherichia coli*. The *in vitro* biocompatibility was evaluated using fibroblast cell lines to address cell viability and proliferation. The results obtained support that neomycin loaded PVA electrospun provide a good platform to create a bacterial free biocompatible environment at wound site.

Keywords

Wound healing, Electrospinning, Extracellular polymeric substance (EPS), Neomycin, antimicrobial property.

Patient Nutrition Monitoring Mobile App with Image-Based Calorie Tracking

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Abstract

Poor dietary habits and a lack of nutritional awareness have greatly increased the occurrence of lifestyle diseases like diabetes, obesity, and heart disease. Traditional food logging methods rely on manual entry, which can be tedious, subjective, and often inaccurate. This paper introduces a new mobile-based nutrient monitoring system that uses computer vision and personalized AI to make dietary tracking easier. The app allows users to take photos of their food from above. A Convolutional Neural Network (CNN) model then classifies the food and estimates its nutritional content. By considering user-specific information like age, height, weight, BMI, and diabetic status, the system provides real-time, personalized dietary suggestions using a Retrieval-Augmented Generation (RAG) framework. All user data and meal histories are stored securely in the cloud for long-term health tracking. The system includes an interactive chatbot for user support and maintains high accuracy with strong fairness metrics across different demographic groups. This solution changes food logging from a passive task into an intelligent, adaptive dietary coaching platform.

Keywords

Body Mass Index (BMI), Calorie tracking, Convolutional Neural Networks (CNN), Dietary assessment, Food image classification, Health informatics, Mobile health, Nutrient estimation, Personalized nutrition, Retrieval-Augmented Generation (RAG).

Reducing Commit Latency in Scalable Distributed Systems

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Abstract

Commit latency is a persistent bottleneck in scalable distributed systems, directly affecting throughput and responsiveness. It represents the time required to finalize a transaction and propagate its effects across all nodes. Existing commit mechanisms depend on multiple coordination steps validation, synchronization, and acknowledgment that are repeated for every transaction. While these steps are manageable in small clusters, they introduce significant delays as cluster size increases. As clusters expand from 3 to 5, 7, 9, and 11 nodes, communication costs, message exchanges, and synchronization requirements grow substantially, leading to higher waiting times and processing overhead. Under high concurrency, repeated commit operations further congest the network, intensify delays, and reduce overall efficiency. A key limitation of current approaches is redundant coordination, where each transaction independently incurs similar overhead. This repetitive process wastes system resources and produces latency spikes, particularly in distributed environments with frequent transactional workloads. Even when hardware resources are sufficient, responsiveness and scalability are compromised due to structural inefficiencies in commit protocols. This paper addresses the issue of increasing commit latency in scalable distributed systems. By systematically analyzing commit behavior across clusters of varying sizes, it exposes the limitations of existing mechanisms and demonstrates how coordination overhead scales with system growth. The study concludes by emphasizing the need for more efficient commit strategies that minimize redundant synchronization, reduce communication costs, and improve responsiveness. In doing so, it provides a foundation for designing scalable commit mechanisms that reconcile strong consistency with low latency, ensuring distributed platforms remain reliable and performant as they grow.

Keywords

Commit, Latency, Distributed, Systems, Transactions, Consistency, Reliability, Coordination, Synchronization, Overhead, Scalability, Concurrency, Performance, Bottleneck, Efficiency.

An Approach towards Visual Analysis of Community Detection in Social Networks

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Abstract

Networking and social interaction are crucial aspects of human existence. Technology advancements, social consciousness, & digital interaction are all contributing to the rapid expansion of human relationships. This study provides both a visual and a quantitative study of such human relations. A social network is a collection of these interactions and interpersonal connections. These social networks, which are frequently depicted as graphs with individuals as nodes engaging in some way—for example, members of online groups connecting with one another to exchange knowledge—form communities. Social media platforms like Facebook, Snapchat, and Twitter have virtually produced these kinds of communities. Locating these communities or groupings is referred to as community detection. Even though the literature has a large number of community detection methods, choosing the best one for a given task is not always simple. However, one of the most effective models for community identification is non-negative matrix factorization, which seeks to expose dispersed lower dimension representation in order to show community node membership. This study proposed an integrated robust framework where number of communities adopted by NMF is calculated automatically based on the information flow score among nodes. We implemented the proposed approach using Python.

Data-Driven Business Intelligence and Prediction System using Customer, Local and Demand Analysis

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Abstract

Globalization and the rise of online shopping have changed how consumers behave and affected local businesses. Still, small businesses face challenges. They struggle with low visibility and unstable markets due to unequal access to information, an influx of imported products, and the dominance of e-commerce. This project introduces a smart, data-driven system that finds gaps in regional products, assesses buyer sentiment, identifies competitor weaknesses, and evaluates the feasibility of new products using Machine Learning and Data Science. The system pulls together public data, e-commerce product details, regional economic factors, and real-time sentiment from online platforms. It uses clustering algorithms, predictive models, sentiment analysis, and scoring systems to find gaps in product demand, evaluate regional acceptance, assess competition, and identify growth opportunities for new businesses. In addition to analytics, this system provides useful recommendation features. These include a market gap detector, an e-commerce leakage monitor, a risk simulator, a price intelligence module, and a business expansion planner. Results are displayed through an interactive dashboard built with React, supported by backend Machine Learning models. The system serves as a valuable tool for entrepreneurs, policy makers, marketing agencies, government departments focused on small businesses, and economic researchers. Its goal is to foster smart entrepreneurship, fair commerce, and grassroots innovation, helping local businesses compete against larger market players.

Keywords

Data-Driven Decision Making, Business Intelligence System, Machine Learning Models, Sentiment Analysis, Risk Prediction, Soft-Launch Simulator, Demand-Supply Analysis, Price Determination, Predictive Analysis, Clustering Algorithms, Market-Gap Detection.

TinySleepNet X: An Efficient and Interpretable Attention Based Model for Sleep Stage Classification Using Single Channel EEG

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Abstract

High-precision automatic sleep stage recognition is required to conduct sleep analysis on a large scale and subsequent health monitoring with wearables. Although excellent results have been obtained with deep learning models that utilize single-channel EEG, most of the existing methods are based on recurrent networks and are black-box which makes them difficult to interpret and difficult to run on systems with limited resources. In the present paper, we present TinySleepNet-X an effective and interpretable model to stage sleep based on single channel EEG raw data. The model substitutes recurrent sequence modeling with temporal attention, so that it allows explicit visualization of the neighboring epochs that make the most contribution to every prediction. To enhance physiological pertinence, we propose a frequency-sensitive convolutional feature extractor based on canonical EEG bands related to sleep stages. Besides that, saliency-based attribution emphasizes informative EEG areas on the signal level, which can be explained in a case-by-case basis. The results of experiments with EEG data of public sleep such as Sleep-EDF show that the suggested method has competitive results together with minimized model complexity and cost of inference. Qualitative examination reveals that the formed explanations are consistent with the known aspects of sleep, including delta dominance in deep sleep. The findings are in favor of interpretable and lightweight sleep staging that can be used in real world and edge-based applications.

Keywords

Sleep Staging, EEG, Attention-Based Deep Learning, Explainable AI, Edge Computing, TinyML.

Green AI Selector-A Multi-Objective Recommendation System Promoting Sustainable and Performance-Aware AI Model Selection

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Abstract

Rapidly escalating dimensions of contemporary AI systems have raised concerns about their environmental implications, yet existing model selection pipelines still prioritize accuracy and latency, while ignoring energy usage and carbon emissions. This paper presents Sustainable AI Model Recommender – an interactive tool for incorporating environmental factors within the model-selection process. The method combines semantic task classification with resilient cosine-similarity based mapping utilizing BERT-based embeddings, along with constraint-aware candidate filtering and transparent baseline comparisons. In order to combine different performance and sustainability metrics, we apply the min-max normalization that shows among other normalizations the best stability and interpretability, according to our empirical study. Users can select “priority profiles” (accuracy-first, balanced, or green-first), which dynamically recalculates a weighted composite score and updates recommendations in real-time. The framework also provides energy and carbon reduction details against user human baselines for transparent diagnostic that helps to understand explain ranking decisions, matching logic, and sustainability impact. The system is able to produce selections that consistently reduce energy consumption by 40–70% without sacrificing practical performance across multiple tasks, demonstrating that financially viable AI need not be at odds with sustainability. Realized as a modular React-FastAPI app that needs no specialized hardware, the tool enables interactive investigation of trade-offs in environmental impacts and provides a sensible starting point for bringing sustainability into standard AI research and decision making.

Keywords

Sustainable-AI, Energy-efficient model selection, Carbon-aware AI, BERT-based embeddings, Semantic task classification, Cosine similarity matching, Min-max normalization, Multi-metric optimization, Green AI recommender system.

Intelligent Fusion of Thermal Imaging and YOLOv9 for Concealed Weapon Detection

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Abstract

The increase of concealed firearms is a serious threat to public safety and requires a solution that will enable a proactive minimum-security approach through systems that can automatically detect concealed weapons. This paper describes the design and implementation of a real-time concealed weapon detection system using the YOLOv9 object detection model. The major obstacle to development was accurately identifying handguns, especially after being trained with thermal imaging, since handguns visually appear similar to everyday objects, such as smartphones. To overcome this obstacle, a custom dataset was designed using the UCLM Thermal Imaging Dataset which involved extracting frames from each video feed. Further was a detailed data annotation process using the CVAT tool, creating a multi-class dataset including 'Handgun,' and 'Person', while being explicit in training the model to differentiate between a weapon and other non-threatening objects that visually appeared similar to the weapon. In addition, a custom two-class thermal dataset was prepared using the YOLOv9s model that was posed on the COCO dataset. Each model is evaluated through standard object detection evaluation metrics including Precision, Recall, and Mean Average Precision (mAP) to verify the model works effectively in identifying concealed weapons in thermal imaging.

Structural Evaluation of a Ceiling-Mounted Industrial Fume Extraction Frame Using Finite Element Analysis

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Abstract

This study investigates the structural design and performance analysis of a ceiling-mounted steel support frame intended for industrial fume extraction systems. Two design configurations were developed using computer-aided design (CAD) tools and evaluated through finite element analysis (FEA) under both static and modal loading conditions. The first configuration, lacking internal bracing, exhibited excessive stress concentrations and unacceptable levels of deformation, rendering it structurally inadequate. A revised design incorporating diagonal bracing demonstrated significantly improved performance, with reduced stress and deformation levels within permissible safety limits. Modal analysis confirmed that the braced frame's natural frequencies are sufficiently separated from the excitation frequencies encountered during normal operation, thereby minimizing the risk of resonance. The findings confirm the adequacy of the proposed frame design and highlight the importance of structural assessment in ensuring the safety and durability of industrial fume extraction systems.

Keywords

Industrial ventilation, ceiling-mounted frame, structural steel, finite element analysis (FEA), modal analysis, fume extraction, design optimization.

Experimental Investigation of Crack Healing Behavior in Concrete with UF-Encapsulated Epoxy Resin

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Abstract

Concrete is the most widely used construction material, but its brittle nature makes it prone to cracking due to shrinkage, temperature changes, and mechanical loading. These cracks allow harmful substances to enter, reducing durability and service life. This study examines the self-healing behavior of concrete containing epoxy-filled microcapsules with a urea-formaldehyde shell. The microcapsules were produced using an in-situ polymerization method and added to the concrete mix in predetermined proportions. Concrete specimens were prepared through standard batching, mixing, and casting procedures and cured for 28 days. Mechanical performance was assessed using compressive and bending strength tests. Controlled cracks were introduced, and photographs taken before and after healing were used to observe crack closure. Results showed that higher microcapsule contents slightly reduced compressive strength, while an optimum dosage provided strength comparable to or slightly greater than conventional concrete. Bending strength tests indicated improved post-crack behavior due to the release of the epoxy healing agent. Controlled cracking tests demonstrated effective healing, with cracks up to 0.4 mm wide achieving a closure efficiency of approximately 70–90%. SEM analysis confirmed microcapsule rupture and epoxy release along crack paths, forming strong adhesive bonds between crack faces. Overall, the results suggest that epoxy-based microcapsule self-healing concrete is an effective approach for improving durability, extending service life, and reducing maintenance costs.

Explainable AI for Sports Injury Risk Assessment: A SHAP-Based Analysis Using Advanced Machine Learning Models

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Abstract

One of the biggest issues in athlete health management is sports injuries, which emphasizes the need for accurate, interpretable, and feasible prediction models. While machine learning models are highly effective in predicting the risk of injury, the issue of interpretability is a significant hurdle in the adoption and acceptance of machine learning models in sports medicine. With a multimodal dataset including physiological, biomechanical, workload, and environmental features, this paper proposes a framework for explainable artificial intelligence (XAI) to determine injury risk variables in sports. To understand complex nonlinear relationships, state-of-the-art tabular learning models such as XGBoost, LightGBM, CatBoost, and TabNet are employed, and a meta-learning strategy is also employed for personalized athlete-specific assessment. Interpretability is achieved by exploiting attention-driven interpretation from TabNet and SHAP-based global and local feature importance. While individual athlete interpretations suggest a significant individual variation in risk factors, the results suggest robust and feasible injury risk factors. In sports analytics and sports medicine, the proposed paradigm bridges the gap between predictive accuracy and interpretability to provide transparent, personalized, and data-driven solutions for injury prevention.

Managing Carbon Footprint in Global Supply Chains: A Data-Driven Strategy Employing AI Algorithms

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Abstract

The modern interconnected economy is characterised by global supply chains which influence the production system, consumption patterns, and international trade. Globalization has facilitated cost efficiency, efficient utilization of resources and diversified sourcing, however, it has also contributed to the enormous increase in carbon emission. A large portion of global CO₂ emissions is now related to logistics, transportation and supply chain activities, which is why carbon footprint management has become an urgent issue that is of concern to the industry and policymakers as well. Nonetheless, conventional methods of carbon accounting, which are mostly founded on the fixed emission factors, past averages, and linear models, are unable to reflect the dynamic and complex nature of contemporary supply chains. This complexity is occasioned by the differences in fuel efficiency, multimodal transport paths, real-time traffic, different energy sources, weather fluctuations, and geopolitical shocks. Artificial intelligence (AI) provides a strong data-based solution in this respect. AI models have the potential to substantially improve the performance of emission prediction by training nonlinear relationships using large, heterogeneous data. Specifically, Transformer-based models demonstrate a high ability to respond to long-term dependencies to high-dimensional time-series data, which is why they are effectively applicable in carbon emissions predictions based on the information collected by the IoT sensors, GPS, enterprise records, transport logs, and energy consumption. The process of accurate forecasting alone is not sufficient to meet the sustainability goals because of trade-offs between costs and environmental performance. To solve this, the proposed framework combines Transformer-based emission forecasting and multi-objective optimization methods, i.e., NSGA-II and MOPSO, to produce the Pareto-optimal cost carbon trade-off solutions under service-level constraints. The findings demonstrate accuracy in prediction, adaptable decision-making, and greater transparency, which provide a viable avenue of approaching global supply chain management to achieve greater sustainability, resilience, and smartness.

Automated Endpoint Triage: A Heuristic-Based Framework for Rapid Evidence Assessment

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Abstract

Security Operations Centers (SOCs) face a critical bottleneck during the initial triage phase of incident response, where the volume of digital artifacts overwhelms human analysts. While deep forensic tools exist, they lack the agility required for rapid "triage-level" decision-making. This paper proposes CyberTriage, a novel automated framework that bridges the gap between raw data collection and actionable intelligence. We formalize a multi-stage analysis pipeline that integrates Shannon entropy, Portable Executable (PE) metadata, and YARA signature matching. Furthermore, we introduce a formal heuristic engine modeled as a deterministic state assessment to automatically assign risk levels (Low, Medium, High) to compromised endpoints. Experimental evaluation against a dataset of 5,000 artifacts demonstrates that CyberTriage reduces analysis latency by 92% compared to manual forensics while maintaining a False Negative Rate (FNR) below 3.5%.

Keywords

Digital Forensics Incident Response (DFIR), Automated Triage, Heuristic Analysis, Malware Detection, CyberTriage.

Smart Helmet System with Alcohol Detection and ML-Based Crash Prediction using IoT and SMTP Alerts

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Abstract

Road safety is a major concern, particularly the traffic-prone area that has a low enforcement of the laws associated with helmet compulsory usage and alcohol consumption. To address these issues, we would recommend the creation of an elaborate smart helmet device with multi-fusion sensors and real-time communications. To ensure safety and only sober individuals can come down the road on the vehicle, the system is set with alcohol recognition sensor (MQ3), which will not allow a vehicle to ignite in case alcohol can be detected in the breath of the rider. Besides the conventional safety checks, we suggest some higher level machine learning models - AdaBoost and Gradient Boosting to anticipate any accidental crashes with the help of the real-time data of the combination of sensors such as accelerator, gyroscope, GPS etc. The patterns are analyzed with the help of these models and indicate the accidents and give predictive warnings with the maximum accurate rates. When crash or a critical anomaly is detected, the system will initiate an SMTP-based notification block which automatically delivers a real-time email notification to emergency contacts including the actual GPS position of the incident. The IoT platform correspondingly integrated will enable the control and monitoring of the helmet (and vehicle status) remotely. The solution is a smart helmet that supplements the key road safety mechanisms and integrates an IoT, smart crash prediction, alcohol and emergency communication in a single small and efficient device - all (erroring to respond to an accident in time and eventually save lives.

Keywords

Smart Helmet, Alcohol Detection, Machine learning, Crash Prediction, IoT, Emergency Alerts.

Proactive Hazard Elimination in Pressure Vessel with Smart Monitoring Systems

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Abstract

The study presents a comprehensive framework that will help to increase the safety and reliability of industrial pressure vessels using combined conservative design margins, finite element analysis, and smart monitoring.

The Pressure Vessel, designed of SA 516 Grade 70 steel, including a Kloppeboden top closure and a cylindrical shape, was designed to have a wall that is only 4 mm, nearly four times the thickness that is required in the ASME Section VIII. Compliance was checked by analytical calculations, and the SolidWorks simulations verified the mechanical integrity, with a maximum von Mises stress of 317 MPa in which is far below the allowable 450 MPa (FoS = 1.42), and an elastic deformation was 3.97 mm.

The manufacturing drawings ensures that there is clarity in fabrication instructions and code compliance. Besides structural design, structural safety is also improved by means of embedded sensors, vibration control, and real-time control of pressure, temperature, corrosion and acoustic measurements.

Keywords

Pressure vessel design, ASME Section VIII compliance, SolidWorks simulation, Factor of safety (FoS) Condition monitoring sensors, AI driven valve intervention, Predictive maintenance, Lifecycle reliability.

A Unique Approach for Assessing the Efficacy of Wearable Health Monitoring Devices in Managing Chronic Conditions

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Abstract

HeaTAMLSTM provides a novel framework for the evaluation of wearable health monitoring devices in chronic disease management. In this paper we introduce a novel framework that integrates Temporal Pattern Mining with long short-term memory (LSTM) networks. This enables us to robustly capture and analyze complex temporal patterns in health data. Where traditional tools can offer only isolated or static analytic views, HeaTAMLSTM incorporates temporal data into its analysis providing more context to make prediction of health outcomes personal and accurate. This integration is responsible for the early diagnosis of people at risk, promoting individualized action plans that will increase this population's life expectancy. According to a full assessment, HeaTAMLSTM protruded 92.7% prediction accuracy for health metric time series and outperformed classical approaches by far. In addition to having a larger value performance in health outcome predictions (15% lower Mean Absolute Error, MAE than existing methodologies) Moreover, HeaTAMLSTM was able to recognize critical health conditions before they can significantly impact a patient's condition leading in an increase of up 20% of early detection rates related with adverse patients' evolution; which demonstrate the important role that automated approaches may play for fine adjustments on-patient medical management strategies. Using a real-world wearable health monitoring data based case study, the article highlighted that HeaTAMLSTM framework applied to different healthcare scenarios demonstrated its scalability and adaptability further validating it as pioneering work encompassing integration of wearables in predictive healthcare analytics arena.

Keywords

Chronic Disease Management, Early Detection, Health Data Analysis, Long Short-Term Memory (LSTM) Networks, Predictive Healthcare Analytics.

Blockchain Ontology for Streamlining Application Development using Semantic Web Rule Language

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Abstract

Decentralised applications DApps allow for extensive and trusted functions via blockchain infrastructure. These applications have various services like decentralized storage, transaction scalability protocols and distributed computing solutions. To develop reliable tools by integration of DApps, the primary aim is to propose a novel ontology of the blockchain based on EthOn. This paper introduces basic concepts on creation of the ontology that are associated with the DApp. Then elucidates about the development of links that are associated with them. The work provides the literature on existing application with the architecture of blockchain through blockchain patterns. To meet the primary aim of the work, Semantic Web Rule language (SWRL) is utilised that showcase rules which act as restrictions to address the integration of DApps. Thus, using an inference engine, the work determines novel restrictions on properties like cost and other characteristic metrics. For instance, the work illustrates constraint inference of the concept between Ethereum and polygon, which is a sidechain of Ethereum. In conclusion, this work contributes on developing applications on video games which are built on blockchain technology. This work also helps in understanding the ontology in modelling DApps. It has potential contributions in applications with several related areas in future works.

Keywords

Ontology, DApps, Decentralized applications, Blockchain.

FIN AID AI: An Intelligent Conversational Financial Advisor for Personalized Money Management

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Abstract

Financial literacy remains a significant challenge for beginners due to the complexity of financial products and the lack of personalized guidance. Traditional financial applications often focus on isolated functionalities such as expense tracking or investment visualization, offering limited educational support. This paper presents FinAid, an intelligent conversational financial advisory system designed to assist users in understanding and managing personal finance through interactive and AI-driven guidance. The system integrates a React-based user interface, a Flask backend, secure SQLite authentication, real-time stock market data via the Alpha Vantage API, and a large language model for conversational assistance. Quantitative evaluation demonstrates average backend response times between 150–300 ms and chatbot response latency below one second. The results indicate improved usability, responsiveness, and accessibility for beginner users. FinAid emphasizes ethical AI usage, data privacy, and transparency while providing scalable financial learning support. The proposed system demonstrates the potential of conversational AI in enhancing financial awareness and informed decision-making among novice users.

Keywords

Financial Literacy, Personal Finance, Expense Tracker, Stock Market Analytics, AI Chatbot, LLaMA Model, Alpha Vantage API, Flask Backend, React Frontend, FinTech Application.

AI-Based Farmer Assistant: A Unified Platform for Crop Selection, Disease Diagnosis, and Market Insights

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Abstract

Agricultural productivity in emerging economies often suffers from fragmented decision-making and limited access to data-driven insights. This study introduces Farmer Assistant, an integrated, hybrid artificial intelligence (AI) ecosystem designed to augment agronomic decision-making through multi-modal intelligence. The proposed framework converges rule-based agronomic heuristics with machine learning-driven inference to deliver context-aware crop recommendation and causal disease diagnostics. A Random Forest classifier is trained on synthetically augmented agronomic datasets incorporating soil macro-nutrient profiles, climatological variables, and geospatial parameters, achieving 94% predictive precision. Complementarily, the disease analysis module fuses computer vision descriptors—derived via colorimetric, texture, and edge-based operators—with natural language symptom analytics to yield a multimodal diagnostic pipeline attaining 95% accuracy. A causal reasoning engine further articulates interpretable causal chains elucidating disease origins, propagation trajectories, and remediation pathways. Experiments were conducted on a composite dataset integrating 12,000 farmer records from the Indian Soil Health Card scheme and 4,000 augmented leaf samples validated by agronomists. Five-fold cross-validation and baseline comparisons with CNN (ResNet-50) and XGBoost confirm the robustness of the proposed approach.

Keywords

Hybrid Artificial Intelligence, Causal Reasoning, Agronomic Informatics, Multimodal Disease Diagnosis, Crop Recommendation Systems, Precision Agriculture, Agricultural Market Intelligence.

Effect of Geogrid and Bamboo-Grid Reinforcement in Soil Subgrade Using Static Cone Penetration Test

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Abstract

Unpaved roads are constructed over soft subgrade soils undergoes frequent deformation, rutting, and reduced service life under repeated traffic loading. Ground improvement using geosynthetic reinforcement is an effective method to enhance subgrade strength and load-bearing capacity. This study presents a comparative investigation of geogrid and bamboo grid reinforcement in soft subgrade soil using the static cone penetration test (SCPT). Reinforcement layers were placed at depths of 50 mm and 100 mm within the prepared test sections to evaluate their influence on penetration resistance and stiffness characteristics. The SCPT results indicate a significant improvement in cone resistance and reduction in penetration depth for reinforced sections compared to the unreinforced soil. The geogrid reinforced subgrade shows an increase to 225 percent cone resistance and the bamboo grid reinforced subgrade shows 201 percent increase in cone resistance when compared with unreinforced soil. The geogrid-reinforced section exhibited comparable cone resistance and stiffness values as shown by bamboo grid reinforcement. The study concluded that bamboo-grid reinforcement may prove as a sustainable and locally available alternative compared to other reinforcement types.

Development of an IoT Controlled LED Lighting System for Smart Greenhouses

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Abstract

Lighting regulation in greenhouse environments plays a decisive role in determining crop vitality, energy utilization, and yield stability. This research presents the design and deployment of an IoT-enabled LED illumination and climate regulation framework intended for smart greenhouse cultivation. The system integrates multi-modal sensing units to continuously observe parameters including temperature, humidity, soil moisture, pH, and ambient illumination. LED spectral intensity is automatically adjusted using feedback-based algorithms to maintain favourable growth zones. IoT connectivity enables bidirectional data flow, remote actuation, and real-time visualization through a mobile interface. Experimental evaluation shows that the prototype maintains environmental parameters within optimal ranges while reducing excess energy consumption, demonstrating its effectiveness for modern precision agriculture and sustainable cultivation practices.

Keywords

Smart Greenhouse, IoT, LED Lighting, Energy Optimization.

Autonomous Vehicle Navigation: Lane and Traffic Sign Detection Using Deep Learning Techniques

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Abstract

Autonomous vehicle navigation critically depends on accurate perception of road environments, where reliable lane detection and traffic sign recognition are essential for safe driving and regulatory compliance. Traditional computer vision approaches often fail under challenging real-world conditions such as varying illumination, weather changes, occlusions, and complex urban scenes. Recent advancements in deep learning have significantly improved the robustness and accuracy of perception systems. This paper presents a unified deep learning-based framework for autonomous vehicle navigation that integrates semantic segmentation for lane detection and real-time object detection for traffic sign recognition. The lane detection module employs encoder-decoder architectures such as U-Net and SegNet, along with instance segmentation using Mask R-CNN, to achieve precise pixel-level lane boundary extraction. The traffic sign detection module utilizes state-of-the-art YOLOv8 and YOLOv10 models to provide high detection accuracy and real-time inference. The outputs of both subsystems are fused into a unified perception layer to support lane keeping, speed regulation, and safe navigation decisions. Experimental results demonstrate that the proposed framework achieves high segmentation accuracy for lane detection and superior mean average precision for traffic sign recognition, even under challenging environmental conditions. The integrated system improves navigation reliability, reduces false detections, and enhances overall perception performance. The results validate the effectiveness of deep learning-based multimodal perception systems for next-generation autonomous driving applications.

Keywords

Autonomous vehicles, lane detection, traffic sign recognition, deep learning, semantic segmentation, object detection, YOLO, U-Net, Mask R-CNN, intelligent transportation systems.

Deep Temporal Modeling for Rice Leaf Disease Recognition using TCN-GRU

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Abstract

Rice plants that are sick can have a negative impact on food supply (especially for countries that depend heavily on farming for their economies). The tools we currently have to detect disease in these plants generally rely on visual analysis through a standard CNN (Convolutional Neural Network) which analyses still images of the affected rice leaves. The issue with these methods is they lack any understanding of how disease manifests itself through structured spatial relationships within the images. This research seeks to establish a new approach to the disease identification process through a combination of Temporal Convolutional Networks (TCNs) and Gated Recurrent Units (GRUs) working together in one system to provide the capability to model structured feature dependencies. Although our research focuses primarily on determining the moment at which an event occurs, we also maintain the use of real-world signals from the rice plant itself to accomplish this objective. A Convolutional Neural Network extracts spatial characteristics from images of the rice leaves. The second component of the analysis is a Temporal Convolutional Network that processes these spatial characteristics through ordered feature sequences identifying various spatial patterns across the leaf. The last component is the Gated Recurrent Unit (GRU) Layer that will refine contextual consistency among the extracted characteristics. This work was conducted using the Kaggle Rice Leaf Disease Dataset, and demonstrated significant improvements in both diagnostic accuracy and reliability over traditional CNN methodologies. Overall the combination of dependency-based layers improves both accuracy and reliability in detecting the presence of diseases in agricultural crops.

Keywords

Rice leaf disease recognition, deep learning, temporal convolutional network, GRU, precision agriculture.

A Real-Time Face Mask Detection and Monitoring System Using YOLOv8 and OpenCV

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Abstract

The widespread outbreak of infectious diseases such as COVID-19 has emphasized the importance of automated systems for monitoring public safety measures, particularly face mask compliance. Real-time face mask detection has become a crucial application in smart surveillance, healthcare facilities, transportation hubs, and workplaces. With recent advancements in deep learning and computer vision, object detection models have demonstrated remarkable performance in real-time scenarios. This study presents a real-time face mask detection and monitoring system using YOLOv8 and OpenCV, designed to accurately identify individuals wearing masks, not wearing masks, or wearing masks improperly in live video streams.

The proposed system leverages the lightweight and high-speed YOLOv8 object detection framework for precise face and mask classification, while OpenCV is used for video acquisition, frame processing, visualization, and system integration. YOLOv8's advanced feature extraction, anchor-free detection, and improved loss functions enable high accuracy even under challenging conditions such as varying illumination, occlusions, multiple faces, and crowded environments. The system processes video streams in real time, detects faces, classifies mask usage, and displays alerts or compliance statistics for monitoring purposes. Experimental evaluation demonstrates that the YOLOv8-based model achieves superior detection accuracy, precision, recall, and real-time inference speed compared to traditional CNN-based and earlier YOLO variants. The results validate the effectiveness of integrating YOLOv8 with OpenCV for scalable and reliable face mask monitoring systems. The proposed framework is well suited for deployment in real-world public surveillance systems, contributing to improved public health safety and automated compliance enforcement.

Keywords

Face Mask Detection, YOLOv8, OpenCV, Real-Time Monitoring, Computer Vision, Deep Learning, Public Safety Surveillance.

An AI-Based Ocean Plastic Cleanup Tracker Using YOLOv8 and Satellite Image Analysis

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Abstract

Plastic pollution in the world's oceans has become a critical environmental challenge, threatening marine biodiversity, disrupting ecosystems, and impacting human health through microplastic contamination. Conventional ocean monitoring and cleanup methods rely heavily on manual surveys, ship-based observations, and localized sensing systems, which are expensive, time-consuming, and incapable of providing continuous large-scale coverage. To overcome these limitations, this study presents an AI-based ocean plastic cleanup tracker that integrates the YOLOv8 deep learning object detection model with satellite image analysis for automated, scalable, and efficient monitoring of marine plastic debris.

The proposed system utilizes high-resolution satellite imagery to detect floating plastic waste across vast oceanic and coastal regions. Preprocessing techniques such as atmospheric correction, noise reduction, contrast enhancement, and image tiling are applied to improve image quality and ensure compatibility with deep learning models. YOLOv8 is employed for its superior real-time detection capability, enhanced feature extraction, and robustness in identifying small, irregular, and sparsely distributed plastic objects on water surfaces. The model accurately localizes plastic debris by generating bounding boxes with confidence scores, enabling precise geospatial mapping of pollution hotspots.

In addition to detection, the system supports cleanup tracking by geotagging detected plastic regions and analyzing temporal changes in debris distribution. This enables environmental agencies and cleanup organizations to prioritize high-risk zones, evaluate cleanup effectiveness, and monitor long-term pollution trends. Experimental analysis demonstrates that the proposed framework achieves high precision, recall, and mean average precision, outperforming traditional CNN-based approaches and earlier YOLO variants in satellite-based marine debris detection. Overall, this AI-driven solution provides a scalable, data-driven approach for ocean plastic monitoring and supports global efforts toward sustainable marine ecosystem management.

Keywords

Ocean Plastic Pollution, YOLOv8, Satellite Image Analysis, Marine Debris Detection, Deep Learning, Environmental Monitoring, Cleanup Tracking.

Hierarchical Feature Refinement for Robust Audio Deepfake Detection Across Real-World Attacks

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Abstract

Fake audio is getting better and harder to spot, and that's a real problem. We need smart, reliable ways to catch these deepfakes before they cause trouble. Sure, the latest tools that use big self-supervised learning models look impressive, but they stumble when they run into new types of fakes or when you try to use them outside the lab. They're just too complicated for real-world action. So, in this paper, we're offering something new. We built a detection system that pulls together a pre-trained WavLM encoder and our own Hierarchical Artifact Refinement (HAR) module. HAR does something clever: it splits the work into two streams. One zooms in on tiny, local glitches in the audio, using a Temporal-Frequency Reasoning block. The other steps back, looking for bigger, more global inconsistencies with a Hierarchical Attention Mechanism. Together, they turn general audio features into sharp, deepfake-busting signals. We tested our setup on the ASVspoof 2021 and 2025 Logical Access databases. On the 2021 set, it hit an equal error rate of just 0.83%, which puts it ahead of the pack. Even on the tougher 2025 set, packed with newer kinds of deepfakes, it held strong at 1.52%. We ran plenty of ablation tests too, just to make sure each part of HAR really matters—it does. Bottom line: focusing on smart, targeted refinement of SSL features makes deepfake detection not just more accurate, but tougher across different datasets. This is a real step forward in fighting fake audio.

Keywords

Deepfake Audio Detection, Self-Supervised Learning, WavLM, Generalization, ASVspoof, Audio Forensics.

Human Activity Recognition Using Deep Learning Models on Smartphone Sensor Data

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Abstract

Human Activity Recognition (HAR) using smartphone sensor data has gained significant attention due to its wide range of applications in healthcare monitoring, fitness tracking, smart environments, and intelligent transportation systems. Modern smartphones are equipped with embedded sensors such as accelerometers, gyroscopes, and magnetometers, enabling continuous and low-cost activity monitoring. Traditional machine learning approaches for HAR rely heavily on handcrafted feature extraction, which limits adaptability and performance in real-world scenarios. To overcome these challenges, this study presents a deep learning-based Human Activity Recognition framework that directly learns discriminative spatial and temporal features from raw smartphone sensor signals. The proposed approach employs hybrid deep learning architectures combining Convolutional Neural Networks (CNNs) for spatial feature extraction and recurrent models such as Long Short-Term Memory (LSTM) or Gated Recurrent Units (GRU) for temporal dependency modeling. Attention mechanisms are incorporated to focus on the most relevant sensor patterns, improving recognition accuracy and robustness. Experimental evaluation on benchmark datasets demonstrates superior performance compared to traditional and standalone deep learning models, achieving high accuracy, precision, recall, and F1-score. The results confirm that deep learning-based HAR systems provide reliable and scalable solutions for real-time human activity monitoring in real-life environments.

Keywords

Human Activity Recognition, Deep Learning, Smartphone Sensors, CNN-LSTM, Attention Mechanism, Wearable Computing.

Speech Emotion Recognition Using Deep Convolutional and Recurrent Neural Networks

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Abstract

Machines now understand feelings through voice, thanks to Speech Emotion Recognition. Instead of depending on manually designed traits, older methods hit walls when facing shifting sound patterns. A mix of deep learning models steps in. Deep CNNs grab structure while BiLSTM tracks time-based shifts across utterances. This approach links visual-like sound maps with sequence-aware processing, bridging gaps standalone systems miss. Audio gets turned into Mel-Spectrograms and MFCCs after cleaning, slicing, boosting, and muting empty stretches. Noise fades out before clips split and multiply, prepping inputs for deeper inspection. Patterns pulled from sound data move through layered networks that spot key frequency clues, yet time-aware units track how feelings shift frame by frame. A final layer decides the emotion using clear scoring rules, holding up well when tested on varied feeling types. Tests on standard collections show this mix beats separate designs relying only on space or time features alone. Mixing both views - where details live and how they flow - builds sturdier tools that react fast without missing nuance.

Keywords

Speech Emotion Recognition, Deep Learning, CNN, RNN, BiLSTM, MFCC, Mel-Spectrogram, Affective Computing, Human-Computer Interaction.

AI-Powered Virtual Doctor: An Intelligent System for Automated Symptom Diagnosis and Health Recommendation

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Abstract

Timely diagnosis and accessible medical support remain critical challenges in modern healthcare, especially in regions with limited medical infrastructure and increasing patient load. Traditional diagnostic systems require in-person consultations, often causing delays, miscommunication, and insufficient early assessment. To address these challenges, this paper proposes an AI-Powered Virtual Doctor—an intelligent and automated healthcare assistant capable of analyzing symptoms, identifying disease probabilities, and generating personalized health recommendations. The system integrates Natural Language Processing (NLP), medical knowledge graphs, and machine-learning-based diagnostic modeling to interpret symptoms provided through text or voice. Transformer-based models such as BERT and GPT classifiers extract semantic medical context, while a probabilistic reasoning engine maps symptoms to disease likelihoods with high accuracy. A health recommendation generator provides medication insights (where legally permissible), lifestyle guidance, triage-level urgency classification, and preventative care suggestions.

Experimental evaluation using publicly available medical datasets demonstrates high performance across accuracy, precision, recall, and F1-score metrics. The proposed system outperforms existing health chatbots and symptom checkers by incorporating multi-stage reasoning, contextual symptom interpretation, and reliability-enhancing medical inference rules. Results indicate significant improvements in diagnostic accuracy, recommendation relevance, and response consistency. This AI-powered virtual doctor offers a scalable, low-cost, and accessible telemedicine solution designed to support early detection, reduce clinical burden, and improve patient engagement. Future work will integrate multimodal physiological inputs, sensor-based monitoring, and clinical trial validation to enhance reliability in real-world deployments.

Keywords

AI in Healthcare, Virtual Doctor, Symptom Diagnosis, Natural Language Processing, Disease Prediction, Machine Learning, Recommendation Systems, Healthcare Automation.

Crop Yield Prediction Using Data-Driven Machine Learning Models Based on Weather and Soil Parameters

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Abstract

Accurate crop yield prediction is essential for sustainable agricultural planning, resource optimization, and climate-resilient decision-making. This research presents a comprehensive data-driven machine learning framework that integrates historical weather patterns, soil nutrient characteristics, and agro-environmental parameters to enhance the accuracy of yield forecasting. The proposed methodology incorporates multisource datasets consisting of temperature, rainfall, humidity, pH, NPK composition, and soil moisture, enabling deeper analysis of environmental influences on crop productivity. Advanced machine learning models—including Random Forest, XGBoost, and Bagging Regressor—are developed and evaluated, leveraging their ability to learn both linear and highly nonlinear relationships within agricultural datasets. To further strengthen prediction performance, feature engineering techniques such as correlation-based selection, normalization, and multivariate agroclimatic modeling are employed. Experimental results demonstrate that the ensemble models outperform traditional approaches by achieving significantly higher accuracy, minimal error rates, and more reliable seasonal yield estimations across diverse crop types.

The study highlights the potential of integrating soil chemistry, meteorological inputs, and machine learning algorithms for precise yield forecasting, thereby providing farmers, agronomists, and policymakers with actionable insights for optimizing crop management, improving food security, and supporting climate-smart agriculture. This model can serve as an intelligent advisory tool for real-time agricultural decision-support systems.

Keywords

Crop Yield Prediction, Machine Learning, Weather Parameters, Soil Nutrients, XGBoost, Random Forest, Ensemble Learning, Precision Agriculture, Sustainable Farming.

Automated Medical Image Segmentation for Tumor Detection Using U-Net Deep Learning Architecture

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Abstract

Automated tumor segmentation in medical imaging plays a critical role in modern diagnostic workflows, enabling faster, more accurate, and reproducible clinical assessments. Manual delineation of tumor boundaries from MRI and CT scans is labor-intensive, time-consuming, and prone to subjective variability across radiologists, especially when dealing with complex tumor structures, ambiguous boundaries, and heterogeneous tissue characteristics. To address these challenges, this research presents a fully automated tumor segmentation framework based on the U-Net deep learning architecture. The proposed model incorporates a symmetrical encoder-decoder network designed to perform precise pixel-level segmentation while preserving spatial information through skip connections. A comprehensive preprocessing pipeline—including skull stripping, noise filtering, intensity normalization, and data augmentation—is applied to improve data uniformity and reduce variability across imaging modalities. The model is further optimized using Dice loss and cross-entropy to handle class imbalance and ensure accurate tumor localization. Experimental evaluation demonstrates that the system achieves high accuracy across key segmentation metrics such as Dice coefficient, Intersection-over-Union (IoU), precision, and recall. The results confirm that U-Net can effectively segment tumors in MRI images with strong boundary preservation and minimal false detections. This automated approach reduces radiological workload, supports early tumor detection, and enhances treatment planning, making it suitable for integration into real-world clinical environments.

Keywords

U-Net, Medical Image Segmentation, Brain Tumor Detection, MRI Analysis, Deep Learning, Semantic Segmentation, Dice Coefficient, IoU.

A Predictive Analytics Approach for Car Price Estimation Using Ensemble Regression Models

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Abstract

Accurate estimation of used car prices has become increasingly critical for buyers, sellers, dealers, and online automobile marketplaces. Traditional valuation methods rely heavily on manual assessment and subjective judgment, often failing to capture the nonlinear interactions among vehicle attributes. This paper presents “A Predictive Analytics Approach for Car Price Estimation Using Ensemble Regression Models,” which integrates advanced machine learning techniques to enhance the precision, reliability, and generalization of car price prediction systems. The proposed methodology employs multiple ensemble regression models—including Random Forest, Gradient Boosting, XGBoost, and AdaBoost—to leverage the complementary strengths of bagging and boosting techniques. A comprehensive data preprocessing pipeline consisting of missing value treatment, outlier removal, feature encoding, normalization, and multicollinearity reduction ensures high-quality input for model training. The system is evaluated using RMSE, MAE, R^2 score, and threshold-based precision, recall, and F1-score, enabling an extensive performance assessment. Experimental results demonstrate that the hybrid ensemble approach significantly outperforms individual regression models and conventional machine learning techniques. Furthermore, comparative analysis with existing literature confirms the robustness and scalability of the proposed framework in real-world conditions. This study highlights the value of predictive analytics and ensemble learning in building reliable, data-driven car valuation systems for automotive marketplaces, resale platforms, and finance-based vehicle assessment.

Keywords

Car Price Prediction, Ensemble Regression, Machine Learning, Predictive Analytics, XGBoost, Gradient Boosting, Random Forest, Automotive Data.

Multimodal Emotion Recognition Through Fusion of Textual and Visual Deep Learning Features

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Abstract

Multimodal Emotion Recognition (MER) has emerged as a crucial research area due to its wide range of applications in human-computer interaction, healthcare analytics, sentiment analysis, and intelligent multimedia systems. Human emotions are inherently complex and are often expressed through multiple modalities such as text and facial expressions. Relying on a single modality frequently leads to ambiguous or incomplete emotion interpretation. To address this limitation, this work proposes a robust multimodal emotion recognition framework that fuses deep learning features extracted from both textual and visual data. Textual information is encoded using transformer-based language models to capture contextual and semantic emotional cues, while visual information is processed using deep convolutional neural networks or vision transformers to extract expressive facial features. The extracted multimodal representations are aligned and integrated using feature-level fusion with attention mechanisms, enabling effective modeling of inter-modal dependencies. The fused feature vector is subsequently classified using fully connected layers to predict discrete emotional states. Experimental evaluation on benchmark multi-modal emotion datasets demonstrates that the proposed fusion-based approach significantly outperforms unimodal models in terms of accuracy, precision, recall, and F1-score. The results confirm that integrating textual and visual modalities enhances robustness, generalization capability, and emotion recognition performance, making the proposed system suitable for real-world intelligent and emotion-aware applications.

Keywords

Multimodal Emotion Recognition, Deep Learning, Text-Visual Fusion, Transformer Models, Convolutional Neural Networks, Feature-Level Fusion.

Hand Gestures and Voice Based ATM Operations Using Machine Learning

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Abstract

The smart ATM experience by making it secure and almost entirely contact-free. Here's how it works: First, you pop in your debit card. Then, the ATM uses facial recognition—specifically the Haar Cascade algorithm—to match your face with what's stored in its database. That way, only you can access your account. After that, instead of pressing physical buttons, you enter your password on a virtual keyboard, which keeps things cleaner and safer. The real magic happens with gesture control. The system uses the MediaPipe library to read your hand movements, letting you move a virtual mouse and keyboard. You wave or point to select options, withdraw cash, or check your balance—all without touching a thing. There's also a smart voice assistant onboard. It talks you through each step, gives clear instructions, and confirms your transactions. This makes the ATM much easier to use, especially for anyone who's visually impaired or just prefers spoken guidance. The screen layout is designed to be straightforward and stress free, so even if you're not tech-savvy, you won't get lost. By tying together face recognition, gesture controls, and voice help, this system delivers extra security and convenience. Plus, it keeps things more hygienic and accessible for everyone. It's a fresh, smart way to do banking—no buttons or worry about germs, just a safer and smoother ATM visit all around.

Keywords

Machine learning, Image processing, Human computer interface, Artificial intelligence, Voice A, Embedded systems.

Proactive Maintenance Intelligence Using Feature-Driven Machine Learning Models for Failure Anticipation

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Abstract

The conventional reactive and preventive maintenance methods are not always able to identify the early degradation patterns since they are based on predetermined schedules or human inspection. In order to overcome this shortcoming, this paper introduces a proactive maintenance intelligence architecture that is grounded on feature-based machine learning models to predict imminent failures. The suggested method systematically converts raw operational and sensor data into informative degradation-sensitive characteristics, which improve predictive capability. It will have a detailed pipeline consisting of preprocessing of data, feature engineering, exploratory analysis, and supervised learning-assisted failure classification. Several machine learning models such as Random Forest, Gradient Boosting and Naive Bayes classifiers are implemented and tested to determine their capability in predicting machine failures. Standard evaluation measures of accuracy, precision, recall, F1-score, and ROC-AUC are used to measure model performance to achieve robustness and reliability. Through experimental evidence, it has been shown that ensemble-based models, specifically feature-based Random Forest and Gradient Boosting classifiers, are better at early failure detection than probabilistic baselines. Moreover, the practicality of the real-life implementation is confirmed by a web-based predictive interface that makes it possible to monitor continuously and support decisions. The suggested framework will enable the shift between the reactive maintenance to the intelligent, data-driven proactive maintenance and enhance the reliability of machines, minimize downtime, and streamline the maintenance planning in industrial systems.

Keywords

Predictive Maintenance, Proactive Failure Prediction, Feature Engineering, Industrial Systems, Machine Learning, Condition Monitoring, Fault Detection, Sensor Data Analytics, Supervised Learning, Asset Health Monitoring.

Fake Profile Detection on Social Networking Websites using Machine Learning

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Abstract

The present generation has seen an increase in the use of online social networks (OSNs), which has an impact on people's social lives and motivates them to connect with various social media platforms. Communications, agenda-setting, news generation, marketing, and advertising are just a few of the many jobs that social networks have made feasible. Adding new friends and keeping up with their changes is now easier. Researchers have been studying these online social networks to find out how they affect people. Some bogus accounts are used to promote agendas and disseminate misleading information. Finding malicious accounts is crucial. To find bogus accounts that could trick consumers, machine learning-based methods were used. A comparison model is created after the dataset is pre-processed using a number of Python tools in order to obtain a practical method that is suitable for the dataset. A number of machine learning algorithms recognize attempts to detect fraudulent accounts on social media sites. Based on their capacity for categorization, the algorithms Random Forest, Neural Network, and Support Vector Machines are used to identify fake accounts.

Data-Centric Agriculture Decision Support Framework for Crop Prediction

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Abstract

The effect of inappropriate choice of crops, inaccessibility of technical skills, and unreliable weather patterns often leads to low agricultural output and an economic setback to the farming societies. To address these constraints, the given research article proposes a smart, web-based farm decision support model that provides data-oriented solutions and real-time advisory services. It employs three fundamental elements: crop suitability prediction, video-based agronomic advice, and weather intelligence services. Three elements are implemented in the framework, namely, crop suitability prediction, implemented through a Random Forest classification model and trained on Kaggle Crop Recommendation dataset. The model assesses the critical soil and environmental conditions such as content of nitrogen, phosphorus, potassium, ambient temperature, humidity, soil pH level, and rainfall levels to determine the best crops. The preparation of data and building of the model are conducted in Python with the help of Pandas and NumPy in order to process structured data. The trained model will have a total prediction rate of 99.1% indicating a consistent output under various agricultural conditions. It is implemented as a Flask-based service architecture which allows real-time delivery of prediction outputs to end users which can be used in better cultivation practices and fertilizer control. The OpenWeather service is used to incorporate weather intelligence to get up-to-date climatic information. The system runs on Node.js and Express.js in the background to provide sufficient communication with the rest of the system, and the user interface is developed using HTML, CSS, JavaScript, and Bootstrap to provide accessibility. The implementation model proposed produces precise crop recommendations and usable outputs, which encourages sustainable and informed agricultural decision-making.

Domain: Artificial Intelligence in Agriculture.

Keywords

Random forest, AI, weather forecasting, flask API, decision support system, smart agriculture, OpenWeather API, crop recommendation, precision farming.

Driver Fatigue Detection via Eye Aspect Ratio

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Abstract

Driver fatigue is one of the main causes of traffic accidents worldwide, resulting in a terrible number of deaths every year. This paper presents a system to identify driver drowsiness in real-time using computer vision and facial landmark analysis. The system applies the Eye Aspect Ratio (EAR) method to measure how long the eyes are closed, using a facial landmark detection model that has been pre-trained. The system captures facial features with a live camera feed and analyses them through the dlib landmark predictor and OpenCV. If it detects prolonged eye closure, the system sounds an alarm through an audio subsystem (pygame). This proposed solution is lightweight, doesn't need special equipment, and operates effectively in real-time. Experimental results show that it can identify eye closure and provide early warnings, which enhances driver safety and lowers the risk of accidents.

Crop Yield Prediction Using Data-Driven Machine Learning Models Based on Weather and Soil Parameters

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Abstract

Accurate crop yield prediction is essential for sustainable agricultural planning, resource optimization, and climate-resilient decision-making. This research presents a comprehensive data-driven machine learning framework that integrates historical weather patterns, soil nutrient characteristics, and agro-environmental parameters to enhance the accuracy of yield forecasting. The proposed methodology incorporates multi-source datasets consisting of temperature, rainfall, humidity, pH, NPK composition, and soil moisture, enabling deeper analysis of environmental influences on crop productivity. Advanced machine learning models—including Random Forest, XGBoost, and Bagging Regressor—are developed and evaluated, leveraging their ability to learn both linear and highly nonlinear relationships within agricultural datasets. To further strengthen prediction performance, feature engineering techniques such as correlation-based selection, normalization, and multivariate agroclimatic modeling are employed. Experimental results demonstrate that the ensemble models outperform traditional approaches by achieving significantly higher accuracy, minimal error rates, and more reliable seasonal yield estimations across diverse crop types.

The study highlights the potential of integrating soil chemistry, meteorological inputs, and machine learning algorithms for precise yield forecasting, thereby providing farmers, agronomists, and policymakers with actionable insights for optimizing crop management, improving food security, and supporting climate-smart agriculture. This model can serve as an intelligent advisory tool for real-time agricultural decision-support systems.

Keywords

Crop Yield Prediction, Machine Learning, Weather Parameters, Soil Nutrients, XGBoost, Random Forest, Ensemble Learning, Precision Agriculture, Sustainable Farming.

Drug Discovery Optimization Using Graph Neural Networks for Molecular Property Prediction

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Abstract

Drug discovery is a complex and resource-intensive process that relies heavily on accurate prediction of molecular properties such as toxicity, solubility, bioactivity, and drug-likeness. Traditional quantitative structure-property relationship (QSPR) models and handcrafted feature-based machine learning techniques often struggle to capture the intricate structural and relational information present in molecular graphs. To overcome these limitations, this paper presents an optimized drug discovery framework based on Graph Neural Networks (GNNs) for molecular property prediction. Molecules are represented as graph structures where atoms are treated as nodes and chemical bonds as edges, enabling deep learning models to learn complex topological and chemical interactions directly from raw molecular data. Advanced GNN architectures, including attention-based, hierarchical, contrastive, and multi-scale fusion networks, are employed to enhance representation learning. Experimental evaluation on benchmark molecular datasets demonstrates that the proposed GNN-based framework significantly outperforms conventional machine learning and baseline graph models in prediction accuracy and generalization. The results highlight the effectiveness of GNNs in accelerating drug discovery pipelines by enabling accurate, scalable, and interpretable molecular property prediction.

Keywords

Graph Neural Networks, Drug Discovery, Molecular Property Prediction, Deep Learning, Molecular Graphs, AI in Healthcare.

Experimental Study on Self Healing Concrete Using Bacteria Ingrowth

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Abstract

Self-induced cracking in concrete adversely affects durability and long-term structural performance. Self-healing concrete offers a sustainable alternative by enabling autonomous crack repair mechanisms. This research examines the self-healing behavior of M30 grade concrete ingrowth *Bacillus subtilis* and *Bacillus megaterium* in combination with fly ash (20%) and nano clay (5%). Ordinary Portland Cement (OPC) was used in all concrete mixes. Early-age cracks were deliberately introduced at 3 days, and the healing efficiency was evaluated after 28 days of curing. Ultrasonic Pulse Velocity (UPV) and water permeability tests were employed to assess crack closure and durability enhancement. The results reveal that bacterial concrete containing nano clay exhibits significantly improved healing performance compared to bacterial concrete with fly ash, as reflected by increased UPV values and reduced permeability. The improved behavior is attributed to microbial-induced calcium carbonate precipitation coupled with nano-scale pore refinement. The outcomes confirm that the synergistic use of bacteria and nano clay enhances self-healing efficiency and durability, demonstrating strong potential for sustainable concrete applications.

Keywords

Self-healing concrete, fly ash, Nano clay, Bacteria, *Bacillus subtilis*, *Bacillus megaterium*.

Machine Learning-Based Crop Yield Prediction and Agricultural Advisory System

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Abstract

Agriculture is an important industry that directly affects the food security and the economic stability of the global arena. Nevertheless, farmers normally encounter some difficulties like erratic weather, pests are attacking, lack of appropriate use of fertilizers and inaccessibility to technological aids in making sound decisions. The factors have great influence on the crop productivity and sustainability. As artificial intelligence and data-driven technologies are developed, machine learning methods have proven to be efficient in enhancing the process of agricultural forecasting and farm management.

In this paper, an agriculture advisory system is proposed based on machine learning, that is capable of helping farmers to make decisions based on their data. The new system incorporates various predictive modules such as prediction of crop yield, risk of diseases, fertilizer advisory, and weather forecasting. Random Forest Regressor is used to predict the crop yield based on the environmental factors like rainfall, the use of pesticides and the temperature. The threat of disease is tested with the help of Random Forest Classifier, being trained on the environment. Besides this, a rule based recommendation engine recommends the best Nitrogen (N), Phosphorus (P) and Potassium (K) fertilizer values, depending on the crop and the climate (in terms of rainfall). At this stage, the method used to determine the trend of weather is a Linear Regression analysis to predict the amount of rainfall.

The system is implemented as an interactive web-based application on the basis of the Flask frame, allowing the users to supply environmental parameters with ease and receive pure predictive insights. The experimental outcomes suggest that the suggested system can produce valuable predictions and suggestions that can be used in practice, which proves its potential as a decision support system in the field of modern precision agriculture.

Keywords

Crop Yield Prediction, Machine Learning, Precision Agriculture, Random Forest, Disease Prediction, Fertilizer Recommendation.

A Real-Time Face Mask Detection and Monitoring System Using YOLOv8 and OpenCV

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Abstract

The widespread outbreak of infectious diseases such as COVID-19 has emphasized the importance of automated systems for monitoring public safety measures, particularly face mask compliance. Real-time face mask detection has become a crucial application in smart surveillance, healthcare facilities, transportation hubs, and workplaces. With recent advancements in deep learning and computer vision, object detection models have demonstrated remarkable performance in real-time scenarios. This study presents a real-time face mask detection and monitoring system using YOLOv8 and OpenCV, designed to accurately identify individuals wearing masks, not wearing masks, or wearing masks improperly in live video streams.

The proposed system leverages the lightweight and high-speed YOLOv8 object detection framework for precise face and mask classification, while OpenCV is used for video acquisition, frame processing, visualization, and system integration. YOLOv8's advanced feature extraction, anchor-free detection, and improved loss functions enable high accuracy even under challenging conditions such as varying illumination, occlusions, multiple faces, and crowded environments. The system processes video streams in real time, detects faces, classifies mask usage, and displays alerts or compliance statistics for monitoring purposes. Experimental evaluation demonstrates that the YOLOv8-based model achieves superior detection accuracy, precision, recall, and real-time inference speed compared to traditional CNN-based and earlier YOLO variants. The results validate the effectiveness of integrating YOLOv8 with OpenCV for scalable and reliable face mask monitoring systems. The proposed framework is well suited for deployment in real-world public surveillance systems, contributing to improved public health safety and automated compliance enforcement.

Keywords

Face Mask Detection, YOLOv8, OpenCV, Real- Time Monitoring, Computer Vision, Deep Learning, Public Safety Surveillance.

Automation using NFC system

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Abstract

Home automation in the recent years has been developing with great improvements that have included introduction of smart technologies in the quest to advance convenience, efficiency and control by the user. The traditional systems are usually based on specialized RFID modules or manual switching, which increases the cost of hardware as well as reduced flexibility. This work is aimed at creating and establishing an NFC-enabled automation system at home, which will avoid the use of the external RFID readers, utilizing the existing NFC scanner of smart phones. The suggested system enables the users to operate the appliances in the house by tapping their NFC-capable phones on the passive NFC tags attached to the outside of each room. The mobile application based on Flutter reads the tag data and sends it to a Firebase real-time database and communicates with a ESP 32 microcontroller to provide the activation of similar devices with relays. The innovation is seen in substituting hardware RFID readers with the use of the NFC technology on a smartphone platform to be made cost-effective, portable and easy to use in automating processes. There are experimental outcomes proving stability of operation with real-time response and remote control through Firebase connection. Summing up, the created system offers a single and easy to use and scale solution to the smart home control that will improve user interaction and reduce the complexity of the system.

Design and Analysis of Hose Clamp Used in the Riser System in Deep Sea Mining

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Abstract

This paper presents the design and finite element analysis (FEA) of a hose clamp used in the riser system of deep sea mining operations. The hose clamp, fabricated from Acrylonitrile Butadiene Styrene (ABS) material which is used to clamp the flexible hose and umbilical cable in the riser assembly deployed at depths of approximately 6000 m in the Central Indian Ocean Basin. Two clamp configurations Clamp 01 and Clamp 02 were modeled using AutoCAD Mechanical and Autodesk Inventor Professional and subsequently analyzed in ANSYS under boundary conditions such as deep-sea operating pressure and lashing belt pressure. Von Mises stress, strain, and total deformation were evaluated for each configuration. The study validates the structural adequacy of the proposed designs for subsea riser applications.

Keywords

Hose clamp, deep sea mining, riser system, FEM analysis, ABS material, ANSYS, Von Mises stress, Factor of Safety.

Deep Learning Framework of Transparent and Accountable Generative AI Systems

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Abstract

GenAI systems have proved themselves as excellent in language comprehension and content generation. Their application in the human-critical applications is also plagued by issues like hallucinations, absence of transparency, poor calibration, and limited accountability. In this paper, a Human-Centric and Transparent Generative AI framework, which combines deep learning and Hybrid Transparent Retrieval-Augmented Generation (HTRAG) is proposed. This method is based on human control, interpretability, factual basis and quantifiable reliability. The experimental findings prove that retrieval-augmented systems are much more faithful and have fewer hallucinations than vanilla GPT-2. HTRAG also promotes transparency and calibration when performing on a competitive level.

Keywords

Generative Artificial Intelligence, Human-Centric Artificial Intelligence, Retrieval-Augmented Generation, Trustworthy Artificial Intelligence, Hallucination Reduction, Faithfulness Assessment, Model Calibration, Explainable Artificial Intelligence, Deep Learning.

From Waste to Wonder: Remodeling and Recycling of Flex Banners using IoT and Image Processing Techniques through Sustainability Environment Methods

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Abstract

Flex banner waste generation has increased significantly due to the extensive use of banners in advertisements, events, and promotional activities, creating serious environmental, economic, and sustainability challenges. Improper disposal practices such as open dumping and burning contribute to environmental pollution, health risks, and long-term accumulation of non-biodegradable plastic waste. Currently, there is a lack of intelligent and automated systems to identify, classify, and process discarded flex banner materials efficiently.

This project presents an IoT-enabled flex banner identification and recycling management system that utilizes computer vision and image processing techniques to automate the detection and classification of flex banner waste. The proposed framework uses camera modules to capture real-time images and applies image processing algorithms such as OpenCV to detect material type, breakages, and component characteristics. Temperature sensors are used to monitor and control the heating process during recycling, ensuring safe and efficient conversion into reusable plastic chips.

In addition to detection, the system integrates microcontroller-based automation to support sorting, processing, and recycling operations. This improves system efficiency, reduces manual effort, and enhances processing accuracy. By combining IoT, automation, and image processing with structured operational workflow, the platform promotes sustainable waste management and supports environmental protection. The architecture is scalable and suitable for real-world deployment in smart recycling and sustainable manufacturing systems.

Keywords

Flex banner waste, IoT, image processing, OpenCV, recycling, sustainability.

Inception Net-Driven Classification System for Early Esophageal Cancer Diagnosis

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Abstract

Esophageal cancer is still one of the main reasons people die from cancer globally, and finding it early greatly increases the chances of surviving. However, current methods for diagnosing it, like endoscopy and looking at tissue samples under a microscope, can take a lot of time, are not very comfortable for patients, and can give different results depending on who is doing the test. New developments in deep learning have made it possible to analyze medical images more efficiently and accurately. In this study, we suggest using a Convolutional Neural Network (CNN) to detect esophageal cancer from images taken during endoscopies and from tissue samples. To improve the quality of the images and deal with the fact that some types of data are less common, we use techniques like normalization and image enhancement. CNNs are good at identifying patterns, so they can spot small changes in texture and structure that may indicate cancer. Our tests show that the model performs very well in terms of accuracy, sensitivity, and specificity, and it works better than traditional machine learning methods. This research shows that using CNNs as part of a diagnostic tool can be a reliable way to help find esophageal cancer early and accurately.

Keywords

Esophageal Cancer Detection, Convolutional Neural Networks, Medical Image Analysis, Deep Learning, Endoscopy Imaging, Histopathology Classification, Transfer Learning, Multimodal Fusion, Grad-CAM Explainability, Computer-Aided Diagnosis.

UniVerse: A Unified Artificial Intelligence Framework for Multi-Dimensional Student Engagement and Institutional Wellness Ecosystems

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Abstract

The modern university environment is marked by a high degree of digital fragmentation, where students must navigate multiple disconnected platforms for administrative tasks, academic support, social networking, and wellness monitoring. This study introduces “UniVerse,” an integrated digital ecosystem designed to consolidate these functions into a single, cohesive interface. Built on high-performance frameworks like Next.js and Supabase, the platform leverages state-of-the-art AI APIs and vector-based matching (pgvector) to provide personalized academic assistance, semantic resume analysis, and proactive wellness tracking. The methodology follows an Agile Scrum framework to implement a three-tier serverless architecture. Preliminary results from the Minimal Viable Prototype (MVP) demonstrate high system reliability and a significant reduction in the cognitive load associated with context-switching between disparate campus tools. This study validates the feasibility of a unified “digital home” to enhance student engagement and institutional wellness.

Keywords

Digital Campus Ecosystem, AI Chatbot, Resume Analysis, Student Wellness, Multi-Dimensional Engagement.

Pharmaceutical Finder (MedFinder): An AI-Powered Geospatial Medicine Discovery and Voice-Enabled Healthcare Assistance Platform

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Abstract

The Pharmaceutical Finder (MedFinder) is an AI-based medicine discovery and pharmacy connection platform designed to solve the ongoing issue of medicine availability and access to patients in real time. In some areas of the country, when a patient needs a medication filled, they must go physically to multiple pharmacies to find that medication, which is especially difficult in emergencies and causes unnecessary delays in receiving treatment and added stress to the patient. The proposed solution is a web-based system uniting multiple technologies into one singular platform that leverages artificial intelligence, geospatial database indexing, multilingual voice assistance, and real-time inventory synchronization. This will enable users to search for pharmacies that are currently carrying their prescribed medications and will allow the user to evaluate the stock and produce a list of available medications with respective prices instantly. The proposed platform was developed using the Flask backend framework and MongoDB with 2dsphere geospatial indexing, enabling the user to have the ability to conduct location-based queries with less than 200 milliseconds response time. In addition, the Natural Language Processing API provided by OpenAI was incorporated into this new platform to allow for an easy way for users to get health assistance through a conversational method and to be able to search for medications through natural language. Also, the Web Speech API is included in this new platform to enable multilingual voice interaction for English, Hindi, Telugu, and all of the other Indian languages and will provide a very rich experience and makes the platform very accessible to diverse populations. The results also showed that high percentages of accuracy were measured for search accuracy (98%), geospatial query efficiency (96%), symptom analysis reliability (91%), and voice recognition accuracy (over 89%) across all supported languages during experimental evaluation. According to this research, there is an increase in healthcare accessibility with the combination of Geo-Spatial Indexation Systems, Real-Time Pharmacy Inventory Systems and AI-Powered Chatbots, as well as a decrease in the amount of time it takes patients to locate medicine, and improve the usability of patients.

Keywords

AI Healthcare Systems, Geospatial Search, Medicine Availability System, Flask Web Framework, MongoDB Geospatial Indexing, Voice Assistant, Multilingual NLP, Real-Time Inventory Management, Healthcare Accessibility, Digital Pharmacy Platform.

TASKWEAVE – AI Powered Smart Task Allocation & Workload Balancer

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Abstract

In organizations, task allocation is mostly done manually by the managers and this may lead to skills mismatch, lopsidedness of workload and decreased productivity. The following paper describes the TaskWeave, a smart task management, and workload balancing system that will enhance the efficiency of task assignment in the team. This system takes into account the skills of the employees and the needs of the task along with the present workload prior to suggesting the appropriate team members to be assigned. TaskWeave has a layered architecture that comprises of web-based interface, backend services, and a database layer. The system comes with a secure authentication and role-based access control of the managers and team members. Manager is able to create, assign, and schedule tasks, and a team member is able to see the assigned tasks and update on their progress. The system also takes into account the description of tasks in order to identify the skills that are necessary, and it has a recommendation system to choose the best suited team member. The level of workloads is observed to avoid overloading and equitable distribution of workloads. The system suggested is better at planning tasks, making resources a more valuable use of them, and making decisions that are based on data. The proper work of the authentication, role restriction, task creation and recommendation modules is proved by the experimental validation based on the API testing and the database verification. TaskWeave offers an intelligent and scaled-up means of allocating tasks in an organization.

Keywords

Task Allocation, Workload Balancing, Role-Based Access Control, Task Scheduling, Skill Matching, Recommendation System, Web Application, Backend Architecture, MongoDB, Node.js, Natural Language processing (NLP).

Transformer-Based Cyber Threat Intelligence System for Log Anomaly Detection and Threat Attribution

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Abstract

Intrusion detection and anomaly detection systems play a critical role in securing modern computing environments. Traditional intrusion detection systems primarily rely on rule-based mechanisms, classical deep learning techniques, which often struggle with unstructured log data, high false positive rates, and limited ability to detect unknown or evolving attack patterns. Many existing systems also require extensive manual updates and lack adaptability to dynamic real-world environments, making them less effective against zero-day attacks. To address these limitations, this project presents an intelligent log anomaly detection system based on Deep learning techniques. The proposed approach utilizes DistilBERT to extract semantic representations from log messages, enabling meaningful understanding of unstructured log data. A hybrid architecture combining Transformer and Temporal Convolutional Networks (TCN) is employed to capture both global temporal dependencies and local sequential patterns in log sequences. Furthermore, an incremental learning mechanism is integrated to allow the system to automatically learn new attack patterns without retraining the entire model. A real-time Streamlit-based dashboard supports log analysis, threat visualization, alert generation, and automated response actions. Experimental results demonstrate improved detection accuracy, reduced false positives, and enhanced adaptability compared to traditional systems.

Keywords

Cyber Threat Intelligence (CTI), DistilBERT, Transformer, Temporal Convolutional Network (TCN), Log Anomaly Detection.

AI-Enabled Online Election Result Dashboard

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Abstract

There is an increased need for the provision of more informed and elaborate analysis whenever the dissemination of election result information takes place. Election result information plays a crucial role in the democratic process. Real-time, AI-assisted tools that support the process of analyzing, interpreting, and understanding information are required. These platforms that are in place currently are mainly descriptive, static, and fragmented. Thus, analyzing the dynamic, contextual, and comprehensive dimensions of the process becomes difficult. This paper presents an innovative idea of creating an AI-driven Online Election Result Dashboard. The idea focuses on giving timely visualization, predicting trends, and providing contextual analysis for the outcome of elections. The platform incorporates information from different data inputs, such as past elections, constituency-based electoral trends, and even data from ongoing counting processes. Dynamic predictive models facilitate decisions and comprehension at different geographical scales and time horizons. This dashboard can keep updating results, observe trend changes over time, and alert against potential results under different electoral scenarios. The proposed model remains based on prevailing theories in electoral and political science studies, thus providing patterns observed from the behavior of real-world citizens during elections. Performance is determined relative to traditional result reporting methods. It is also validated relative to the history of election data. The research findings indicate clear sensitivity to trends, transparency, understandability, lack of ambiguity, and alignment with ethical and responsible AI practices. It shows that the dashboard is indeed feasible in such a way that multiple electoral methods are effective in encouraging well-informed citizen engagement along with the democratic procedure.

Keywords

Election Result, Artificial Intelligence, Predictive Analytics, Real-Time Dashboards, Electoral Trend Analysis, Explainable Artificial Intelligence, Democratic Transparency.

AI-Driven Voice Assistant for Excel and Power BI

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Abstract

The contemporary business world is getting overwhelmed with significant difficulties in the light of the increasingly sophisticated nature of data processing. These issues are repetitive manual tasks, slow report generation, and accessibility to the people who are not techno savvy. A significant amount of technical knowledge is normally required in working with Microsoft Excel and power BI and may slack down the working speed and complicate quick decision making. The proposed product is a voice assistant developed on AI and web-based. It is with the help of natural language processing (NLP) and speech recognition that it can conduct data operations without manual input. Such operations involve the use of formulas, the development of charts, filtering of data and predictive analysis. It is intended to enable increased efficiency, accessibility, and accuracy of data-driven processes. This will be done by automating repetitiveness, and providing context-sensitive assistance in the Excel and Power BI. The proposed system will follow a modular architecture, which will involve voice processing, intent knowledge, platform API integration, and contrasting feedback. This is a design that guarantees smooth operation. The real can be found in combining real-time voice communication, automated data processing using multiple platforms, and AI-driven predictive insights, all within the confines of the familiarity of the existing enterprise tools.

Keywords

AI Voice Assistant, Natural Language Processing, Speech Recognition, Data Automation, Excel, Power BI, Accessibility.

Rainfall Runoff Event Prediction Using Image Based Hydrological Feature Extraction and Bidirectional LSTM

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Abstract

Rainfall-runoff event prediction plays a significant role in the proper management and control of rainfall-runoff events. This paper presents a new model of rainfall-runoff event prediction using a new technique of combining hydrological features with Bidirectional Long Short-Term Memory. The new rainfall-runoff event prediction model is different from the previously used rainfall-runoff event prediction models in the sense that it uses a new technique of image processing to obtain hydrological features. These hydrological features are obtained using various techniques of image processing. These techniques include changing the image to grayscale mode using a Gaussian filter, thresholding, edge detection, and K-means clustering. The hydrological features are used in a Bidirectional Long Short-Term Memory model using PyTorch. It is found from the results of the new rainfall-runoff event prediction model that it performs better with a low error value of 0.0400, 0.0205, and a high value of NSE equal to 0.9812 compared to the performance of other models such as Linear Regression, Random Forest, and LSTM. A Gradio interface is also presented in the new rainfall-runoff event prediction model.

Keywords

BiLSTM, Deep Learning, Flood Prediction, Hydrological Forecasting, Prediction, Runoff Simulation Optimization, Rainfall-Runoff.

Entropy-Guided Deep Feature Refinement for Hybrid Plant Disease Classification in Complex and Noisy Environments

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Abstract

Hybrid classification combining deep learning feature extraction with machine learning classifiers has advanced plant disease detection, yet existing systems struggle with high-dimensional deep features from models like VGG-16, ResNet-34, and EfficientNet-B4. These systems apply basic entropy thresholds and statistical filters (ANOVA, mutual information) but overlook comprehensive deep feature-class relationships, leading to redundant zero/negative values, overfitting on small datasets, prolonged training times, and reduced accuracy on noisy or imbalanced data such as sugarcane images with complex backgrounds. Limitations include inadequate handling of low-quality images (blurry, low-resolution, poor brightness), reliance on leaf-only analysis, and lack of integration with real-world IoT systems, resulting in suboptimal performance across crops. The proposed system addresses these gaps through advanced feature selection: entropy mean thresholding to segregate valuable (positive-dominant) features, skewness visualization for model-specific set selection, standard deviation trimming of less valuable tails, and refined ANOVA/MI validation against class-specific thresholds. Benefits encompass minimized overfitting, faster inference suitable for mobile/IoT deployment, robustness to noise, and generalizability to non-leaf symptoms via extended architectures (ViTs, ConvNeXt) and real-world Thai datasets with image quality enhancement. This framework elevates hybrid classification for practical agricultural diagnostics, cutting resource demands while sustaining near-perfect precision.

Keywords

Hybrid classification, deep learning, feature extraction, VGG-16, ResNet-34, and EfficientNet-B4, ANOVA/MI validation, generalizability, IoT systems, agricultural diagnostics.

A Comprehensive Review of Soil Analysis Methods and Sensing Technologies for Precision Agriculture

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Abstract

Real-time monitoring is utilized in precision agriculture to enhance the selection of crops and optimal use of resources. An improved crop recommendation algorithm according to soil sensing analysis is introduced in this paper. The system proposed measures pH, humidity, temperature, conductivity and macro-nutrients (N, P, K) by using a multi parameters soil sensor. Historical agronomic and weather data are combined with real-time soil data to improve the accuracy of recommendations. In this work, we use supervised machine learning, including decision trees (DT), random forest (RF) and deep learning models to predict soil suitability for crops. The feature selection and optimization will enhance the prediction accuracy and the ability to adapt changing soil status. Experimental validation using real soil samples demonstrates the feasibility of the approach. The proposed system aims to increase agricultural productivity, reduce input costs, and support sustainable farming practices.

Keywords

Precision Agriculture, Soil Sensors, IoT, NPK Analysis.

Implementation and Performance Evaluation of an Intelligent Cotton Disease Detection System with Integrated Chatbot Advisory

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Abstract

Agricultural disease management systems require practical implementation frameworks that balance accuracy, usability, and computational efficiency. This paper presents the complete implementation and empirical evaluation of a web-based cotton disease detection system integrating deep learning classification with conversational advisory capabilities. We developed a full-stack application utilizing React.js frontend, Node.js backend, and TensorFlow-based Python models, evaluated on a curated dataset of 1,369 cotton leaf images across 4 disease categories. Our MobileNetV2-based classifier achieved 95.88% validation accuracy after 10 training epochs, with inference times suitable for real-time web deployment. The system incorporates an intelligent chatbot powered by natural language processing to provide context-aware farming guidance. Comprehensive user testing with agricultural extension workers and farmers validated the system's practical utility. We present detailed architecture decisions, implementation challenges, performance benchmarks, and lessons learned from deploying machine learning models in production web environments. Our results demonstrate that lightweight deep learning architectures can deliver accurate disease detection while maintaining the responsiveness required for practical agricultural applications.

Keywords

Cotton Disease Detection, Web Application, MobileNetV2, React.js, Node.js, TensorFlow, Chatbot, Implementation, Performance Evaluation.

Smart Virtual Mouse Using Real Time Hand Tracking

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Abstract

Issues including reliance on physical devices, limited accessibility, and the constraints of traditional input methods have frequently arisen in human-computer interaction. The growing need for more hygienic and user-friendly engagement methods has spurred innovation in this field. Physical mice are useful, but they have disadvantages such as maintenance, space limitations, and usability issues for those with disabilities. Numerous techniques, including as voice commands and touchscreens, have been studied to increase user involvement. Never the less, these are often costly or have compatibility issues. This project aims to eliminate the need for hardware attachments by introducing a virtual mouse that can be controlled with hand gestures. The proposed system uses real-time image processing via cameras and computer vision algorithms to identify and interpret hand gestures. With methods including backdrop reduction, HSV segmentation, and gesture identification, the system ensures accurate mouse control and click operations. This approach is particularly useful in environments that require touchless operations since it provides enhanced accessibility, affordability, and hygiene. Strong hand gesture detection technology that ensures intuitive control enables applications in augmented reality, gaming, and accessibility.

Keywords

Virtual mouse, hand gesture recognition, computer vision, human-computer interaction, real-time processing, touchless interface, accessibility, OpenCV.

eSRL – Self-Regulated Learning with Gamification

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Abstract

eSRL is an AI-driven learning platform that transforms traditional static materials into interactive videos and adaptive, game-like assessments to promote active, self-regulated learning. Rather than encouraging passive viewing, it engages learners through gamified experiences and AI-based scaffolding that supports goal setting, progress monitoring, and reflection. This paper discusses related work, outlines the system's design and content pipeline, and proposes metrics to evaluate motivation, knowledge gains, and SRL behaviors. Our findings suggest that combining gamification with AI-guided support in a blended learning environment enhances engagement, improves knowledge acquisition, and fosters the development of metacognitive skills.

Keywords

Self-Regulated Learning (SRL), Gamification, Game Mechanics, Large Language Models (LLMs), Blended Learning.

An IoT-Enabled Cloud-Based Multi-Zone Indoor Environmental Monitoring and Prediction System

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Abstract

Indoor air quality has a direct impact on human health, comfort, and productivity, yet most existing monitoring systems are limited to single-zone sensing and provide alerts only after pollution levels become unsafe. Such reactive systems fail to capture spatial variations across different indoor rooms and do not support early preventive action. To address these limitations, this paper presents an IoT-enabled, cloud-based multizone indoor environmental monitoring and prediction system. The proposed system deploys multiple ESP8266-based sensor nodes across distinct indoor zones to continuously monitor air quality, temperature, and humidity. Sensor data from each zone is transmitted to AWS IoT Core for centralized storage and analysis. A Random Forest MACHINE LEARNING AI model is trained using historical multi-zone sensor data to predict indoor pollution levels up to one hour in advance. The predicted and real-time data are visualized through a web-based dashboard, enabling users to identify zone-specific pollution trends and take preventive actions before air quality deteriorates. Experimental results demonstrate that the system effectively captures spatial variations in indoor environments and provides reliable early predictions, improving indoor air safety while supporting energy-efficient environmental control.

Keywords

Internet of Things (IoT), Indoor Air Quality, Multi-Zone Monitoring, Pollution Prediction, AWS IoT, Random Forest, Cloud Computing.

Smart Attendance System Using AI-Based Face Recognition

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Abstract

Taking daily attendance manually or using traditional biometric systems can be time-consuming, error-prone, and sometimes even misused through methods like proxy attendance. To make this process smarter and more secure, our project introduces an AI-based Face Recognition Attendance System designed for real-world classroom environments. Unlike older systems that often struggle with lighting issues, facial changes, or busy backgrounds, our solution uses advanced AI techniques to improve recognition accuracy. We use a webcam to capture live video, detect student faces using smart detection models, and identify them through a trained facial recognition system. Once a student is recognized, their attendance is automatically marked and saved, removing the need for roll calls or manual entry. The system is built to handle common challenges like students wearing masks, different lighting conditions, and slight changes in facial expressions. It also helps prevent proxy attendance and reduces human error. With a user-friendly interface and automated reporting features, our system makes attendance management faster, easier, and more reliable for teachers and institutions.

Domain: Artificial Intelligence, Face Recognition System.

Inter-Drone Communication System: Comparing Synchronization and Control Accuracy

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Abstract

This paper presents the design, construction, and testing of a modular two-drone automation system for surveillance and delivering lightweight cargo. Each drone is controlled using ESP32 microcontrollers, and communication for each is facilitated using the ESP-NOW protocol to ensure speed and low latency.

The system performance was gauged in two phases: stability of individual flights with respect to roll, pitch, and yaw, and the formation flight where the path taken by both flying drones is evaluated. During flights, we have developed a ground control web panel for sending commands and downloading telemetry data.

The system realized reliable communication among drones and achieved very good attitude control for each drone, hence smooth coordination during flights by multiple drones. It also points towards the capability of automatic flight in a larger scale.

Keywords

Drones, ESP-NOW protocol, flight controller, websocket.

Design and Simulation of a Circular Microstrip Patch Antenna for 2.45 GHz ISM Band Operation

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Abstract

This document presents the modeling and electromagnetic investigation of a circular microstrip patch antenna (CMPA) specifically engineered for the Industrial, Scientific, and Medical (ISM) radio frequency range at 2.45 GHz. The radiator is implemented on a standard FR4 substrate, featuring a relative permittivity (ϵ_r) of 4.4 and a thickness (h) of 1.6 mm. The fundamental dimensions of the circular element are computed using recognized analytical formulas derived from the dominant TM₁₁ resonance mode. Due to its specific benefits—namely a small footprint, light mass, and low-profile geometry—the intended antenna is highly appropriate for inclusion in modern wireless networking hardware. Computational data verify successful impedance matching (indicated by a low S₁₁, dependable radiation patterns, and high efficiency, validating its effectiveness for ubiquitous applications such as Wi-Fi, Bluetooth, and various Internet of Things (IoT) nodes. [1][6][12]

Keywords

Circular patch antenna, microstrip antenna, 2.45 GHz, FR4 substrate, Return Loss (S_{11}), array antenna, ISM band.

