



**09th International Conference on
Applied Sciences, Engineering, Technology
and Management**
ICASETM-2026

 **29th August, 2026**  **Bogotá, Colombia**

Organized by: IFERP Academy

9th International Conference on Applied Sciences, Engineering, Technology and Management (ICASETM 2026)

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Table of Contents

Preface	V
About ICASETM-2026	VI
About IFERP	VII
MD's Message, IFERP	IX
CEO'S Message, IFERP	X
Plenary & Invited Keynote Speaker	XI
Keynote Speakers	XIV
Session Speakers	XVIII
Committee Members	XXIV
Abstract's Index	XXV



Conference Theme

“Sustainable Futures: Integrating Applied Sciences, Technology and Management for Global Impact”

Preface

We cordially invite you to attend the 9th International Conference on Applied Sciences, Engineering, Technology and Management (ICASETM 2026) on 29th August, 2026. The main objective of ICASETM 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 Applied Sciences, Engineering, Technology and Management. 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 ICASETM 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 ICASETM - 2026

The 9th International Conference on Applied Sciences, Engineering, Technology and Management (ICASETM-2026) is a premier global forum organized by IFERP Academy that brings together researchers, academicians, industry professionals, and policymakers. Scheduled to be held on August 29th, 2026, in Bogotá, Colombia, the conference focuses on advancing applied research and practical innovations across multidisciplinary domains. ICASETM-2026 aims to promote knowledge exchange, foster interdisciplinary collaboration, and support sustainable and technology-driven solutions to address contemporary global challenges.

Purpose

ICASETM 2026 aims to foster global knowledge exchange and interdisciplinary research across science, technology, and management. The conference emphasizes sustainable innovation and real-world solutions for societal and economic growth.

Conference Theme

Theme: "Sustainable Futures: Integrating Applied Sciences, Technology and Management for Global Impact".

Conference Objectives

- To provide an international platform for researchers, academicians, and industry professionals to present and discuss applied research findings.
- To encourage interdisciplinary collaboration across applied sciences, engineering, technology, and management.
- To foster networking, partnerships, and future research collaborations among global participants.
- To support the dissemination of high-quality research that contributes to technological advancement and effective management practices.
- To promote innovative and sustainable solutions addressing global and societal challenges.
- To bridge the gap between academic research and industry practices through knowledge exchange.

Benefits

Participating in ICASETM-2026 provides valuable academic, professional, and collaborative advantages:

- **Global Networking Opportunities:** Connect with leading researchers, clinicians, innovators, and policymakers from around the world.
- **Knowledge Enhancement:** Gain insights into cutting-edge advancements in medical science, healthcare technology, and public health innovation through keynotes, panels, and workshops.
- **Skill Development & Professional Growth:** Participate in specialized workshops and sessions focused on clinical advancements, digital health, biotechnology, and sustainable healthcare systems.
- **Multidisciplinary Collaboration:** Engage with experts from diverse fields to co-develop holistic and scalable healthcare solutions aligned with global needs.
- **Showcase Your Research:** Present your work to an international audience, receive expert feedback, and strengthen your academic and scientific visibility.
- **Stay Ahead of Emerging Trends:** Explore the latest breakthroughs in AI for health, biomedical research, precision medicine, public health strategies, and healthcare technology.

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.

IFERP Mission & Vision

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

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

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

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

Managing Director, IFERP



Mr. A. Siddh Kumar Chhajjer

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 9th International Conference on Applied Sciences, Engineering, Technology and Management (ICASETM 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 Applied Sciences, Engineering, Technology and Management. ICASETM 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.

ICASETM 2026 will explore the new horizons of innovations from distinguished researchers, scientists and eminent authors in academia and industry working for the advancements in Applied Sciences, Engineering, Technology and Management from all over the world. ICASETM 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



Dr. Rudra Bhanu Satpathy

**Chief Executive Officer & Founder, IFERP
Technoarete Group, India**

Message:

IFERP is hosting the 9th International Conference on Applied Sciences, Engineering, Technology and Management (ICASETM 2026) this year in month of August. The main objective of ICASETM 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.

Plenary Speaker



Mr. Vineet Vijay

Lead AI Engineer
University of Liverpool / Deutsche Bank
India

Biography:

Vineet Vijay leads the design of production LLM systems as a Lead AI Engineer in financial services. His earlier career includes healthcare and finance technology roles at major enterprises in London, giving him a grounded view of what it takes to deploy AI in highly regulated environments. He earned an MSc in Data Science and Artificial Intelligence from the University of Liverpool. A published technical writer, Vijay speaks regularly on AI ethics, LLM evaluation, and responsible AI adoption.

Plenary Speaker



Dr. Fatemehsadat Mirmohammadmakki

**Shahid Beheshti University of Medical
Sciences, Iran**

Biography:

Dr. Fatemehsadat Mirmohammadmakki received her Ph.D. in Food Industrial Engineering and Science – Food Chemistry from the Islamic Azad University, Science and Research Branch, in 2021. She is currently a Postdoctoral Researcher at the Medical Ethics and Law Research Center, Shahid Beheshti University of Medical Sciences. Her research focuses on food safety, agricultural products, edible oils, natural extracts, and biosorbents for the reduction of heavy metals in food, soil, and wastewater. In addition, she has extended her studies to food security ethics. Dr. Mirmohammadmakki has published many articles, authored several books and book chapters, and presented at more than 50 national and international conferences.

Invited Keynote Speaker



Ms. Andrea Carolina Sanchez Diaz

Professor
Politécnico Grancolombiano, Colombia

Biography:

Professor at Politécnico Grancolombiano, Environmental Engineer and MSc in Clean Technologies with emphasis on renewable energy systems. She leads the Environmental Innovation Research Seedbed and develops research and educational initiatives in sustainability. Her work focuses on electric mobility, air quality monitoring, renewable energy systems, and water analysis and treatment.

Keynote Speaker



Assoc. Prof. Dr. Shamsollah Ghanbari

Associate Professor
Islamic Azad University
Ashtian Branch, Iran

Biography:

Shamsollah Ghanbari is an Associate Professor in the Department of Computer Science at Islamic Azad University and a Non-Resident Researcher at the School of Computer Science, Institute for Research in Fundamental Sciences (IPM) in Iran. He holds a PhD in Distributed Computing and High-Performance Computing from Universiti Putra Malaysia (UPM). His research focuses on distributed systems and artificial intelligence, resulting in numerous publications in high-quality international journals and conference proceedings. Actively engaged in the academic community, Dr. Ghanbari serves on the editorial boards of several journals. He is the founder of the Iran Journal of Distributed Computing Systems and has frequently acted as a guest editor for special issues. Dr. Ghanbari is also the founder and head of the Distributed Systems and Computing Group. Under his leadership, the group organizes the biennial Distributed Computing and High-Performance Computing (DCHPC) conference series. He has chaired this event in 2018, 2022, and 2024, and will chair the upcoming 2026 edition. Additionally, he has been invited as a Visiting Professor to Auezov University in Shymkent, Kazakhstan, in 2019 and 2023.

Keynote Speaker



Assoc. Prof. Hera Oktadiana, CHE

Trisakti Institute of Tourism, Indonesia
Adjunct Associate Professor
Griffith University and James Cook University
Australia

Biography:

Hera Oktadiana is an Adjunct Associate Professor at Griffith University and James Cook University, Australia and an Adjunct Professor at the University of Brawijaya, Indonesia. She is also a postgraduate academic at Trisakti Institute of Tourism, Indonesia, founder of Muslim Women in Tourism & Hospitality (M.WiTH), and founder of Halal, Sustainability and Inclusive Tourism (HaSIM) Forum. She holds a Ph.D. from the Hong Kong Polytechnic University and CHE (Certified Hospitality Educator) from the American Hotel Lodging Educational Institute. She has served as Head of Tourism and Hospitality at several Indonesian tourism institutions. Her research focuses on tourist behaviour, Muslim tourists, Halal tourism, tourism sustainability, and tourism education, with several of her works receiving academic awards. She is also a member of the editorial board of several reputable international tourism journals and has been a speaker at various national and international tourism events.

Keynote Speaker



Prof. Ir. Dr. Ismail Musirin

**Universiti Teknologi MARA
Malaysia**

Biography:

Prof. Ir. Dr. Ismail Bin Musirin obtained his Bachelor of Electrical Engineering (Hons) from Universiti Teknologi Malaysia in 1990, followed by an MSc in Pulsed Power Technology from the University of Strathclyde, United Kingdom in 1992, and a PhD in Electrical Engineering from Universiti Teknologi MARA (UiTM), Malaysia in 2005. He is currently a Professor of Power Systems at the Faculty of Electrical Engineering, UiTM. He also leads the Power System Operation Computational Intelligence Research Group (POSC). With over 34 years of academic experience, he has made significant contributions to teaching, research, and academic leadership. Prof. Ismail has published more than 400 papers in international indexed journals and conference proceedings. He actively contributes to the academic community as a reviewer for leading publishers, including IEEE Transactions, Elsevier, WSEAS, John Wiley, and IET. Since 2007, he has chaired over 20 international conferences and has delivered keynote speeches in various countries, including the United Kingdom, United Arab Emirates, South Korea, China, India, and Malaysia. He has also been entrusted with evaluating research grants at both national and international levels, including for the Ministry of Higher Education Malaysia. His research interests encompass artificial intelligence, optimization techniques, power system analysis, renewable energy optimization, distributed generation, power system stability, and machine learning applications. A Professional Engineer by qualification, Prof. Ismail is a Senior Member of the International Association of Computer Science and Information Technology (IACSIT), and a member of the Artificial Immune System Society (ARTIST) and the International Association of Engineers (IAENG), Hong Kong. He has held several academic and professional appointments, including Visiting Professor positions at UTHM Batu Pahat, UTHM Pagoh, and Lincoln University. He has served as a Panel Expert for Universiti Malaysia Pahang (UMP) engineering programmes and as an External Examiner for undergraduate and postgraduate programmes at multiple institutions, including Limkokwing University, Lincoln University, and Universiti Teknikal Malaysia Melaka. Additionally, he has been appointed as an External Adviser for Universiti Malaysia Terengganu (UMT).

Keynote Speaker



Dr. Diana Teresa Parra-Sanchez

**Centro de Innovación y Productividad
Innovation, Colombia**

Biography:

Diana Teresa Parra-Sanchez is a researcher in Information Technology with a Ph.D. in Engineering. She specializes in the adoption of digital technologies, digital transformation in small and medium- sized enterprises (SMEs), and innovation policies. She is currently the Scientific Director of InnovaCTlon and is undertaking a postdoctoral fellowship at the Universidad Autónoma de Bucaramanga, Colombia, where she explores the impact of artificial intelligence and augmented reality on nature-based tourism. With extensive experience in the formulation and management of science, technology, and innovation projects, she has led initiatives aimed at fostering digital adoption and technological innovation. She is also an editor and reviewer for high-impact scientific journals, with her research published in international journals covering digitalization, IoT adoption, and knowledge management.

Session Speaker



Prof. Dr. Abhilasha Singh

American University in the Emirates (AUE)
United Arab Emirates

Biography:

Prof. Abhilasha Singh, Dean and Professor of HR and OB at the American University in the Emirates (AUE), is a seasoned academic leader who has held several senior academic administrative positions, including President, Provost, and Vice President for Academic Affairs. A certified reviewer for the UAE Ministry of Education's Commission for Academic Accreditation (CAA), she is deeply committed to quality assurance, outcome-based learning, and continuous improvement. She has received prestigious honors, including the Hind Ratan Award and recognition as Most Influential Women by Filmfare Middle East. A prolific scholar with extensive publications in high-impact outlets and a senior editor of a leading Q1 Scopus-indexed journal, she contributes actively to the global higher education discourse, particularly through her work on worldviews and values in higher education and her frequent speaking engagements at major national and international forums. She serves on the executive board of the International Higher Education Teaching and Learning Association (HETL) and has secured multiple research grants, including from the Dubai Future Foundation and the UAE National Research Foundation. Her work on inclusive higher education has been recognized internationally, including an invitation to speak at a UNESCO-aligned conference in Moscow, and her perspectives have also been featured through sector commentary in University World News.

Session Speaker



Prof. Dr. Kiran Kumari

**President Innovation Council &
Deputy Director
School of Engineering Technology
CMR University, India**

Biography:

Dr. Kiran Kumari Patil is the Deputy Director of School of Engineering and Technology at CMR University Bangalore, India. She is the President-CMRU of the Institute Innovation Council, Ministry of Education, Govt of India. She is a seasoned academician and visionary leader in Higher education, a leading many initiatives for the growth and excellence of HEI. With over 25years of experience in the Higher Education Institutions in the capacity of Professor, Director and Dean in HEI has proven record of building, scaling and sustainable academic initiatives. Her contribution in the space Academics, Industry – Academia collaborations, Tech driven Innovation and Startup is remarkable. Dr. Patil has extensive experience in fostering innovation and entrepreneurship. She has mentored over 50+ startups at the various Technology Business Incubator and Startup India and has published numerous research articles in reputed national and international journals. Dr. Patil's expertise lies in driving industry collaborations, nurturing innovation, and supporting the growth of startups. She plays a crucial role in bridging the gap between academia and industry, fostering a vibrant ecosystem for innovation and entrepreneurship. She has successfully executed National and International projects in the space of Skill development, Innovation and Entrepreneurship. Dr.Patil is passionate drive student lead programs to solve rural community problem through technology.

Session Speaker



Prof. Dr. Ir. Fahmi

Dean
Universitas Sumatera Utara, Indonesia

Biography:

Prof. Dr. Ir. Fahmi, ST., M.Sc., IPU, ASEAN Eng, SMIEE, is a distinguished professor and senior lecturer in digital technology with over 20 years of experience. Currently serving as Dean of the Faculty of Engineering at the Universitas Sumatera Utara (USU), he also acts as a Strategic Advisor on SPBE and e-Government to the Provincial and District governments. His expertise covers enterprise digital systems, data and information management, digital transformation and integrated public service platforms. He has held pivotal roles, including Head of the Comlabs Laboratory, ICT Systems Officer at USU, and Data Management Consultant for JICA and WESTAT. He is also an official SPBE Assessor appointed by KEMENPAN-RB and holds international certifications in Digital Transformation Strategy from Imperial College London and the University of Oxford. Academically, Prof. Fahmi has contributed extensively to digital systems research, with an H-index of 17 on Scopus and more than 176 publications, books, and intellectual property. He is also actively involved with IEEE, ASEAN Engineering, and AI innovation networks across Southeast Asia. He currently serves on the Indonesian Higher Education Board. With a strong foundation in academic research, a deep understanding of strategic policy, and hands-on experience in IT governance, he is uniquely equipped to enhance national data infrastructure, ensure digital transformation, and build robust, secure digital ecosystems within the higher education sector.

Session Speaker



Dr. Rudzidatul Akmam Binti Dziyauddin

Associate Professor
Universiti Teknologi Malaysia, Malaysia

Biography:

Dr. Rudzidatul Akmam is an Associate Professor at Faculty of Artificial Intelligence, Universiti Teknologi Malaysia, and a Fellow at Wireless Communication Center. She also serves Ubiquitous Broadband Access Networks (U-BAN) research group in her faculty as a research member. Dr. Rudzidatul holds a PhD in Electrical and Electronic Engineering from the University of Bristol, UK. She chaired several international conferences, namely the International Conference on Telematics and Future Generation Networks, and International Conference on Smart Sensors and Applications. Her national contribution is significant as she becomes a Chair of Vehicle-to-Everything (V2X) Subworking Group under Malaysian Technical Standards Forum Berhad (MTSFB) and leads in deliberating the V2X technical code for Malaysia. She also serves International Future and Networks (IFN) Working Group as a member since 2019. With over two decades of experience, she has also contributed to the development of Malaysia's AI National Roadmap. She is a recipient of numerous national and international awards for her research, innovation, and academic contribution. She has produced two patents on intercell-interference mitigation at Toshiba Research Europe Limited in the UK. Her expertise spans wireless communication networks, radio resource management and scheduling, vehicular networks, Internet-of-Things, and machine learning.

Session Chair



Emanuel Ortiz Ruiz

President
Department of Computer Science
Colombian Research Academy of
Cybersecurity and Cybercrime, Colombia

Moderator



Samriddhi Shukla

Student
Amity University
Bangalore, India

Conference Convenor



Prof. Dr. G. P. Ramesh

Conference Convenor
India

Biography:

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.

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Abstract's Index

Toward a Semantic SCOR-VSM Framework for Supply Chain Performance Evaluation	01
Manawa Anakpa *	
Hervé Manier	
Tchamye Tcha-Esso Boroze	
NCBI Tools for Computational Tasks: A Review.....	02
Neelofar Sohi	
Railway Track Fault Detection Using Vibration Sensors.....	03
Jyoti Yadav	
Sonali Kadam	
Srushti Padekar	
Madhura Magadum	
Arpita Jagdale	
XAI-Driven Hybrid Churn Prediction Model for Personalized Retention in Online Retail	04
Aditya Rautaray	
Explainable AI-Based Fake Profile Detection Framework Using Behavioural Analytics and Multimodal Learning	05
Sudipta Acharjee	
Dr. Pankaj Lathar	
LEXORA: An AI Based Legal Guidance and Age Adaptive Constitutional Learning System.....	06
Trupti Gajanan Ghongade	
Iqra Irfan Khan	
Shraddha Devidas Kale	
Ruchita Raghunath Mane	
Anjali Shantaram Rane	
Snehal Sambhaji Bomble	
A Comparative Study of Machine Learning and Deep Learning Frameworks for Bushfire Burned Area Detection and Severity Classification	07
Nguyen Trong Khanh	
Lightweight Spatial-Spectral Vision Transformers for Satellite-Based Burn Severity Classification.....	08
Nguyen Trong Khanh	

Toward a Semantic SCOR-VSM Framework for Supply Chain Performance Evaluation

Manawa Anakpa *

LARSI, Ecole Polytechnique de Lomé, Université de Lomé (UL), Lomé, Togo

FEMTO-ST, Université de Technologie de Belfort Montbéliard (UTBM), Belfort, France

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Hervé Manier

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Tchamye Tcha-Esso Boroze

LARSI, Ecole Polytechnique de Lomé, Université de Lomé (UL), Lomé, Togo

Abstract

Supply chain performance assessment requires models that are capable of linking strategic, tactical, and operational data in a consistent and traceable manner. SCOR provides a standardized process and performance framework, while Value Stream Mapping (VSM) captures operational flows, waste, and machine-level data. However, SCOR remains weakly connected to shop-floor observations, and VSM often supports local improvement without aggregating data into global supply chain indicators. To address this gap, this paper proposes a conceptual architecture integrating SCOR, VSM, and ontology through a semantic, data-driven pivot layer. Rather than extending SCOR to a universal Level 4, which would be subject to industry limitations, our approach normalizes VSM data at the machine level and semantically maps it to SCOR Level 3 processes. The ontology formalizes relationships among operators, activities, resources, flows, contexts, constraints, and metrics. The proposed prototype supports traceability from shop-floor data to global performance evaluation and prepares future implementation in digital supply chain environments, including process mining, industrial IoT, and digital twin-based decision support.

Keywords

SCOR model, value stream mapping, ontology, OWL/RDF, supply chain performance, semantic integration, digital supply chain.

NCBI Tools for Computational Tasks: A Review

Neelofar Sohi

Assistant Professor, Department of Computer Science and Engineering, Punjabi University, Patiala, Punjab, India

Abstract

NCBI (National Centre for Biotechnology Information) tools act as for Bioinformatics. NCBI tools are based upon algorithms, statistics and database methods for processing and analysis of genomic data such as DNA and protein sequences. These tools are capable of handling high-throughput sequencing data, generate knowledge by analysing this data and provide algorithms as web interface or command line tool. In this study, prominent NCBI tools are reviewed and discussed.

Railway Track Fault Detection Using Vibration Sensors

Jyoti Yadav

Department of Computer Science and Engineering, Vishwakarma Institute of Technology, Pune, India

Sonali Kadam

Department of Computer Science and Engineering, Vishwakarma Institute of Technology, Pune, India

Srushti Padekar

Department of Computer Science and Engineering, Vishwakarma Institute of Technology, Pune, India

Madhura Magadum

Department of Computer Science and Engineering, Vishwakarma Institute of Technology, Pune, India

Arpita Jagdale

Department of Computer Science and Engineering, Vishwakarma Institute of Technology, Pune, India

Abstract

Deformation of the railway tracks including cracks, buckling, loosening of joints etc. leads to various railway accidents, and to disruption in railway service. Most of the traditional defect detecting techniques use manual inspection techniques and they are mostly time consuming and are not able to provide real time monitoring of the railways. To overcome the above limitations, an Edge-AI based Railway Track Failure Prediction and Monitoring (RTFPMS) is proposed in this paper to make rails safer by adding intelligence. It has various sensors such as piezoelectric sensor, MPU6050, load cell (and HX711), and DHT22 which are used to determine vibration, stress, load variation, tilt, and environmental conditions, respectively. The information gathered is processed locally by an edge computing device – ESP32 – to obtain real-time information about any potential failures of tracks. Predictive analysis is used to detect cracks or buckling before failure. A dashboard has been developed for live monitoring of data of different sensors and status of tracks. The experiment and confusion matrix shows an accurate prediction and low false detection ratio.

Keywords

Crack Prediction, Early Warning System, Edge Computing, Edge-AI, ESP32, IoT Sensors, Load Cell, MPU6050, Piezoelectric Sensor, Predictive Maintenance, Railway Safety, Railway Track Monitoring, Real-Time Monitoring, Smart Railway System, Track Failure Detection.

XAI-Driven Hybrid Churn Prediction Model for Personalized Retention in Online Retail

Aditya Rautaray

CVS Health, Woonsocket, Rhode Island, USA

Abstract

Losing customers is one of the biggest challenges online businesses faces. Studies consistently show that winning a new customer cost far more than keeping an existing one, which means customer churn when a buyer stops returning directly hurts a company's bottom line.

To tackle this problem, we built a smart prediction system that combines three powerful technologies: TabNet, an Autoencoder, and XGBoost. Rather than relying on a single method, we deliberately paired the pattern-recognition strengths of deep learning with the reliability of gradient boosting to get the best of both worlds.

We trained our model using real data from 5,631 e-commerce customers. Since churned customers were far fewer than retained ones in the dataset, we used a technique called SMOTE to balance the data before training. TabNet worked by focusing on the most relevant customer features at each step, while the Autoencoder learned hidden behavioral patterns that traditional analysis would likely miss. Both models then fed their insights into XGBoost, which made the final prediction about whether a customer would churn. When we tested the hybrid model against two simpler approaches, Logistic Regression and Decision Tree, the results were impressive. Our model achieved 98% accuracy and an AUC-ROC score of 0.9813. It outperformed Logistic Regression by 18 percentage points, and statistical tests confirmed the improvements were not due to chance.

To make the model useful for actual business decisions, we applied SHAP analysis to explain why the model flagged certain customers. The three biggest churn warning signs turned out to be customer tenure, complaint history, and cashback usage.

Ultimately, this research shows that combining deep learning with gradient boosting creates a churn-prediction tool that is both highly accurate and easy for business teams to trust and act on.

Keywords

Deep Learning, Hybrid Model, Machine Learning, TabNet, Autoencoder, XGBoost, Explainable AI, SHAP, SMOTE, Feature Engineering, AUC-ROC.

Explainable AI-Based Fake Profile Detection Framework Using Behavioural Analytics and Multimodal Learning

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Abstract

Fake profiles on online social networks are increasingly difficult to distinguish from legitimate accounts because malicious actors can combine realistic profile information, human-like activity, coordinated relationships, and generated content. Conventional detection systems commonly emphasise a single modality or provide limited insight into why a profile is classified as suspicious. This paper presents an explainable multimodal framework that combines semantic analysis, behavioural analytics, graph intelligence, and adaptive attention-based fusion. A Transformer-based semantic module represents profile biographies, posts, comments, captions, and messaging patterns; a behavioural module analyses temporal and interaction characteristics; and a Graph Neural Network (GNN) module models relational structure. The resulting prediction is accompanied by feature-level explanations using SHAP, attention visualisation, behavioural explanation vectors, and graph-importance analysis. The experimental configuration described in this study uses balanced collections of real and fake profiles, together with behavioural, honeypot, and synthetic adversarial data. In the reported evaluation setting, the proposed framework achieved 96.5% accuracy, 96.2% precision, 96.8% recall, and 96.5% F1-score, exceeding the listed SVM, Random Forest, and deep neural network baselines. The study therefore demonstrates the value of combining heterogeneous evidence with interpretable decision support for fake-profile detection. The revised presentation also explicitly separates the framework design from the reported experimental results to improve reproducibility and technical clarity.

Keywords

Explainable Artificial Intelligence, Fake Profile Detection, Online Social Networks, Behavioural Analytics, Graph Neural Networks, Multimodal Learning, SHAP, Cybersecurity.

LEXORA: An AI Based Legal Guidance and Age Adaptive Constitutional Learning System

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Abstract

Legal information continues to be difficult to access because of complicated legal language, insufficient public knowledge about laws, and the absence of personalized counseling. Current artificial intelligence-based legal counselors mostly concentrate on answering the questions on legal matters, but they cannot help with personalized learning. In this paper, a mobile application Lexora is suggested; it uses AI technology to combine legal assistance and constitutional education based on users' ages. There are two modules in the application. First, there is an LLM based module that can analyze user's described situation and give advice depending on the context. Second, there is a module that explains the constitution articles depending on the age of the users, which is divided into child, teen, adult, and senior. This application is created using Flutter, Flask, and a knowledge base in JSON format. Moreover, Lexora gives news on legal matters and creates users' profiles.

Keywords

Artificial Intelligence, Legal Chatbot, Constitutional Awareness, Large Language Models, Natural Language Processing.

A Comparative Study of Machine Learning and Deep Learning Frameworks for Bushfire Burned Area Detection and Severity Classification

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Abstract

Accurate detection and severity classification of burned areas are critical for post-fire ecosystem recovery, biodiversity protection, and wildfire management, particularly in bushfire-prone regions like Australia. This study presents a comprehensive comparison between classical machine learning approaches (GPBoost and XGBoost) and conventional deep learning architectures (U-Net) using multi-source satellite observations, including Sentinel-2 optical metrics (dNDVI, dNBR, dEVI), Sentinel-1 SAR backscatter changes (dVV, dVH, dVH/VV ratio), climate data from CHIRPS/ERA5, SRTM DEM topographic features, MODIS fire history, and ESA WorldCover land cover. In feature-engineered tabular models, GPBoost and XGBoost achieved high cross-validation accuracies of 81% and 82%, respectively, with differenced Normalized Burn Ratio (dNBR) identified as the predominant predictor explaining over 82.69% of spatial variability. However, when evaluated on unseen geographic tiles, gradient boosting models exhibited noticeable performance degradation (overall test accuracy ~57–62%). Conversely, deep semantic segmentation with U-Net across multi-spectral stacks significantly enhanced spatial generalization, achieving an overall accuracy of 91.87% and F1-score of 91.62% for binary burn mapping, and 85.91% accuracy for detailed four-class burn severity categorization using weighted Focal Loss to address extreme class imbalance. Our findings highlight the necessity of deep contextual representations and specialized loss functions for scalable satellite-based fire severity assessment.

Keywords

Burned Area Detection, Burn Severity Classification, Sentinel-2, GPBoost, XGBoost, U-Net, Deep Learning, Remote Sensing.

Lightweight Spatial-Spectral Vision Transformers for Satellite-Based Burn Severity Classification

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Abstract

Standard Vision Transformers (ViTs) have achieved state-of-the-art performance in computer vision, but their applicability to multi-spectral satellite imagery is limited by severe over-parameterization, lack of inductive bias, and huge memory requirements. To address these limitations in bushfire monitoring, we propose a domain-specific, lightweight Spatial-Spectral Transformer tailored for patch-level burn severity classification. By reframing the classification task using small spatial patches (e.g., 5x5 or 7x7) over a 36-channel composite stack (combining pre-burn, post-burn, and difference spectral imagery), the model effectively captures complex spectral dependencies without huge parameter overheads. Our customized architecture utilizes an embedding dimension of 32, 4 attention heads, and 5 encoder layers, reducing the parameter count to approximately 100K—a drastic reduction compared to standard ViTs (~85M parameters). Furthermore, we outline future extensions employing self-supervised learning via Masked Image Modeling (MIM) and multi-modal integration with Synthetic Aperture Radar (SAR) data inspired by MultiMAE, paving the way for highly accurate, data-efficient earth observation models.

Keywords

Vision Transformer, Spatial-Spectral Transformer, Self-Attention, Burn Severity, Remote Sensing, Multi-Spectral Analysis, Self-Supervised Learning.

