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ICRAET

4th INTERNATIONAL CONFERENCE ON

Recent Advancements in Engineering and Technology

Virtual Conference

ICRAET-2021

29th - 30th January 2021

Delhi

ORGANIZED BY

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4th International Conference on Recent Advancements in Engineering and Technology

(ICRAET-2021)

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Acknowledgement

IFERP is hosting the ***4th International Conference on Recent Advancements in Engineering and Technology*** this year in month of January. The main objective of ICRAET 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 travel such a long distance to attain this conference.

Mr. Rudra Bhanu Satpathy
Chief Executive Officer
Institute for Engineering Research and Publication (IFERP)

Chief Guest Short Bio

Currently I am Vice Chancellor of D Y Patil International University, Akurdi, Pune. Before this, for five years, I was heading India's Technology Think Tank, TIFAC as its Executive Director. TIFAC is an autonomous body of Dept of Science and Technology, GOI.

For nearly 20 years I have done research work with Nuclear Fusion. I did modelling and simulation and used this to improve the performance of Tokamaks in India. I was associated will all the three Tokamaks in India (2 running and 1 under development). I have made major contribution to improving the performance of both the running tokamaks.

From 2002 to 2013, I was involved with research and teaching related to Embedded Systems and Sensor Networks. We were working on a number of projects to track wildlife using Sensor Networks in collaboration with Wildlife Institute of India.

We also took up a major challenge in collaboration with PRL Planetary exploration group tp detect presence of water in the permanently shadowed polar craters of moon using sensor network technology for India's Chandrayaan-II mission. As mission plans changed, we worked on other projects too.

In last few years, we have worked to develop access to computer and the capability to control environment based on body, voice and brainwave sensors to persons with severe disability. This has been changing life of many persons.

Specialties: Embedded Systems and Sensor Networks, Linux, Nuclear Fusion, Assistive Technology

Dr.Prabhat Ranjan

Keynote Speaker Message

Pastor Arguelles JR

Dean, College of Computer Studies
University of Perpetual Help System Dalta
Philippines

I am indeed honored to receive this highly envied invitation as I know that it comes rare and far. I knew that the first time I entered into this esteemed organization, this would be THE place for me to advance my academic and research career.

I am appreciative of every opportunity that I have been given since my humble beginnings with you in IFERP. Thank you for the opportunity, and I wouldn't have traded my learning and skills for any other.

Everyone has been truly blessed with you all as we travel on the journey of academic excellence and research collaboration. I truly appreciate all the challenges that came along my way to mold me the way I am; I believe this molding will bring us out of our shadow one day. Congratulations to the "4th International Conference on Recent Advancements in Engineering and Technology (ICRAET-2021)" which was being organized by IFERP-Institute for Engineering Research and Publication.

More power and may God bless us all!

Keynote Speaker Message

Prof. Jake R. Pomperada

MAED-IT, MIT, Science Research Specialist II
Technological University of the Philippines Visayas
City of Talisay, Negros Occidental Philippines

I am really honored to be part of this "4th International Conference on Recent Advancements in Engineering and Technology (ICRAET-2021)"organized by Institute for Engineering Research and Publication (IFERP).

Today we can not imagine life without research and it has become an integral part of our life. Such conference gives opportunity to everyone to bring those ideas on the table.

My message to all participants is to carry out and partipate more on research, and development in the area of engineering, and technology which is very important in the progress of our society.

I would like to extend my thanks to all participants who have joined ICRAET-2021and may this be one of the many fruitful exploits we engage into to further research and development.

Thanks and Regards

Prof. Jake R. Pomperada, MAED-IT, MIT

AMITY UNIVERSE

Prof. (Dr.) Ajay Rana
Ph.D. (CSE) & M.Tech (CSE) - Two Time Gold Medalist
Senior Vice President &
Dean - Amity Education Group

2nd February 2021

At the outset I would like to congratulate Institute for Engineering Research and Publication (IFERP) for taking revolutionary steps in imparting and promoting world class research education in India and abroad and at the same time bringing luminaries from across the globe to share their wisdom and areas of research. It is a matter of great delight and proud to see IFERP have the legacy of research and innovation being practiced consistently at their end even at the times of pandemic and conducting learning sessions and conferences in an online mode. I would like to congratulate team IFERP for the successfully organizing 4th International Conference of Recent Advancements in Engineering and Technology (ICRAET- 2021) held on 29th & 30th January 2021. The theme of this Conference is extremely important and upon reviewing the wide variety of topics & exclusive sessions covered during the 2 Day conference, offered unlimited scope of further research and innovation.

There are thousands of online sessions and webinars are currently going with an intent to engage masses. It is important for the organizers to make sessions content rich, engaging and learning oriented. Students must have great learning outcomes from the same. I appreciate the fact that the people not only from PAN India have delivered lectures during this 2 Day conference but has witnessed sessions by people from outside India as well. These days students are in immense stress because the fall in economy and businesses is also worrying them about their career progressions, jobs, higher education, and many other personal and professional aspects. Having live sessions directly with the stake holders i.e. industry experts is needed and I am sure that this conference must have been rewarding for students and must have helped them to have a clear road map to how to proceed further especially the direction.

The deliberations made by the Industry Experts & Researchers at such forums are the source of ultimate inspiration, innovation, strategy building and career advancements to students & the research fraternity. I am sure that the Global gathering of researchers in this conference have led to great collaborations and helped the participants to identify the avenues to have much advanced and joint research for the building of NextGen World. I congratulate and offer my heartiest greetings to all national as well as international researchers, scholars, delegates, speakers, industry leaders, chairs and co-chairs of the conference for their participation in the conference.

My heartiest congratulations to Dr. Pooja Prakashan, Scientific Relations and the entire organizing team for their sincerest efforts to make the conference a grand success.

With warm regards

Dr Ajay Rana

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Organizing Secretary Message

Dr. Anilkumar C. Suthar

Director & Principal,
Electronic & Communication Engineering
L J Institute of Engineering and Technology,
Ahmedabad, Gujarat, India

Dear delegates

Warm greetings!!!

On behalf of organizing committee, I would like to cordially welcome you to the ICRAET-2021 on assistive technology for all. The team had been working on the concept of upgrade and sharing of knowledges of researchers in the field of technology. Earlier many of come to gathers' and share new ideas worked across the world, now-a days due to the pandemic situations everything has been online, the very good platform provide by the team for exchange the knowledge using this conference. Till day as well as present scenario each and every researcher having a limited knowledge about their fields only, but now the time is gone for the same because this plate form will also provide an interdisciplinary knowledgeupdating based on the various research work submitted and presented by various participants.

This is a welcome change for the entire industry where we see clear opportunities and areas of larger networking between various players in this multi domain/ sectoral industry. We could successfully associate ourselves with various technology institutions and academia. Today we see the need of assistive technology and products in every step that we take.

This conference with the theme "Improving access to quality and affordable assistive technology for everyone, everywhere" is the right platform to bring various stakeholders under one roof to discuss needs of human being and their lives in a totality. Through this conference we will put all our effort to drive the policy as proposed by government. This could be the first conference of its kind in the region where everyone could have opportunity to showcase and present their ideas, thoughts, developments that could lead to a meaningful life in the community.

I welcome you, your family and friends again to these wonderful online opportunities and make the maximum out of it.

I thank each and every one of you who are contributing to the success of the conference and looking forward to seeing you all soon.

Best Wishes,

Dr.Anilkumar Suthar

ICRAET-2021

4th International Conference on Recent Advancements in Engineering and Technology

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Twitter sentimental analysis through machine learning And Comparative Analysis of Different Models

Tijil Mittal, Abhay Agarwal, Ujjwal Kansal

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Meerut Institute of Engineering and Technology

Abstract- In this paper, we are willing to adopt an approach that uses a Sentiment analyzer that incorporates Machine Learning. This paper also gives an examination of strategies of sentiment analysis in political sentiments by applying directed ML calculations. Hence we built up a program model for feeling and sentimental examination to deal with users and people sentiments. This paper provides details regarding the plan to analyze sentiments by extracting a tremendous number of tweets. Results classify clients' viewpoint through tweets into positive and negative, which is spoken to in a pie outline and html page

Index Terms-computationally, ML, positive, Sentiment analyzer.

I. INTRODUCTION

Online social media have gotten more consideration nowadays.Public opinions and feedback on a variety of subjects are given and spread effectivelythrough various social media.[2]An online social platform, Twitter is an American microblogging and interpersonal interaction administration in which clients can post refreshes (tweets) to companions (adherents). It has become a gigantic dataset of the purported notions. on which clients post and connect with messages known as "tweets" without any than 140 characters.Tweets can communicate sentiments on various subjects, which can assist with coordinating promoting efforts in order to impart consumers' insights concerning brands and items, episodes of tormenting, occasions that produce instability, extremity forecast in political and sports discussions.

II. LITERATURE SURVEY

Twitter, with an immense number of customers and a large number directives for consistently, has promptly transformed into a huge asset for relationship to invigilate their reputation and brands by removing and researching the inclination of the tweets by everybody about their things, organizations market and even about competitors included that, from the electronic media made ends with the mammoth advancement of the web, super volumes of speculation messages as tweets, overviews, web diaries or any discussion get-togethers and conversations are available for assessment, thus making the web the speediest, most including and viably open vehicle for supposition assessment. While there has been a decent measure of examination on how assessments are communicated in classes, for example, online audits and news stories, how slants are communicated given the casual language and message-length limitations of microblogging has been considerably less contemplated.[5] There were numerous examinations in conclusion, however nearly those zeroed in on a piece of writing or evaluates. A tweet is just restricted to 140 characters, so it is as various as a scrutinize.

III. PROPOSED SYSTEM

The sentiments can be classified into three classes which are negative, positive and unbiased or neutral sentiments.

I. Positive Sentiments: This highlights the inspirational disposition of the speaker about the content. Feelings with good assessments reflect joy, happiness, delight, grin and so forth. In the event of political audits, if the positive surveys/feelings about the legislators are more, it implies individuals are content with his work.

II. Negative Sentiments:This alludes to the negative demeanor of the speaker about the content. Tweets with negative conclusions reflect bitterness, desire, scorn and so on. In the event of political audits, if the adverse

surveys/assessments about the legislators are more, it implies individuals are not content with his work.

III. Nonpartisan/Neutral Sentiments: In this case no particular feeling is reflected about the content. It is neither shows positive nor negative attitude.Thus this class doesn't suggest anything in general, however it is significant to enhance the classification of positive and negative sentiments.

1Irrelevant highlights are dispensed appropriately from the element vector for effective working of Machine Learning calculations and algorithms.[4]

2. ANN beats in supposition order than Naive Bayesclassifiers

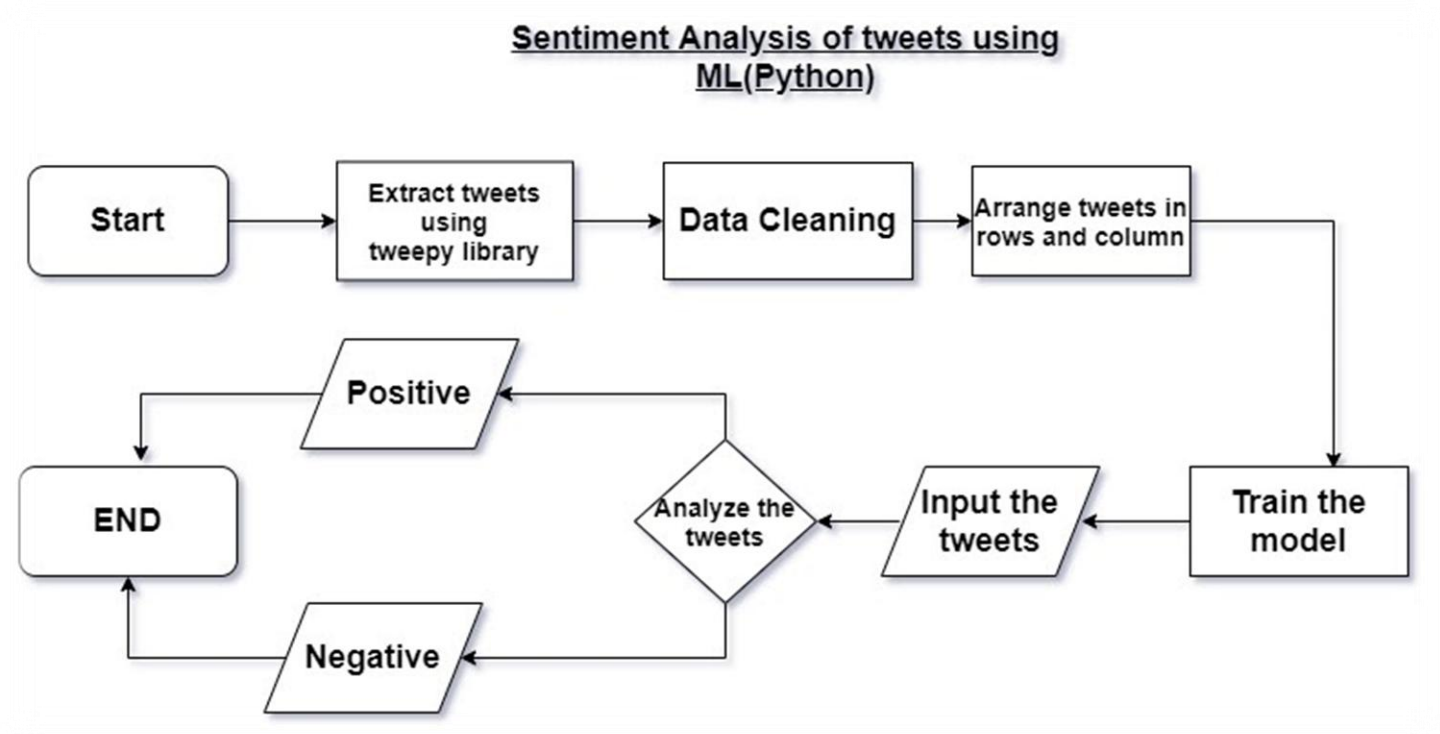

Fig 1: Workflow for the proposed system of sentimental analysis by machine learning

Advantages:

IV. Machine Learning Methods:

It joins AI calculations to find the notion via preparing on a known dataset. This way to deal with notion arrangement is administered and permits powerful content order. AI order requires two distinct arrangements of archives, specifically for preparing and testing. A preparation set is utilized A way to deal with estimation investigation utilizing Artificial Neural Network with near examination by a programmed classifier to learn and separate credits of records, and a test set is utilized to check the exhibition of the programmed classifier. There are many AI procedures embraced to arrange the surveys. AI strategies like NB,ANN ME, and SVM have accomplished better exhibitions in text arrangement.

A. Naive Bayes

Naive Bayesian Classifier is basically a probabilistic classifier which is used in Classification. It is based on principle i.e. every pair of features being classified is independent of each other or we can say it predicts on the basis of likelihood of an article.

B. Support Vector Machines (SVM)

Support Vector Machine is a powerful classifier that works both on linearly and non-linearly separable data.

It basically finds an optimal hyperplane that best separates our data so that distance from nearest points in space to itself (also called margin) is maximized. While these nearest points are called Support Vectors.
For non-linearly separable data, it uses something called 'Kernel Trick'.

C. XGBoost
XGBoost is basically an implementation of Gradient Boosted decision trees where X stands for 'eXtreme'.
In this algo, decision trees are created and arranged in a sequential way. Weights play an important role in XGBoost. Weights are assigned to all the independent variables which are then fed into the decision tree which finally predicts results. These individual classifiers then ensembled together to give a strong and more precise model which has more accuracy than the last ones. It can work on all the applications like regression, classification, ranking, and user-defined prediction problems.

D. Logistic regression
Logistic regression is actually a classification algorithm not a regression one. It is a supervised learning algorithm. It can be used for both binary (0-1) as well as multi-class classification problems. This is an extension of linear regression as it models the data using Sigmoid Function.

$$g(z) = \frac{1}{1+e^{-z}}$$

Here, the output from the linear regression is put on as input to the sigmoid function so that we can have a number in the range of [0,1] and that number can be compared with the threshold value which can help us in the classification purpose.

E. Artificial Neural Networks
An Artificial Neural Network (ANN) learning is robust to errors in the training data and has been successfully applied for learning real-valued, discrete-valued, and vector-valued functions containing problems such as text classification, information extraction, semantic parsing, question answering, language generation, machine translation, and speech and character recognition.ANNs are built out of a densely interconnected set of simple units, where each unit i.e. a neuron takes a number of real-valued inputs and produces a single real-valued output.

Import tweepy library

Enter the consumer key and access token

Run loop to extract the data set

for tweet in tweepy till 4000 tweets

csvWriter = csv.writer(csvFile) //store it in a csv file

V. Statistical analysis:

A. Precision:
Precision isfact of how accurate our model is outof the positive predicted ones. It also tells how many of them are actual positive.

$$\text{Precision} = \frac{True\ Positive}{True\ Positive + False\ Positive}$$

$$= \frac{True\ Positive}{Total\ Predicted\ Positive}$$

B. Recall:
Recall calculates how many of the Actual Positives our model captures through labeling it as Positive (True Positive).

$$\text{Recall} = \frac{True\ Positive}{True\ Positive + False\ Negative}$$

$$= \frac{True\ Positive}{Total\ Actual\ Positive}$$

C. F1 Score:
F1 is a function of Precision and Recall

$$F_1 = 2 \cdot \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}} = \frac{\text{TP}}{\text{TP} + \frac{1}{2}(\text{FP} + \text{FN})}$$

TP = number of true positives
FP = number of false positives
FN = number of false negatives

VI. SAMPLE DATA SET

[b'Fair, election, !, \xf0\x9f\x97\xb3, find, ..., https://t.co/rEwHUwnwrc, ']
[@vincecable, :, On, @BBCNewsnight, dismiss, claim, post, No, Confidence, motion, PM, free, defer, election, Oct, 31, ., Cross, par\xe2\x80\xa6, ']
['', b'@KarenLWms, It, appears, work, contract, w, /, feds, ,, case, ,, fired,\xe2\x80\xa6, https://t.co/7PnsLbFGnJ, ', '']
[@AltRightCanada, :, Google, Manipulating, Search, Engine, Results, To, Get, Justin, Trudeau, Re, -, Elected, https://t.co/ecnvxXTnGR, cdnpoli, cbcnl, qan\xe2\x80\xa6, ']
b'Google, Manipulating, Search, Engine, Results, To, Get, Justin, Trudeau, Re, -, Elected, https://t.co/ecnvxXTnGR, cdnpoli, cbcnl\xe2\x80\xa6, https://t.co/RXXD5zydKb, ']
['', b'"RT, @XposeBlackCrime, :, JudicialWatch, -, Why, Left, ACTIVELY, Fighting, Election, Integrity, |, TomFitton, 's, Issue, Update, -, https:/\xe2\x80\xa6, '', '', '']
[@Silvsports, :, @AOC, Talk, straw, man, argument, ., Boys, boys, saying, acts, natural, happen, ., , The, above\xe2\x80\xa6, ']

TABLE I. DATA SET USED IN TESTING ALGORITHMS

VII. STATISTICAL DATA

MODELS	DATA SET	APPROACH	ACCURACY (Approx)
XGboost	Election tweets	Supervised	82
Naive Bayes	Election tweets	Supervised	80
Logistic Regression	Election tweets	Supervised	85
SVM	Election tweets	Supervised	90
ANN	Election tweets	Supervised	96.27

Table II. TABLE SHOWING THE STATISTICAL DATA IN TERMS OF NUMERICAL VALUES OF VARIOUS MACHINE LEARNING ALGORITHMS

VIII. Conclusion:

Through the investigation of results, the point of this exploration is accomplished in distinguishing the most appropriate calculation for opinion examination on twitter information regarding the chose dataset. ANN model outcomes in having the most elevated exactness of 96.2% among the chose calculations for the conclusion investigation of Twitter information regarding the chose dataset.

Catchphrases: Machine Learning, Sentiment Analysis, Twitter information, Deep Learning, Naïve Bayes, Twitter Sentiment Analysis

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Suggestions for GPS Internet Websites

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ABSTRACT:

Any website is comprised of many components that increase the efficiency and effectiveness of the website one of these components is the sitemap. An excellent site will be wasted if the user cannot access the information or facilities that searching for. So if the user-provided with efficient and user-friendly navigation will maximize the abilities to find and retrieve information from a website and prevent users to be confused, lost, and then leave the site. Designing the navigation system must think as someone see the site for the first time. GPS navigation style or the new Site maps style easy to understand and present an alternative method of navigating the site, It helps the user to find the required page immediately and Increasing the efficient discovery and getting a high-performance for clients and search engines by provides a simple and effective browsing style by converting sitemaps to graph each page as graph node and each link as graph edges after user moving from node to node the browser will display all links of the new node according to web site content so that clients can choose the most appropriate access and navigate the web site using GPS style the new browsing style.

Index Term: - website, internet navigation, sitemap, GPS.

I. INTRODUCTION:

The sitemap is a visual copy of the website with hierarchy pages. Generally, the first task to be completed in any web design and development project is the sitemap. Sitemaps can be built and updated at any time on the website. All our sitemaps (designers, project managers, developers use it in different ways. For instance, the project manager will use the sitemap for comparison when reviewing the set of copies provided by the client or author. Designers will use the sitemap to be sure that no existence of the broken link, major,and all elements of the design concepts. So using a sitemap for browsing websites by giving the user ability to determine what he wants to see and how access to it, the same as a GPS application that lets you be free to move from place to place as we like in the real world.

II. WHAT IS A SITEMAP?

As the website gets more sophisticated, the huge amount of information on the website can be daunting. Track what's going on as it gets more difficult as the team expands from just one person to a full group of designers, developers, managers.

The sitemap also can show where there is a need to improve the website like navigation gaps or an unrecognized user experience even if the site is already running.Sitemap organizes the website

clutter, so the website team can follow the goal even if they're in different places. [5][8][10]

III. SITEMAP CAN DO:

- Sitemap can maintain the overall website's entire design.
- Sitemap can arrange all website pages in a hierarchical manner.
- Sitemap can ensure the User keeps track in the right way through website navigation.
- Sitemap can arrange pages from most broad to lest broad. [6]

A site map is used to detect and describe the web site content so that clients can choose the most appropriate access and navigation of the website.[3][4] In this paper anew browsing style where suggested which is called GBS internet websites, it is using a GPS style to increase efficient discovery and gettinghigh performance.

IV. SITEMAP CAN NOT DO:

- The sitemap cannotshow the last layout.
- The sitemap cannotdefine images, thingamabobs,objects, diagrams,and so on of any page.
- The sitemap cannotshow the hierarchy style ofinformation onany page.
- The sitemap does not tell us what the content of the website is.
- The sitemapdoes not tell us where we should put content to understand how much content they will need.[4]

V. THE SITEMAP PARTES:

The standard website will have 2 or 3 levels of navigation alongside a spread of action items like forms or pop-up interactions. Can break it down to Homepage – This page is typically shown at the highest of a sitemap. However, counting on the structure of the web site, the "homepage" could also be depicted as a part of the first navigation. Primary navigation – Also mentioned as "parent pages," this structure the most navigation of the website, whichthese pages are located at the top level of the site. Secondary navigation – Also mentioned as "child pages" or "secondary pages," these things are most frequently seen during a dropdown menu. They're one level deeper than the first navigation. Third level pages – The pages one level deeper than the secondary level pages. Often, these pages won't be visible within the site's navigation. An example of this sort of page would be product pages on an e-commerce website. Call-to-action items – Usually highlighted separately, they often take the shape of a button you click to finish an action or access a form. Samples of this sort of content include a donation button or a handcart. Usually, these things are located in or near the most navigation of the web site. Special file types – Interactive or downloadable elements like forms, downloadable PDFs, and documents could also be identified within the sitemap. External links – Important links to external websites that are likely to be included within the header or footer of the web site like social media channels and affiliate or partner websites should be included, figure (1) shows a simple example for a normal site map.[2][6][7]

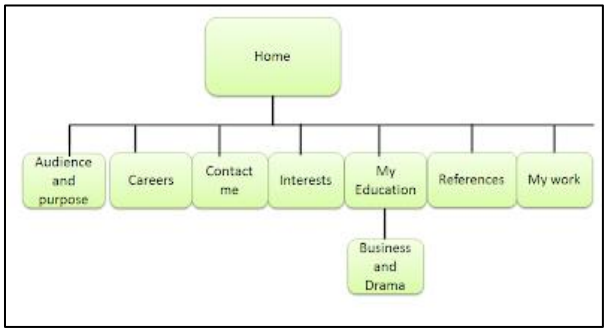


Figure (1)

VI. THE BENEFITS OF A SITEMAP IN GENERAL:

Clarification of themes: The sitemap presents a photo of the website's topic and enables the user higher to hold close the products and services that the site offers. The sitemap also

facilitates the webmaster when they add a new section, as they can view the rules of the site and take in to account the contemporary structure, keeping the corporation of the web site.Reduces broken links:If the website has any broken, missing, or incorrect inner links, crawl reports can be picked up immediately with the help of sitemaps, While the problem should be constant as soon as possible, sitemaps can offer a temporary answer and help in the meantime.

Streamlines conversion funnel: In a conversion funnel, it is higher to have a minimal number of steps for users to convert,the more steps the more chance site visitors should depart the site without finishing their purchase or signup. A visual representation, like a flowchart, can make streamlining the funnel easier.

Content amendment equals higher rankings: maintain higher ranks inside the engines like Google if we maintain modifying content on the website, maintaining it fresh and useful to the wishes of your site visitors. If used a sitemap author or manually created a sitemap, Google could be alerted each time site content material is modified.

Kickstarts' new businesses: The main motive to make investments money and time creating new content material for the internet site is that you anticipate being located through purchasers on the web and through using a sitemap you will be determined fast. This is highly endorsed for new websites as kickstarts activity, hobby, and revenue.

A time-saving tool: Some pieces of data need to be added whilst still sparkling, like information items. You don't have to wait and guess while the spiders are likely to go to your internet site. You notably reduce it at this time.

Understanding your traffic:You can examine a notable deal by way of tracking your sitemap reports, You may be notified of any mistakes will, a good way to the movement you to fix, in addition to in which your traffic comes from and through which keywords., Using these records assist you to improve your content and attract extra traffic to your website.

Bringing groups together: Websites are rarely built via a single person and can regularly involve input from special counterparts within the commercial enterprise, together with a designer, mission manager, or your marketing A sitemap makes sure everybody involved within the assignment is on the same page and now not static, so is possible to change as your enterprise progresses. The sitemap can serve as a principal clearinghouse for monitoring any task, what's been completed, what still desires work, and what progress is being made. [1][3][6][10]

VII. GPS BROWSING WEBSITE:

The new idea in browsing website by adapting the same technique of GPS for navigation in real word which tracks a moving vehicle or person that uses the Global Positioning System (GPS) to track the device's movements and determine its location, But on the net, we can represent any website as a real map by representing each page as a circle or like a graph and each link as edge and the user can navigate the website by using themap of the website after search for any item using a web browser. From the searching result, the user choose one of them which load it to the browser as a real map like the map in figure (1), so the user can move from to another pageby the curser when the user is on any page all links in that pages willappear on the map so the user can keep tracking and navigate through these links also if the user chooses one ofthe loaded pages, then the user is in the second level of the site map when the user puts the mouse cursor on any page all links on that page will be loaded these links may be returned to the home page, or maybe links to new pages or maybe links to any other file have a different format like a picture, audio, video, pdf, doc,….etc.Also, user can jump to any page or file displayed in this screenshot of a sitemap represented as a graph each page represented asa graph node and each

linkrepresented as graph edge, figure (2) describes website has a home page with links to two pages**A** and **B**as the first level where each page have several links the page called **A** have four links three to other pages one of these links C and the audio file, if I want to move to a music file I must choose page called C then go to a music file and so on like the red line in the figure (2).

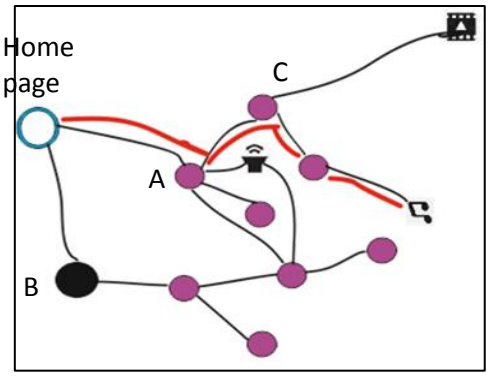
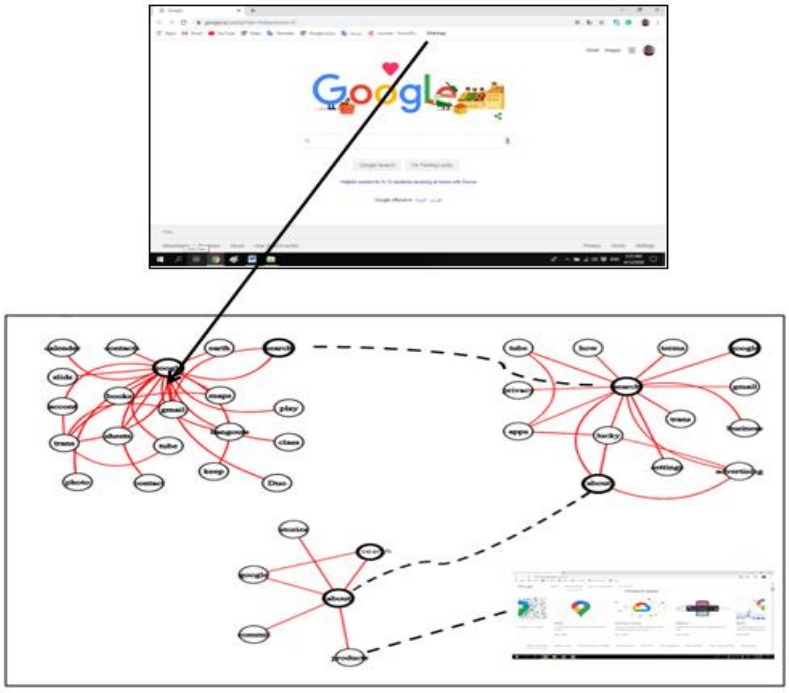


Figure (2)

Another example is the site map of Google as in the figure down there, that show the **google** home page with a dark circle that has several links one of them is the **search** page with a dark circle also if the user chose the **search** page the browser will display all links with **search** page then the view will concentrate on the **search** page and all pages linked to it, one of these pages is **about** page with dark circle also, when the user chose it the browser display the **about** page and all pages linked to it, then the user moves to **about**page and chose the page called **products** the browser displays the content of the **products** page itself so the user can see it and will do whatever want to do. After the user will be done from the **product** page,the user can return to the google site map again from a button or link in the browser windowthat can put it there as default, figure (3) represents the example of a **google** website.



Figure(3)

After the user get what he wants can return the browser window or to the sitemap again by the sitemap button in the browser windows like figure(4):

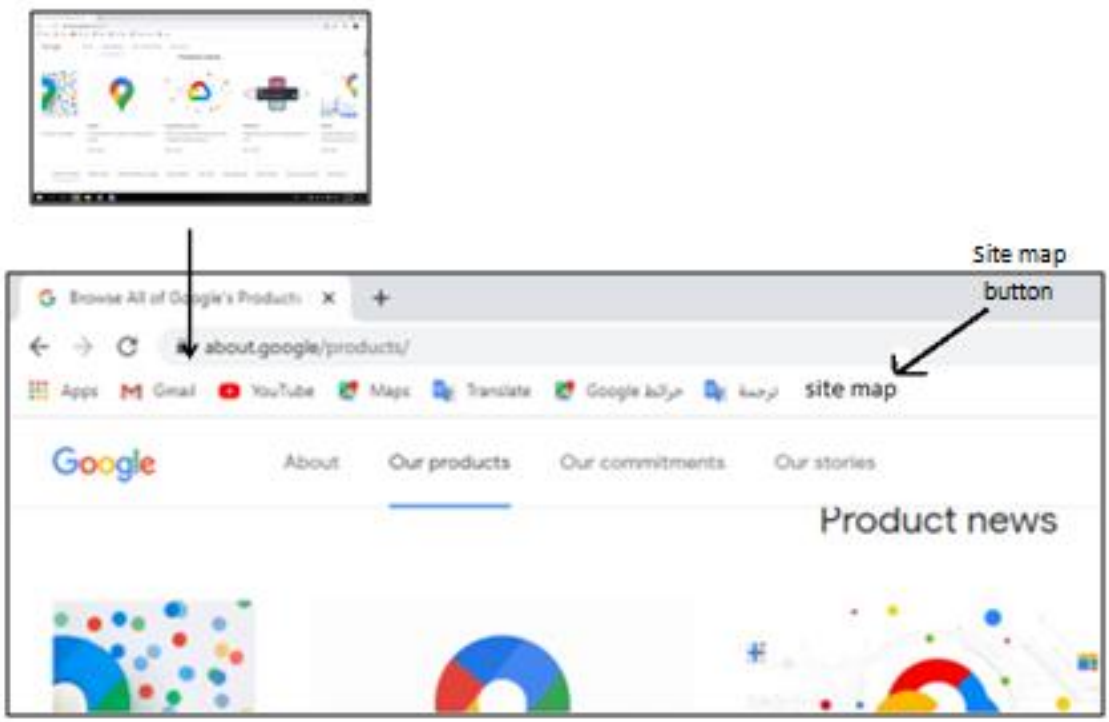


Figure (4)

VIII. GPS SITEMAP STYLE:

We can be making better and easier for the user by using a simple and clear view of the site map and choose global icons that user usually use it like used a double circle for home page with blue color and sold circle for high-level ranking page, and use this icon for Photo, thisicon for zip file or this icon for execution file and so on these icons shapescan be agreed upon globally and be standards and uniform for everyone and it will be very easy after getting used it and keeping it in our memories, here in this example we used Google icon to represent the pages instead of thenames of pages as shown in figure (5).

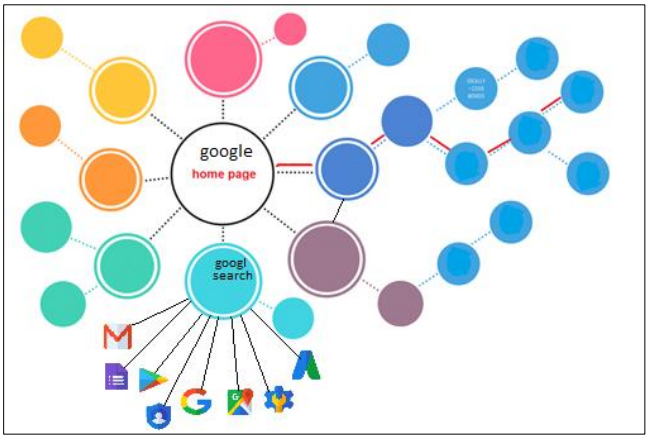
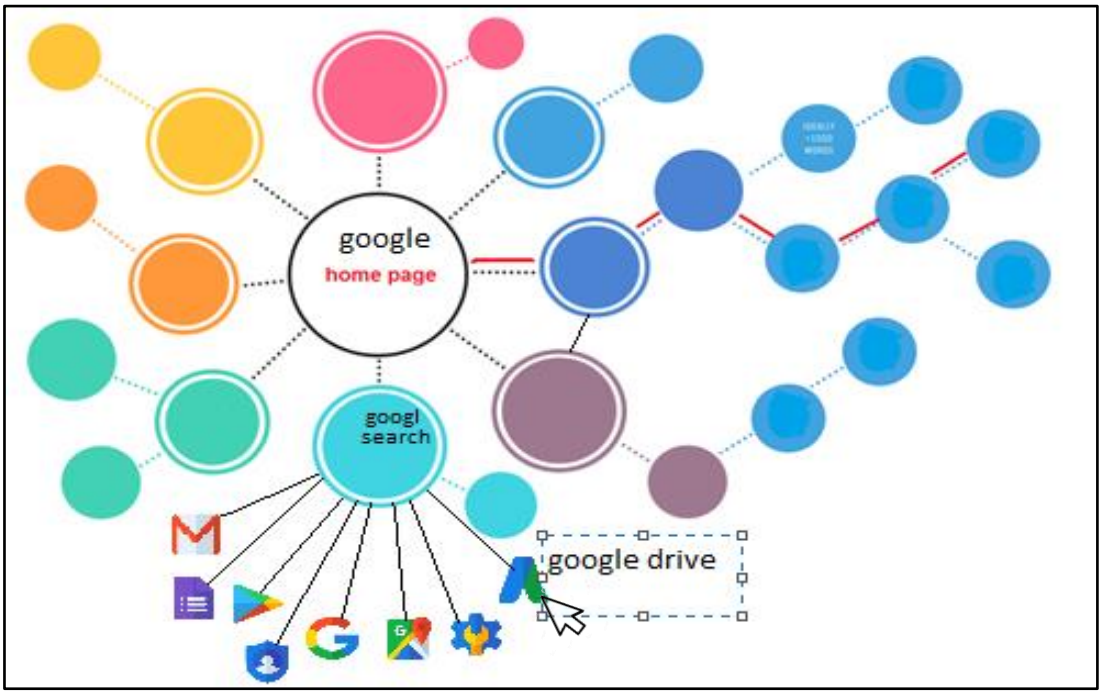


Figure (5)

Other things also can use a popup text window to give more detailed information on such an icon when the mouse cursor hovers on it like figure (6).



Figure(6)

ADVANTAGES OF BROWSING WEBSITE IN GPS STYLE:

1- Fasterbrowsing users can moving from page to another quickly withoutthe need to download any page of the site because the server loads the site map of the website and thenload the page that the user chooses.

2- There is no possibility of the presence of hackers or fake links because they appear on the map if there is any link goes to an unknown location.

3- Seeing the largest amount of the site's contents through clear titles of pages or files of all kinds.

4- Savingthe download time because user moving from one page to another and getting a simple idea about the page from the page's title or short explanation when the mouse hovers on page icon without need to download thepage until the user reaches the wanted page or the search target, at that time the page is loaded.

5- Reduce times the number of pages display on the browser during navigation reduces the deviation from the goal of the search, as the search does not interrupt by advertisements or others.

6- The user has more control of browsing; he knows where the site directs him, whichsummarizes several steps that were essential in classic browsing.

7- Users can distinguish the high-quality pages or high-level ranking from the door page by the overview of the graph of the sitemap.

8- Website quality may be observed from the global view of their site map also from pages title.

9- It is not possible to hide anything from the user, everything appears in front of him, i.e. cannot

be sent user to any place without knowing or without his desire.

A sitemap is very essential to access easily a website links and it saves the time of the visitor. There are mainly two benefits of sitemaps one is it helps to increase the ranking of your website. The second advantage of a site map is it helps to index your web pages quickly in search engines.

The sitemap is an index of your major pages. It's like an index for the book where only chapter or section names appear. This makes finding some content easy. The same can sayabout search engines. The sitemapcan do the same things in search engines to locate the most important pages or parts of the website facilely. [9]

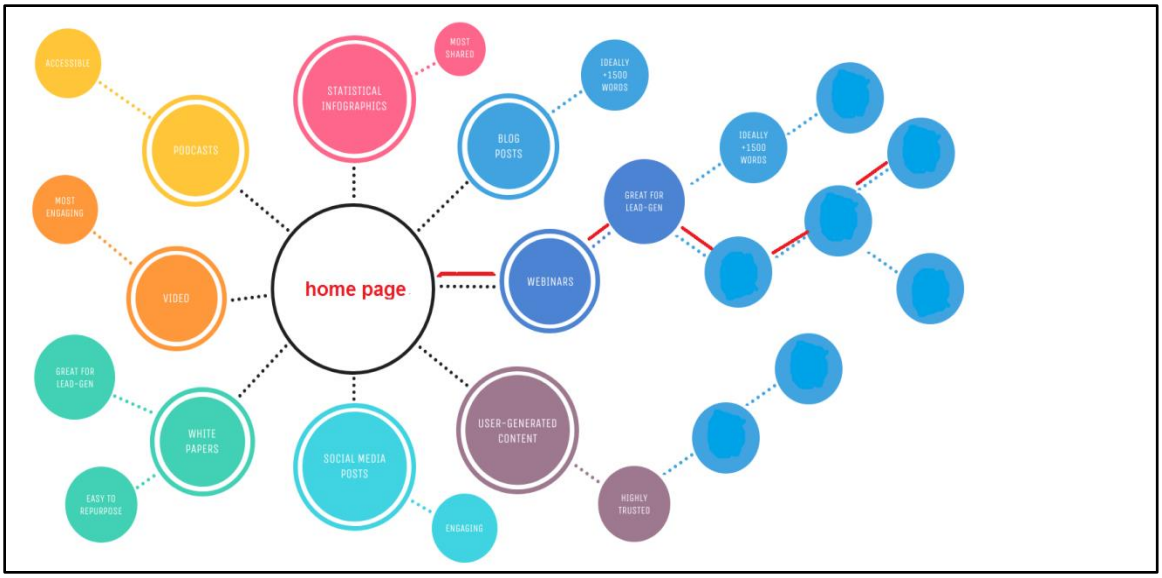


Figure (7)

CONCLUSION:

A GPS site map is a new style of browsing internet websites in which the browser tracking the user movement from page to page paving the way for more easy,flexible, trusted way to keep going navigation until the user find what is looking for, like the GPS tracking system in the principle of tracking on a person or vehicle movements on a real-world map in termsof appearance, not in principles of GPS theory and mathematical background.So good navigation style can improve the effectiveness of information seeking and prevent getting lost.

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Correlation Between Online Partial Discharge Intensity (PDI) Using RTD Sensor And Voltage Breakdown Test At 30 Years Large Turbo Generator

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Abstract*—Inner Cooled Hydrogen Generator 474 MVA 23 kV Single Vapor Pre-Impregnated Insulation (VPI) has been operated from 1988 with average capacity factor more than 80% annually. In 2014, Partial Discharge Intensity (PDI) reached an alarming state on RTD no 8B slot 19 of 30 (phase B) and 12A slot 29 of 30 (phase A). The testing and justification from manufacturers showed that the activity of Partial Discharge (PD) is categorized to HIGH level. This paper proposed a correlation between indication of HIGH PDI and breakdown voltage value. Value of PDI from the 30 years operated bars has been compared with PDI value from the new bars. The result shows the PDI level of old bars lower than new bars, however, both of its breakdown voltage are similar. This result shows that HIGH PDI level has low correlation with voltage breakdown threshold. Hence, it is needed to redefine the level of PDI which contribute to voltage breakdown value.

Index Terms—*Large Generator, Stator Winding Insulation, Partial Discharge Intensity (PDI), Voltage Breakdown Test*

I. INTRODUCTION

Generators are one of the main equipment in the power generation system such that reliability is always maintained at a high level [1, 2]. If the winding generator stator is damaged, it will take a recovery period of 6-12 months, resulting in a substantial loss of production in the power generation business.

Insulation stator winding generator typically has a life cycle of 20-30 years [3, 4]. However, some companies that have generators that have been in operation for more than 20 years have not made full use of the design lifetime, and have to rewind their generator stators with consideration to duration of work time and expensive costs. Some companies use condition-based maintenance to monitor the condition of the stator winding generators, one of which uses partial discharge technology [3, 5].

Defects in the insulation system of the stator generator may occur during the manufacturing process [6]. It may also happen due to thermal, mechanical, electrical, or chemical damage caused by the long-term operation of the generator. With the degradation of insulation due to a combination of operating pressure, voids can be formed within the material insulation, and dielectric damage can gradually occur from partial discharge activity. A forced power outage of the generator during operation due to dielectric damage from the winding stator takes a long time to fix and thus results in a major operating loss. This highlights the importance of isolation diagnosis that evaluates the increase in noise generator stator winding insulator. The voltage breakdown test method is used to verify whether the power is dielectric by applying the voltage until the flash-over occurs and testing the insulation ability to hold the voltage until it fails.

The trend of deteriorating insulation conditions of the stator winding generators can be observed by conducting Partial Discharge Testing, both offline and online [3, 7]. There are several types of sensors that can be used to detect partial discharge activity, such as a coupling capacitor and Resistive Temperature Device (RTD) [8] stator winding. Related parameters include Partial Discharge Intensity (PDI) level, Qmax, and Pulse per Second (PPS). The type of damage that occurs insulating stator winding can be known based on a specific pattern and phase resolve.

The reminder of this paper is organized as following. In Section 2, materials and methods are presented. In Section 3, the results of the experiments are provided. Finally, discussions and conclusions are respectively presented in Section 4.

II. MATERIALS & METHODS

A. Generator General Specification

Testing was conducted on the Inner Cooled Hydrogen Generator which has technical specifications as detailed in Table 1. Location of RTD no 8B & 12A is shown in Fig. 1.

B. Online Continuous Partial Discharge

Online Continuous Partial Discharge is attached to the Inner Cooled Hydrogen Generator using 2 types of sensors,

coupling capacitor, and Resistive Temperature Device (RTD), in stator windings where both sensors become partial discharge inputs online analyzer as shown in Fig. 2.

The output parameters produced by Online Continuous Partial Discharge are PDI level, Qmax (mV), Pulse per Second (PPS), Phase PD, or PD Pattern values.

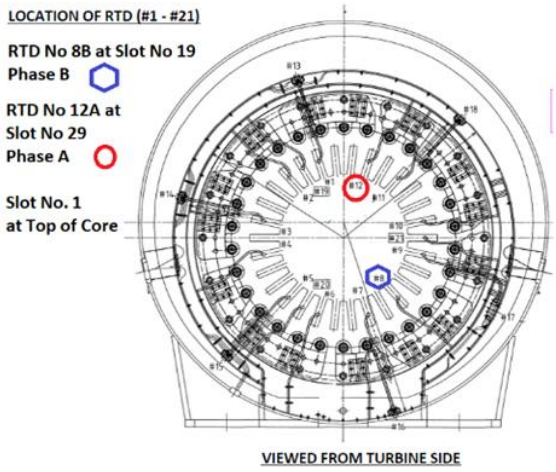

Fig. 1. Location of RTD no 8B & 12A.

Table 1. Inner cooled hydrogen generator technical specifications.

Power	:	474 MVA
Nominal Power Output	:	400 MW
Voltage	:	23 kV
Cooling System	:	Inner CooledHydrogen
Hydrogen Pressure	:	3 kg/cm2
Insulation Class	:	F
Insulation System	:	Epoxy-Mica Paper
Insulation Type	:	Single VPI
Nominal Speed	:	3000 rpm
Commercial Operation	:	since 1988
Total No. of Slots	:	30 Slots
Total No. of Bars	:	60 Pcs

C. Offline Partial Discharge Test

Offline Partial Discharge is performed on new replacement bad and Bar no. 12A after the bar has been removed from the stator slot. The test could not be conducted on Bar no. 8B due to damage that occurred during shipping from the site to the testing laboratory. The testing was conducted by the generator owner, manufacturer, and independent surveyor in the generator manufacturing laboratory. This test is based on the IEEE Standard No. 1434–2000 [9]. The parameters measured are the discharge values (pC) between 20 to 500 PPS. The test was carried out on the 20th April 2017 for the old bar at room temperature (24°C), 38% humidity, and sunny weather conditions. While for the new bar, it was conducted on the 21st June 2016, at room temperature (22°C) and 64% humidity.

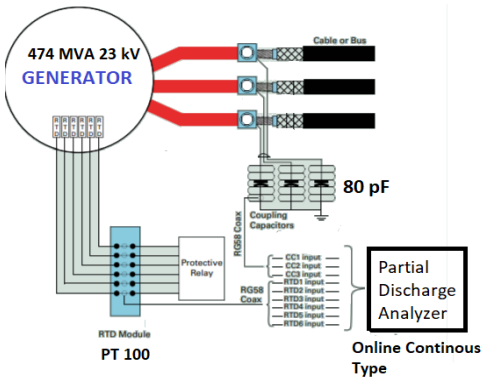

Fig. 2. Wiring Diagram Online Continuous Partial Discharge.

D. Voltage Breakdown Test

Online Continuous Partial Discharge is attached to the Inner Cooled Hydrogen Generator using 2 types of sensors, coupling capacitor, and Resistive Temperature Device (RTD), in stator windings where both sensors become partial discharge inputs online analyzer as shown in Fig. 2.

III. RESULTS

A. Online Continuous Partial Discharge (PDI) Monitoring

The monitoring condition of the generator's Partial Discharge Intensity (PDI) from January 2014 to March 2017 can be observed in Fig. 3.

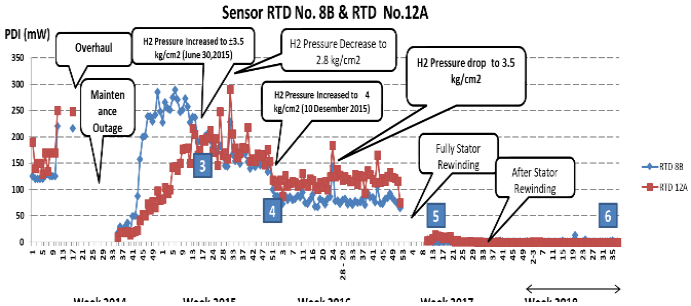

Fig. 3. Activities Trending of Partial Discharge by sensor RTD 8B dan 12A.

Hydrogen pressure raising activities are carried out to verify the partial discharge activity. After rewinding, there was a significant decrease in Partial Discharge in RTD 8B and 12A as shown in Fig. 3. Phase resolve chart before rewinding is displayed in Fig. 4.

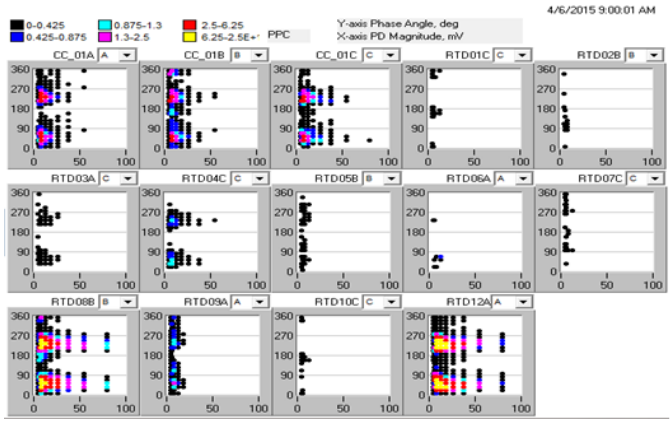

Fig. 4. Phase Resolve Chart before Rewinding.

"HIGH & ELEVATED" partial discharge status of RTD 8B and 12A was observed. The possible cause is thermal deterioration for RTD 8B, and slot discharge activity for RTD 12A. On the other hand, "MODERATE: partial discharge status was captured by the coupling [12]. After total stator rewinding, partial discharge activity in all bars is reduced greatly significantly as per Fig. 5.

B. Offline Partial Discharge Test

Test results for the offline partial discharge of the old bar RTD 12A (Bar Slot No 29) are presented in Table 2. The test voltage 13.3, 16.6 and 23.0 are considered for different partial discharge intensity at pulse.

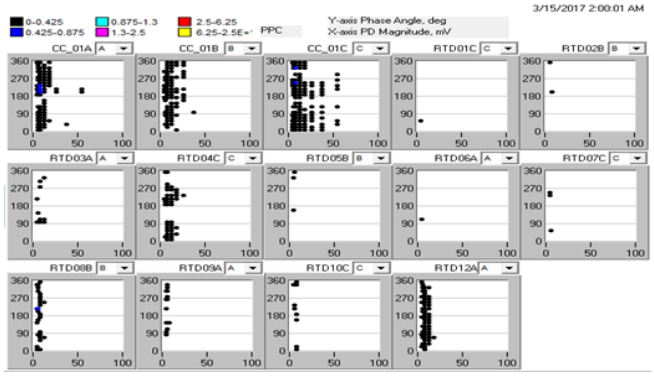

Fig. 5. Phase Resolve Chart after Rewinding.

Table 2. Partial Discharge Test Results For Old Bar.

Bar No.	Test Voltage (KV)	Partial Discharge (pC)				
		Partial Discharge Intensity at Pulse (PPS)				
		20	***50***	***100***	***200***	***500***
Old Bar B29 (RTD No. 12A)	13.3	25200	21100	19300	14000	11100
	16.6	34200	28100	23900	19600	14900
	23.0	46800	42100	35400	21300	273000

From the results, it can be concluded that the partial discharge values can be classified in the "CRITICAL" criteria, based on the reference by the generator manufacturer. However, as seen in Table 3, the Offline Partial Discharge test result for the new replacement bar is better than the old bar.

Table 3.Partial Discharge Test Results For Old Bar.

Bar No.	Test Voltage (KV)	Partial Discharge (pC)				
		Partial Discharge Intensity at Pulse (PPS)				
		20	***50***	***100***	***200***	***500***
New BAR	13.3	2800	2600	2500	1500	800
	16.6	3200	3000	2800	2500	1900
	23.0	4500	4000	3500	9200	2400

C. Voltage Breakdown Test

From Table 4, the average value of the breakdown test result between the old bar and the new bar is relatively the same. Average breakdown voltage for old bar (B29) is 151 kV and for new bar is 139 kV.

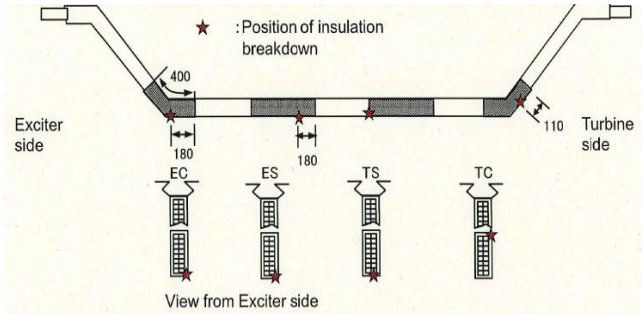

Fig. 6. Insulation Breakdown Location of Old Bar No 29.

Table 4. Partial Discharge Test Results For Old Bar

Bar No		EC	ES	TS	TC	Ambi-ent Temp (^{O}C)	Hu-midi-ty (%)	Wea-ther
B29 (RTD no 12A)	Insula-tion Break-down Voltage (kV)	140	150	155	160	23	32	Sun-ny
	Averag e (kV)	151						
New Bar	Insula-tion Break-down Voltage (kV)	125	150	155	125	22	64	Rai-ny
	Averag e (kV)	139						

Location along with photo where breakdown insulation is tested in 4 parts on bars namely straight portion and knee portion shown in Fig. 6 and 7 for old bar as well as Fig. 8 and

9 for new bar.

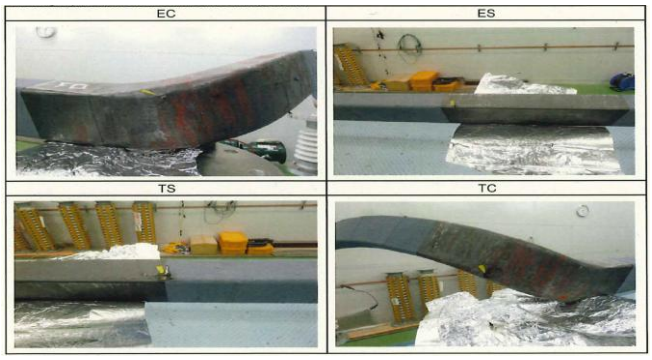

Fig. 7. Photograph Insulation Breakdown Portion of Old Bar B29.

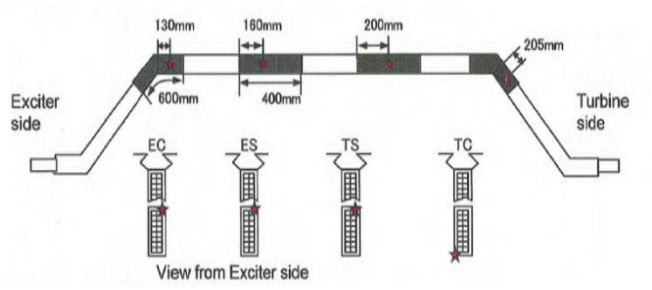

Fig. 8. Insulation Breakdown Location of New Bar.

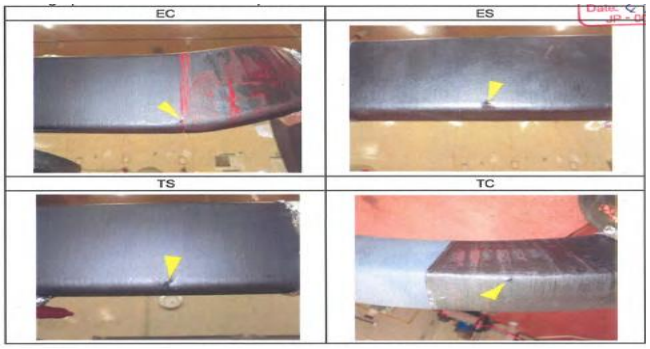

Fig. 9. Insulation Breakdown Location of New Bar.

IV. Discussion & Conclusions

Voltage Breakdown test result for the old bar is still in a good range and still far from the Limit of Safety Margin for Operation, which is 49 kV as per Generator Surge Arrester Cut Off Voltage. Even the average value is still better the new bar. The Stator Bar Winding should then be than able to operate much longer.

After rewinding, the Partial Discharge Intensity (PDI) decreased in both RTD and coupling capacitor sensors, suggesting that the activity of the new partial discharge winding is lower and better than the old winding. The result shows the PDI level of old bars lower than new bars, however both of its breakdown voltage are similar. This shows that HIGH PDI level has low correlation with voltage breakdown threshold. Hence, it is needed to redefine the level of PDI which contribute to voltage breakdown value.

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DATA DISSEMINATION USING MACHINE LEARNING APPROACH

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Abstract— In today's' world of Big Data, where data is increasing at a very rapid speed, data mining and data dissemination had taken a lot of attention from various researchers across the globe. Data mining is nothing but the way where the important data or pattern is extracted from a big volume of data, whereas data dissemination is a way of distributing or transmitting useful data to end-users. Both technologies combined become very powerful and helpful technology to solve the complex problem of large business where available data can be made useful for some kind of analysis using a data cluster mechanism. In this paper, we are thus discussing various data mining clustering technologies of Machine Learning (ML) which will help for better processing of Knowledge Discovery in Databases (KDD). Different types of Classification, Clustering, and Regression algorithm will be discussed and towards the end, we will be concluding on the comparison, advantages, and disadvantages of these ML models for data mining and data dissemination process.

Keywords:
Index Terms— ***Data mining, Data Dissemination, Clustering, KMeans, Unsupervised Machine Learning***

I. INTRODUCTION

Data mining and machine intelligence are one of the most important areas of discussion today due to the emergence of big data across the corporate world globally. The importance is more because data mining, data dissemination is connected to database manipulation, finding out exact important data, artificial intelligence, and data statistics so that clustering and finding out matching pattern becomes easy in big data analysis. Data mining is mainly the unstructured data and extracting useful information we had to train this unstructured data so that will help the client to make good business decisions. Methods of data mining use mathematical methods and techniques of the computer intellect. The importance of such techniques has been upgraded by the advent of huge information [1] in dissecting market problems.

Data mining is one of the most trusted and proven methodologies to handle the big data and analyze the pattern from that data which will help to make better decisions. Lately, there was a great deal of advancement in data collection technology development, such as standardized bar-code detectors in business spaces and sensor systems in logical and modern parts, which led to the era of huge data measurements. This new advanced development in the big data domain had delivered a great interest in developing new methodologies. Scientists from the Statistician's database and the MIS and corporate world group started using the term " data mining "first to retrieve important information from big data. Knowledge Discovery in Databases (KDD) is one of such new concept data mining is used to extract useful information from big data.KDD includes data preparation, determination, cleaning, and a legitimate understanding of the effects of data mining to ensure useful data is collected from the data. Data mining compares with traditional computer analysis and computational methodologies by using rational structures with a few commands, such as numerical analysis, pattern matching, and artificial intelligence fields, such as deep learning, and neural networks, and genetic algorithms[2],[3]. Data mining, or information discovery in databases, is the method of extracting information from vast datasets in data mining three styles are used to group items into defined groups such as grouping, regression, and clustering [12] as seen in Fig1.

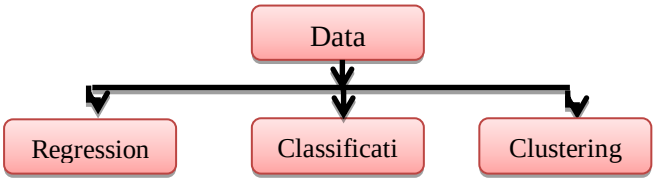

Figure 1: Data Mining Approaches

Classification is the way where we separate the data into different classes based on input values. It can be decided

based on binary partitioning or sometimes even multiclass problem data also can be classified. Regression analysis is generally used when there is a continuous analysis in a numeric format based on input values. In both cases of classification or regression, the data is always labelled as input and output values. In the case of clustering algorithms of data mining, there is no labelled data. The data is grouped based on common properties named clusters [4].

Classification is used to separate the information into classes. Characterization of the classes can then be utilized to make expectations for new unclassified information. Classes can be a generally binary partition or can be difficult and multi-valued. There are two phases included in Classification. The first is the learning process phase in which the analysis of training data is done then the creation of rules and patterns. The second phase is used to tests the data and archives the accuracy of classification patterns [3].

The machine learning approach uses two-phase data analysis. In the first step which we called as learning phase where analysis of training data is done based on certain rules and data patterns. In the second phase, we used to test the data based on learned pattern and thus predicts the accuracy and output values [3].

Being we are in this paper discussing the unlabelled data, we will be focusing on clustering algorithms of data dissemination technology where we can group similar data points with some identified patterns.

II. CLUSTERING ALGORITHMS

Analysis of clusters, or clustering, is a process of unsupervised machine learning. It requires the automated exploration of natural data classification. Unlike supervised learning (such as statistical modelling), clustering algorithms only perceive inputs and locate in feature space normal groups called classes or clusters. Clustering methods occur where there is no class to be expected but then if the instances are to be separated into natural classes. A cluster is also a density field in the application space where domain instances (observations or data rows) are closer to the cluster than other clusters. The cluster may well have a test or point function space centre (the centroid), which may have a border or distance. These clusters probably represent some processes at work in the environment from which instance is taken, a phenomenon that causes certain cases to imitate each other more strongly than other cases.

Clustering may be useful as a data mining method to learn more about the problem area, the so-called pattern exploration, or the exploration of information. Clustering can also be useful as a function engineering method in which current and new instances can be mapped and classified as belonging to one of the clusters defined in the data.

Assessment of different portions is subjective and can include a domain specialist as several objective methods are unique to clustering. Usually, clustering algorithms are academically contrasted with predetermined clusters on synthetic datasets where an algorithm is supposed to identify. Many clustering algorithms are available for spatial data mining and data dissemination. In an attempt to seek dense areas of predictions, many techniques employ similarity or specific markers between illustrations in the feature vector. As such, scale-up data before using clustering algorithms are often great training.

Some of the clustering algorithms require that you should specify the number of clusters to discover based on data availability and data visualization, where some of the clustering algorithms require specifying the minimum close distance between two data points.

Here in this paper, we will be providing details of 5 popular clustering algorithms, their performance and we will evaluate this clustering algorithm at the end. Every algorithm provides a different approach to the challenge of finding natural groups in data.

1. Affinity Propagation

Affinity Propagation means finding a collection of copies that best sum up the results. Affinity propagation is a clustering algorithm that takes similarities between pairs of data points as input steps. Real-assessed messages are shared between data points before a high-quality collection of copies and related clusters steadily emerge.

2. BIRCH

BIRCH Clustering (BIRCH short for the use of controlled iterative reduction and clustering Hierarchies) includes creating a tree system from which centroids of the clusters are derived. BIRCH incrementally and dynamically clusters incoming multidimensional metric data points to attempt to generate the highest performing clustering for the available resources (i.e., memory and time constraints available).

3. DBSCAN

Density-Based Spatial Clustering of Application and Noise commonly named DBSCAN Clustering algorithm is used to find high-density proportion in the given proportion and expand those proportion of feature space around them known as clusters. DBSCAN clustering algorithm relies on a cluster notion dependent on density that is structured to discover arbitrary form clusters. DBSCAN only needs one input parameter and assists the consumer in deciding a reasonable value for it.

4. K-Means

K-Means Clustering is perhaps the most commonly recognized clustering technique, which includes assigning cluster examples in an attempt to minimize the variability in each cluster. The algorithm works on partitioning an N-dimensional population into k sets based on a sample. The process, which is called 'k-means,' appears to give partitions that are reasonably efficient in the sense of within-class variance.

5. OPTICS

OPTICS clustering (where OPTICS is short for Ordering Points To Identify the Clustering Structure) is a modified version of DBSCAN described above.

OPTICS algorithm works for cluster analysis which does not produce a clustering of a data set explicitly but instead creates an augmented ordering of the database representing its density-based clustering structure. This cluster-ordering contains information that is equivalent to the density-based clustering corresponding to a broad range of parameter settings.

III. RESULTS AND DISCUSSION

For analyzing the performance of all above mentioned 5 clustering algorithm for data mining and data dissemination kind of problem, we had used an arbitrary dataset which consists of 1000 samples with two input features and one cluster per class. The clusters are visually obvious in 2 dimensions because of which we can plot the data with scatter plot concepts and we had used various colour combinations which will help to identify the cluster formation. For this, we are using Python 3.7 as a programming language on Windows 10 Operating system, 8 GB RAM. We will be using the make classification () method to create the sample test dataset for binary classification problems. The clusters in this test problem are based on the Gaussian multivariate, and not all clustering algorithms would be successful in defining these cluster types. Figures 2 to 6 display the scatter plot of cluster formation using Affinity Propagation, BIRCH, DBSCAN, KMeans, and OPTICS algorithm respectively.

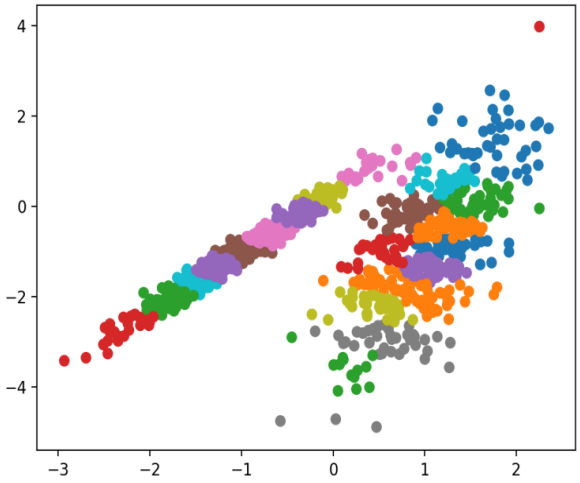

Figure 2: Affinity Propagation

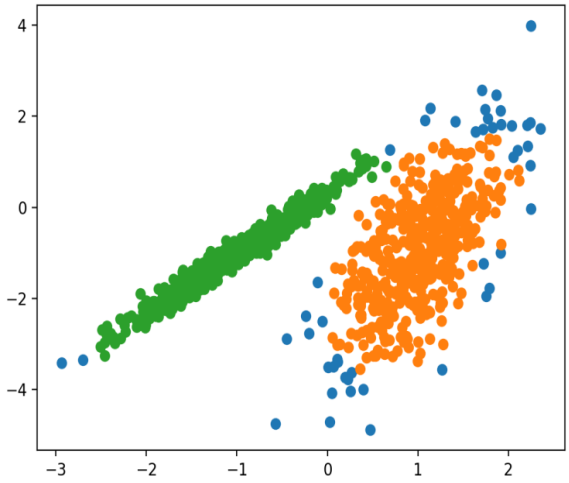

Figure 4: DBSCAN

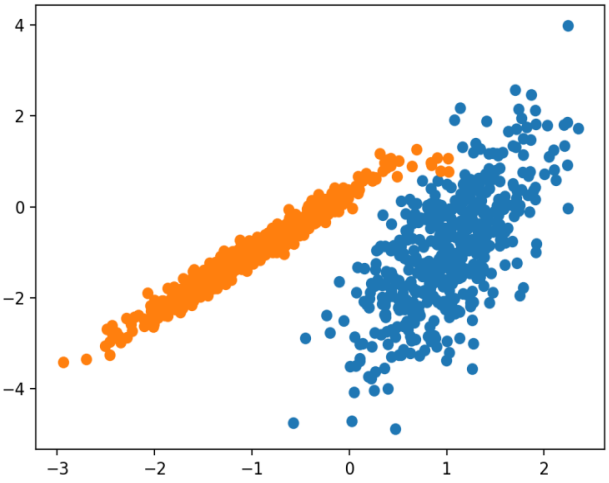

Figure 3: BIRCH

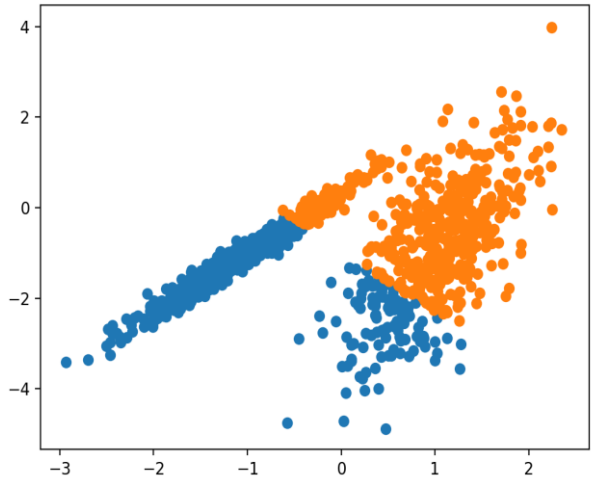

Figure 5: KMeans

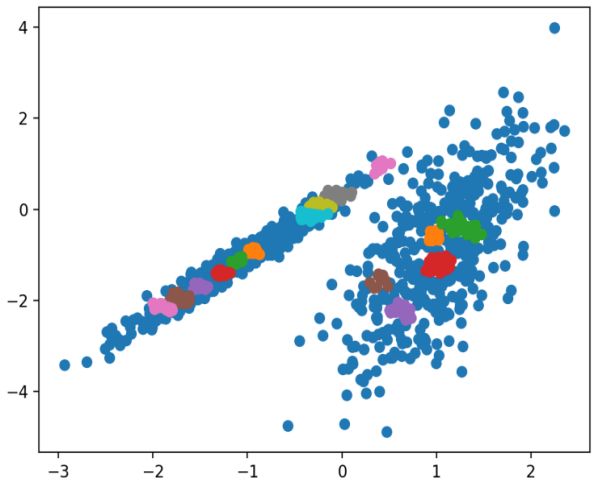

Figure 6: OPTICS

Through the scatter plot, we can conclude that Affinity propagation clustering is not achieving the proper clustering results. BIRCH clustering algorithm is achieving proper cluster formation with the number of clusters as 2. In DBSCAN reasonably good grouping of data is found but to make it even better some fine-tuning is required. In the case of the KMeans clustering algorithm again a fair amount of grouping of data clusters had found, but still, some unequal equal variance in each dimension makes the method less suited to this dataset. In Optics again the data clustering is a little clumsy on this dataset and no proper clustering of data is observed. So on a given dataset of 1000 samples and number of clusters as 2 BIRCH is best performing and then followed by KMeans.

IV. Conclusion

In this paper, we had discussed different types of Clustering algorithms for data mining and data dissemination technologies. We had performed some experiments by keeping random data selection of 1000 samples and the number of cluster formation as 2. We had used 5 top clustering algorithms of Machine Learning methodologies on unlabelled data and when we have done a comparison of this data by plotting the scatter plot for cluster formation and visualization, we found that BIRCH and KMeans performance is better on the given dataset. Best of the given dataset the clustering algorithm formation and their performance may vary and hence before implementing the clustering algorithm through data visualization one can conclude or guess which clustering algorithm will be best suitable. In future scope, we want to work on a dynamic variant of clustering algorithm which is one of the limitations of all above clustering algorithm as all of them works on static data and dynamic data dissemination is need of the hour at this moment because of increasing speed of big data over the globe.

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Computation Offloading in Fog Computing: Use Cases, Techniques & Issues

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Abstract --- In this era, fog computing is a horizontal, physical, or virtual resource emerging paradigm that extends cloud computing to the edge of the network. Now a day, there are many resources hungry applications i.e. face recognition, augmentation reality, video surveillance, speech recognition, virtual reality that requires high computation capabilities and large memory, which are not available at the end devices. Moreover the distance between the cloud and the end devices may also be an issue for delay sensitive applications. This paper present a comprehensive survey of computation offloading in fog computing. It reviews different techniques used to implement computation offloading along with variation parameters. This study also represents that there are various use cases of computation offloading in real world environment. Finally, open research issues related to computation offloading are also investigated to point out future research directions for the efficient computation offloading in the fog computing environment.

Keywords: Computation offloading, Delay, Energy, Fog Computing, IoT

I. INTRODUCTION

Cisco introduced the term fog computing in 2012[1]. Fog computing is complementary to cloud computing for better Quality of Service(QoS) and Quality of Experience(QoE). It is an intelligent layer sitting between cloud and IoT devices i.e. it is a distributed, heterogeneous paradigm that acts as a middleware between cloud and IoT devices and it can be deployed anywhere like on the tower, on university floor, in the shopping mall, on the street light, in-vehicle, in metro stations, etc. A device with computing power, memory and internet connectivity (Router, Gateway, Camera, Switches, Set-top boxes, Hub, Proxy Servers, etc) can be used as a fog node. Here data is accumulated at network edge like the floor of company, trains, airport, shopping complex, etc. After collecting data, it is required to process that data with minimum latency or in few nanoseconds. Here fog node can reduce latency by sitting at the edge of the network.

Due to geographically distributed, heterogeneity of nodes, the major issue in fog computing is unpredictable environment. There are many variations like network condition, number of task, type of devices, and heterogeneity of application. In this paper, we survey the computation offloading techniques and variation parameters addressed by different authors. We also present practical use cases of computation offloading in fog computing. Finally issues related with offloading a task to either fog node or cloud are also investigated to point out future research directions.

In this paper section II will describe computation offloading with respect to fog computing along with 5 w's and 1'h questions associated with the scenario. Section III will cover offloading algorithms with focus on variation parameters and section IV will

discuss about various practical use cases of offloading in real world environment. Section V present various techniques used to implement computation offloading. Finally section VI will discuss about research challenges faced in computation offloading.

II. COMPUTATION OFFLOADING

Computation offloading[2] is the practice to offload the resource-intensive task to nearby fog or cloud node to overcome the problem of resource limitation and increasing efficiency and reducing latency. Resource demanding task takes longer time in execution at local device because they have limited resources like primary memory, processing power, etc[3].

During computation offloading many questions arise in mind what to offload, where to offload, when to offload, why to offload, who will offload and how to offload[4].

A. What to offload

One of the major problems is to identify what task could be offloaded and what task should be offloaded. The off-loadable task can be identified manually or automatically. Researchers used different application partitioning algorithms based on different approach such as brute force, Greedy heuristic, fuzzy logic to extract offloadable part. In ULOOF[5] framework granularity for offloading is also defined i.e on class basis or method basis. ULOOF works on method level because at class level both offloadable part and non offloadable part exist.

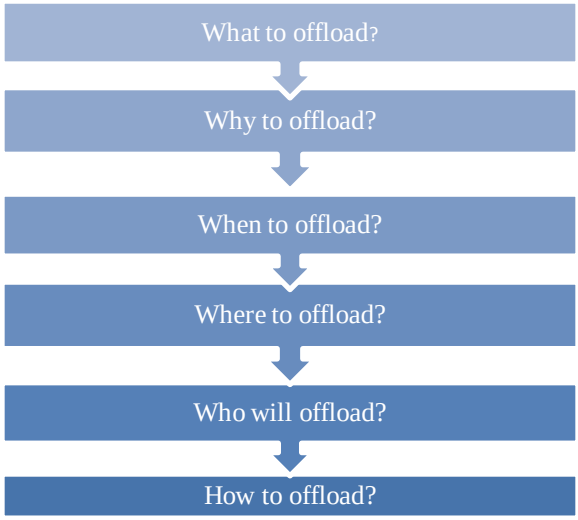

Fig. 1: 5 Q's & 1 H for Offloading

B. Why to offload

To answer this question, there are various criteria based on which decision is taken:

1) Load balancing

It refers to efficiently distributing tasks among backend servers for effective utilization of available resources. For example, a website receiving more than a million requests for image, graphics, audio, video file requires task is to be distributed among different servers for fast processing.

2) Permanent Storage of data

Now a day's Smartphone comes with ample memory space but not good enough to store memory-intensive applications like voice recognition, face recognition, video games, audio files, video files, etc. As a result, the data can be offloaded to higher resource node for permanent storage.

3) Data security

Security refers to preventing data from unauthorized access. A smart phone user can transfer confidential data to the private cloud for security purposes.

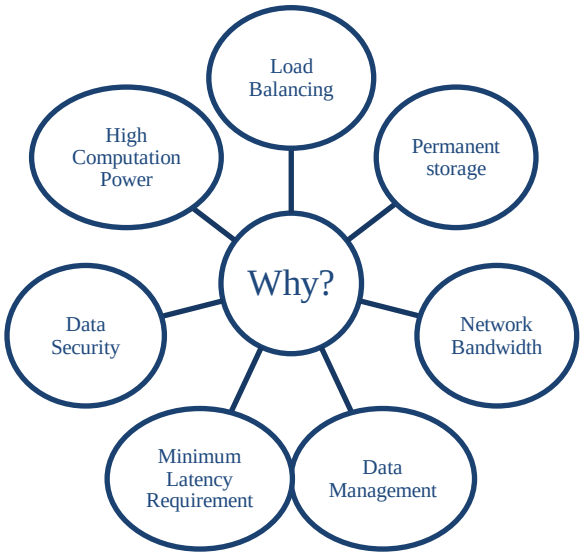

Fig 2: Criteria for why to offload

4) High computation power

If a job is requiring more computing power as compared to its native device, in that case, a complete or part of the job can be offloaded to a remote node or cloud which has high computing capability.

5) Minimum latency requirement

Applications that require real-time processing of data, for example, road traffic data management, patient health monitoring system, etc require minimum latency. If we have limited resources, it will take more time to execute the task locally. If we send a job to the distant cloud, then it will increase latency. In such a situation, a fog node can be a better option for offloading tasks with minimum latency.

6) *Data management*

In mobile phones, rarely used data is offloaded to fog nodes and whenever that data is required is brought back to the native device. Offloading can be used for organizing and managing data.

7) Network bandwidth

With the emergence of IoT massive amount of data is generated by devices in every millisecond. While limited bandwidth is available, so it's not the right tactic to send all tasks to the distant cloud for execution. Here fog node can be used for pre-processing, analyzing, aggregating data at the edge of the network. So offloading can be used to save network bandwidth[6].

C. When to offload

It is not necessary to always offload the task, because offloading a job adds extra cost, for example, low network speed can increase transmitting time in such a situation some time constraints task should be executed locally. So the decision to when to offload not only depends upon user requirements but also on the current status.

D. Where to Offload

Generally we consider cloud as destination of offloading. There exist various middleware technologies for offloading like cloudlet, micro datacenter, Mobile edge computing, nano data center, famto cloud, etc. Cloudlet is a distributed computing technology that is available at the edge of the network. It is a mini cloud that brings cloud services to the user[7]. Edge computing is the technology that allows computation at the edge of the network[8]. It improves latency, QoE, context-aware service, user experience, and reduce bandwidth consumption[9]. Micro Datacenter is a modular, centralized, and portable data center. Femtocell connects using broadband and DSL Connection to the service provider's network[10]. Where to offload the task either at cloud or middleware technology or execute at native device is to be considered for offloading the task.

E. Who will offload

In fog computing during computation offloading, one of the big tasks is who will act as a decision engine. Some authors prefer gateway as a decision engine others prefer mobile node to work as a

decision engine. The decision engine is also called orchestrator and it is responsible for decision of whether the task should be offload or execute it locally. Location of decision engine also play major role in offloading process. Three approaches are used for orchestration centralized, distributed or clustering.

F. How to offload

Various techniques offload tasks at a different level, and we can classify them into system level, application level, and method level. The system-level offloading means to move the entire operating system and its applications on a different node. The application-level technique usually runs a set of apps on the cloud, and the client can call it as web services. The method-level approach partitions a program into pieces and decides which part should run remotely.

The following table represents different variation parameters considered for addressing computation offloading in fog computing.

Variation Parameters

Functionality of offloading system is measured with the help of different variation parameters. These parameters may be in the context of network, availability of resources for execution, or applications. In the list of parameters delay, bandwidth, channel capacity, data rate comes under network context. Energy, computation capability, and memory are considered under device context. Heterogeneity, concurrency comes under application context. Table I shows different variation parameters considered by different authors for offloading algorithm.

Table I. List of variation parameters considered for performance evaluation of computation offloading architecture

Paper	Parameters							
	Delay	**Energy**	**Channel capacity**	**Cost**	**Data rate**	**Computation capability**	**Heterogeneity**	**Band width**
[11]	Yes	Yes						
[12]	Yes	Yes		Yes	Yes			
[13]	Yes	Yes						
[14]			Yes			Yes		
[6]	Yes	Yes						
[15]								Yes
[16]	Yes	Yes				Yes		
[17]				Yes			Yes	

IV. USE CASES OF COMPUTATION OFFLOADING

Computation offloading in fog computing has holds promising capabilities for various applications. These applications may be interactive or non-interactive. This potential has been unveiled through several use cases.

A. User behavior driven health care monitoring

[6] Proposed a technique that involves human-driven, device-driven intelligence as a key component to minimize latency and energy

consumption via case studies. The first case study makes use of the machine learning to recognize user behaviors for health care monitoring and perform adaptive low-latency Medium Access Control (MAC)-layer scheduling amid sensor devices. In the second case study, they designed an algorithm for task offloading using which devices can take offloading decisions with minimum latency and energy consumption.

B. Counting number of persons in the image

A prototype of a smart offloading framework designed to work in IoT devices using the Fuzzy Multi-Criteria Decision Making as the decision tool [18],. Network condition is considered for making the decision of whether execution will be done at IoT devices or cloud. A set of the linguistic variable is defined to set offloading criteria. The membership function represents the degree to which the criteria belong to a set of assessment methods or to select the decision method. Hence, a proposed algorithm will work for real IoT devices.

C. *Scanning car number to detect car detail*

A framework that supports IoT applications with adaptive computation offloading capabilities is designed[19]. Firstly they proposed a design pattern to enable an application to be computation offloaded on demand. After that, an estimation model is employed to automatically decide the deployment plan for offloading. Then the framework is proposed which supports the design pattern and estimation model. Then this framework is used for real-time case study i.e license plate recognition system to collect car details by scanning the number plate.

D. Location-based service

Now a day location-based service had evolved into smart location-based service. These smart location-based services provide many services based on location such as entertainment, traffic, weather condition, etc. So smart location-based service required a complex operation to be executed that's why it requires the task to be offloaded to the fog nodes[20].

E. Game theory

Computation offloading game represents the competition among IoT users and optimized allocation of the processing power of fog nodes[16]. Here resources are allocated hierarchically in fog nodes and clouds. The main aim is to reduce delay and computation energy and maximize the quality of experience and to know offloading decisions for each problem incoming to the IoT user whereas fog nodes work in cooperation to offload task either to neighboring nodes or to the cloud.

Table II. U**se cases of computation offloading in fog computing**

Paper	Use cases	Details
[6]	User behavior-driven health care monitoring	User behavior-driven health care monitoring application is introduced in the paper
[18]	Counting the number of persons in the image	An algorithm for counting no of objects in an image by using deep learning
[19]	Scanning car number to gather car details	A framework for adaptive computation capability to design pattern and to estimate pattern proposed.
[20]	Location-based service	Running a virtual machine on low-performance network platform degrade quality of service while fog computing and smart virtual machine provide effectively and efficiently location-based service
[16]	Game theory	It uses Nash equilibrium near-optimal resource allocation mechanism

[21]	Environment monitoring system	It utilizes fog architecture for environment monitoring and hazard detection by deploying a computation-intensive applications at sensors.

F. ***Environment monitoring system***

The distributive optimization framework implements cooperative fog computing[21]. Here a problem is divided in N number of tasks and each fog node is capable to execute the task. This subtask optimization is monitored by the work forwarding coordinator. Each fog node executes three cases if it can execute a complete task then it does not pass to other fog nodes or cloud. If it cannot execute tasks then it may pass whole to other nodes or cloud, it may also partially offload workload. So in the proposed algorithm, the unprocessed workload can be shared with the neighboring fog nodes to enhance the quality of experience for the users and power efficiency.

V. TECHNIQUES USED FOR COMPUTATION OFFLOADING IN FOG COMPUTING

Different authors used various techniques for implementing computation offloading in fog computing in literature. Some of the most popular papers which have used the popular method for performing computation offloading in fog computing are as follows:

A. Energy-efficient optimization for computation offloading in Fog computing system

Energy-efficient optimization for computation offloading solved the problem of energy optimization for a fog computing [22]. Two queuing models one at a mobile device and another at fog node is used to study energy consumption and delay in fog computing. Computing capability and wireless transmission are explicitly considered. The heterogeneity factor is also considered at the network level. Authors formulate an energy-efficient optimization problem that reduces energy utilization by finding transmit power and offloading probability. They have used ADMM based method to address the optimization problem.

B. A new hybrid adaptive GA-PSO computation offloading algorithm for IoT and CPS context application

The hybrid adaptive GA-PSO computation offloading algorithm reduces energy consumption and execution time [23]. Here Particle Swarm Optimization (PSO) and Genetic Algorithm is utilized to find out the solution for scheduling off loadable components in an application. First Task Interaction Graph(TIG) is created for mobile devices where a node represents computational task and edge represents the relationship between nodes. Then the weight is assigned to each node and cost is associated with the edge. The partitioning problem is expressed as a minimization problem.

Table III. Techniques used for computation offloading in fog computing

Technique	Paper
Nash Equilibrium	[16], (Liu, Chang, et al., 2018), [17]
Markov Model	[25]
Fuzzy	[6], [18]
Genetic Algorithm	[23], [26]
Q learning (Reinforcement	[27]

Learning)	
Multiple Choice Knapsack Problem	[15]
Interior Point-Based Method	[12]
Alternate Direction Method of Multiplier	[22]
Distributed Alternate Direction Method	[21]

C. Socially aware dynamic computation offloading scheme for Fog computing system with energy harvesting devices

Socially aware computation offloading algorithm considered the social relationship of energy harvesting mobile devices [24]. A game-theoretic approach is used to minimize the social group execution cost and to model the interaction among groups. To analyze the delay performance during the offloading process different queuing models are used. Firstly, they utilize the exponential penalty function method to penalize the coupling constraints and convert the inventive Generalized Nash Equilibrium Problem into a classical Nash Equilibrium Problem. Then they synthesized the Karush-Kuhn-Tucker conditions for the smoothing penalized Nash Equilibrium Problem into a system of nonsmooth equations, and then apply the semi-smooth Newton method with Armijo line search to resolve the system.

D. *Autonomic computation offloading in mobile edge for IoT applications*

Autonomic computation offloading implemented deep Q learning-based autonomic management framework to handle computation resource demand from mobile devices [27]. Here the problem is represented using the Markov decision process (MDP) and the solution is given through reinforcement learning. The randomness of the demand for resources and the mobility of the devices is considered for decision making. This algorithm minimizes the latency of service computing.

E. Multiobjective Optimization for computation offloading in fog computing

Multiobjective Optimization for computation offloading have used queuing theory for balancing energy consumption and delay and estimated payment cost of computation offloading in fog computing [12]. Here three queuing model is used to maintain queue at fog node, mobile node and cloud, data rate and power consumption of wireless link are explicitly considered. Authors formulated a multi-objective optimization problem to minimize execution delay, payment cost, and energy utilization by finding the best offloading probability and transmission power of the mobile device. Using the scalarization method they can change the multi-objective problem into a single-objective problem. Interior Point Method (IPM) is used to address the transformed optimization problem.

F. Computation offloading and resource allocation in mixed Fog/Cloud computing systems with Min-Max fairness guarantee"

In this paper[13], the authors proposed Offloading Decision Making and Resource Allocation Algorithm (CORA) algorithm where semi definite relaxation (SDR) and random extracting are

used for offloading decision. Bisection Method for Computation Resource Allocation Algorithm (BCRA) algorithm was proposed to solve computation resource allocation in order to solve the nested resource allocation problem in CORA.

G. Scalable fog computing with service offloading in bus networks

In this paper [26], the authors considered the scalable fog computing paradigm with service offloading in the bus network. The main point is that not only mobile devices can use the fog server services but also overloaded roadside cloudlet can offload the computational task to the fog server. So it also helps in enhancing the capabilities of the cloudlet also. They have used a genetic algorithm for allocation purposes and improve user experience also. Scalable fog computing paradigm used a cyclic approach. The first estimation of the volume of a computational task is made by roadside cloudlets. Then it does planning for task allocation. After that using the access point task is offloaded to the fog servers. This minimizes the cost of transmitting data and enhances user experience.

VI. OPEN ISSUES AND FUTURE DIRECTIONS

In this section authors recapitulate the challenges and open issues associated with computation offloading in fog computing. Authors have noticed that the offloading algorithm generally focuses on one part of computation offloading. It may be in reference to either what, why who, how or when. Mostly algorithm works on few parameters and improves them. But there should be a combined decision based on what, who, why, how and when the offloading should be done.

The following are the major issues associated with computation offloading in fog computing.

A. *Platform Variety*

One of the challenges is variation and heterogeneity in end devices and fog node used in computation offloading. A standard offloading framework is still a challenging issue.

B. *Fault Tolerance*

In fog computing environment end devices can move from one location to another then network bandwidth and data exchange rate may vary or connection may be lost. In such cases offloading algorithms should be provided with suitable fault tolerance mechanisms.

C. *Security*

There may be some security and privacy issues associated with computation offloading. When we send some critical and confidential tasks to other fog nodes for computation purpose then the risk may arise. So the computation offloading algorithm must follow some security mechanism while offloading a task to distant fog node.

D. *Context Awareness*

Offloading decisions must be on the basis of different offloading parameters. Offloading will not be yielding positive results all the time. So the offloading decision must be based upon the current context of the situation. Here context will refer to end device resources, network condition and fog node resources.

E. S*ervice Level agreement*

Offloading a computing task involves end device, fog node and cloud node. There should be some mechanism which ensures that no service level agreement violation during offloading.

VII. CONCLUSION

Fog computing allows shifting of resource-intensive tasks to the edge of the network by using computation offloading. It reduces energy consumption, latency and improves QoS and user experience. This paper has identified major components associated with computation offloading in fog computing which includes what, where, why, how and who will offload task to fog node. This paper is focusing on the use cases of computation offloading and the techniques used for the implementation of computation offloading in fog computing. Authors also identified variation parameters which were used by different authors for the evaluation of algorithms. There were several architectures proposed for fog computing but they were theoretical because fog computing is in the initial stage. With the emergence of IoT computation offloading gets momentum in research.

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A waste heat recovery in internal combustion engines using a novel absorption power cycle; thermodynamic analysis

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Abstract*— A novel absorption power cycle (APC) is proposed to recover the waste heat of exhaust gases from large-size internal combustion engines. The proposed cycle works with ammonia/water as the working fluid and the exhaust gases are assumed as the heat source in superheater and vapor generator. Based on the first law of thermodynamics, the effects of thermodynamics parameters on cycle performance are investigated. Thermal efficiency, net output work, turbine size, and cost of heat exchangers are the parameters that are examined here in this work. Results show that for typical working conditions, the thermal efficiency of the cycle increases by increasing the heating source temperature, the high pressure, and the rich solution ammonia mass fraction.

Index Terms— ***Waste heat recovery, Internal combustion engine, Absorption power cycle*.**

I. INTRODUCTION

In energy conversion and power generation systems, there are heat losses present in the process. Additionally, in recent years, environmental and energy problems using low-temperature heat sources are of great interest. Therefore, it is of major importance to find alternative ways to reduce these wastages or/and use that to generate power for other consumptions. For low-temperature sources, the heat cannot efficiently be converted to power with typical conversion systems such as the Rankine cycle (RC). Moreover, more attempts have been made to obtain new energy conversion systems such as the utilization of organic fluids in the RC[1, 2] and using binary mixtures or APCs like the Kalina cycle. In some studies, researchers compared the performance of these cycles to produce power from low-grade heat sources. For example, Shokati et al. [3] proposed a comparative analysis of Rankine and APCs from an exert economic viewpoint. They showed that the APCs had better first-low efficiency than the Rankine cycle.

Thus far, some studies have been conducted into energy conversion systems to improve their efficiency. Shu et al. [4] explored a theoretical analysis and comparison between the RC and different organic Rankine cycles (ORCs) to recover the waste heat from a specific large internal combustion engine. Avaritsioti [5] presented an analytic model to examine the environmental and economic benefits of car exhaust heat recovery. Singh used an absorption refrigeration system to enhance the performance of the Brayton-Rankine combined cycle power plants in Indian atmospheric conditions. Her absorption refrigeration cycle operated with the exhaust gas from the combined cycle to decrease the compressor inlet air temperature [6]. Chaiyat and Kiatsiriroat investigated a method to improve an ORC with reduction of the condenser temperature by combined cooling heating and power generation from an absorption system. They determined that the new system had higher efficiency than the normal ORC about 7%. From an environmental aspect, a new unit has a lower environmental impact than the normal unit, but in terms of the economic result, the modified system has a higher Levelized electricity cost than the ORC [7]. Cao et al, modeled and simulated an absorption cycle cooling system using waste heat in detail and validated it for shipboard application. They simulated

this system in a different climate and determined that in a hotter climate like Abu Dhabi, the fuel consumption and CO_2 emission were 68% less than those of the baseline [8].

Heat losses from the exhaust gas and other parts of the internal combustion engines contain almost 30-45% of the fuel energy. This is one of the low-grade heat sources which can be used to generate power for other parts of the vehicle. Furthermore, the temperature of the exhaust gases is high compared to the ambient temperature. On the other hand, even using this waste heat has environmental advantages. In other categories of these studies, researchers focused on the heat recovery in the internal combustion engines, even in a light-duty diesel engine. Briggs et al. [9] developed an ORC for a light-duty diesel engine, the peak brake thermal efficiency can be improved from 42.6% to 45%. To use the waste heat from the heavy-duty internal combustion engines, Wu et al. [10] offered a novel carbon dioxide transcritical power cycle combined with an absorption refrigeration cycle (CDTPC-ARC). They utilized the exhaust gas to drive the CDTPC to generate power, while ARC was driven by jacket water to provide coolant for CDTPC. Arias et al. [11] utilized RC with three strategies to recover waste heat in a hybrid vehicle to generate electric power. Three configurations of RC were considered: a cycle running with the exhaust gases, a cycle with the engine coolant system, and a combined exhaust-engine coolant system. To improve the efficiency of the oxyfuel internal combustion engines, Wu et al. [12] presented a novel concept of combining water injection processes. They directly injected water into the combustion chamber in an Otto cycle at the top dead center with different conditions. According to experimental results, thermal efficiency increases from 32.1% to 41.5% under appropriate test conditions. Yamada and Mohammad [13] proposed a new concept for a waste heat recovery sub-system for a hydrogen internal combustion engine (HICE). They used an open-cycle power generation system based on the RC utilizing exhaust water from HICE as the working flow. Their sub-system has two types of thermodynamic models: one with a condenser and one without a condenser. Their results showed that the modified system with a condenser had 2.9% to 3.7% higher overall thermal efficiency than the conventional HICE working without any recovery sub-system in the engine speed range of 1500 rpm to 4500 rpm. He et al. [14] proposed a combined thermodynamic cycle to enhance the fuel utilization efficiency and the performance of ICE. To recover waste heat from lubricant and exhaust gas, they exploited an ORC, and utilized Kalina cycle to recover waste heat from low-temperature cooling water. Turbocompounds technology is another way to recover waste heat from internal combustion engines. In this technology, exhaust gas is utilized to drive the turbine and produce power for compressor consumption to boost the engine, therefore, no direct extra power exists [15-18].

Maloney and Robertson are pioneers working on APCs [19]. These cycles are one of the most important thermodynamic cycles used to generate power from low-grade heat sources such as solar energy [20, 21] and ocean thermal energy [22, 23]. They used a cycle as a turbine between the generator and absorber in a typical ARC with removing the condenser and evaporator. They concluded that APC had no significant thermodynamic advantage over the steam RC[19]. Working fluid in this cycle One of the most popular APCs is the Kalina cycle [24] in which ammonia-water is used as working fluid in this cycle. Kalina concluded that his cycle had approximately 30-60% higher thermal efficiency than its comparable steam power cycle. Ibrahim and Klein [25] performed a comparison between the Kalina cycle and the Maloney and Robertson cycle with a maximum power cycle. KCS-11 is one of the Kalina cycle families under extensive investigation in comparison to others [26-29]. KCS-11 is similar to the Maloney and Robertson cycle. In this cycle, a mixer and a condenser are used instead of an absorber. Zhiwei et al. [30] explored advanced APCs, one double-effect APC, one half-effect APC and one ejector-combined APC, which were evaluated using KCS-11 as the basic cycle. They showed that each APC had its advantages and shortcomings in some aspects. Ammonia-water working flow in the Kalina cycle does not need a constant temperature for condensation and evaporation, with this specific, it can reduce the heat transfer irreversibility in an evaporator and condenser, resulting in improved performance. Vaclav et al. [31] have recently proposed an experimental rig to validate the APC concept.

More studies have been conducted into the power-cooling cycle to generate power and cooling [32-35]. However, ammonia-water solutions have a high operation pressure and some other weaknesses such as causticity and toxicity. Therefore, some attempts have been made to find better working fluids for the APCs [36-38].

As mentioned, owing to the importance of energy, most researchers focused on using the waste heat in energy conversion systems to generate power. This paper proposes a novel APC to utilize the waste heat in commercial vehicle engines and analyzes it from energy and economical viewpoints.

II. CYCLE DESCRIPTION

In internal combustion engines, a high percentage of fuel

energy has been wasted through exhaust gases. The temperature of these gases is around 400˚C to 600˚C in diesel engines and 600˚C to 900˚C in gasoline engines. To use this waste heat, Fig. 1 shows the recommended APC in which ammonia/water has been used as the working fluid. Based on the cycle schematic, to increase the thermal efficiency of the cycle, the heat of exhaust gases is used twice. The temperature of exhaust gases has been decreased from 450˚C (state 11) to 300˚C (state 12) to superheat the working fluid, and then the gases enter the vapor generator to vaporize ammonia/water, and its temperature reaches 130˚C. The rich solution enters the vapor generator with the mass fraction of XR at high pressure of cycle (state 3). After heating, during a constant pressure process, ammonia vapor with the mass fraction of XV (state 4) superheats to state 5 in a superheater and enters the turbine, and expands isentropically. During the expansion process, the pressure decreases to the condenser pressure (state 6), then enters the condenser to cool it and leaves it as saturated liquid (state 7). The percentage of the solution not vaporized in the vapor generator is called a weak solution that is the mass fraction of Xw, is discharged as saturated liquid (state 8), and gives heat to the Rich solution in the preheater. After decreasing the temperature of the weak solution (state 9), its pressure decreases by a throttle valve to the low pressure of the cycle (state 10). The weak solution (state 10) and ammonia vapor (state 7) enter the absorber and leave it as the rich solution (state 1), then they are pumped to the high pressure on saturation liquid line (state 2), and this cycle is repeated.

To analyze the APC with ammonia/water as the working fluid consisting of three different compositions of ammonia and water based on the mass fraction of ammonia in the mixture, and are the rich solution, ammonia vapor, and weak solution mass fraction, respectively. kg rich solution enters the vapor generator that produces kg ammonia vapor and kg weak solution as saturated liquid (Fig. 1). By applying the mass balance in the vapor generator, two relations are presented:

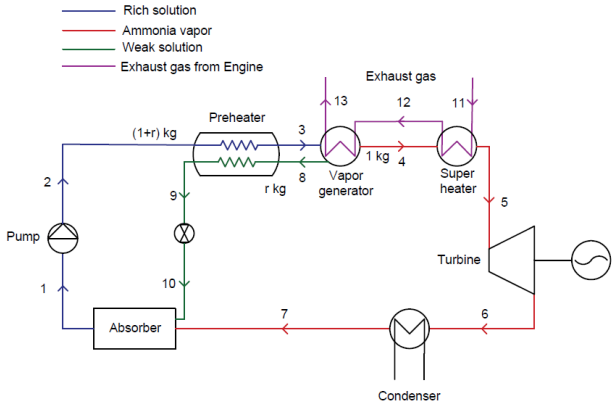

Fig. 1. Schematic of the APC

$$(1+r)X_R = X_V + rX_W \quad (1)$$

In this work, high pressure, low pressure, and the temperature of ammonia\water at the entrance of the superheater is $P_H = 20$ (bar), $P_L = 2$ (bar) $T_4 = 545$ (K), respectively.

Some assumptions have been considered:

1) The kinetic and potential energy are negligible.
2) The pressure drops and heat losses are ignored.
3) The extracted weak solution of the generator outlet is saturated.
4) The solution at the condenser and absorber is saturated

By applying the energy balance equation, the energy relation for each device can be found in Table 1.

Table 1: Energy relation for each device

Pump	$W_P = (1+r)\upsilon(P_H - P_L)$
Preheater	$m_1 h_2 + m_3 h_8 = m_1 h_3 + m_3 h_9$
Vapor generator	$m_g C_p (T_{12} - T_{13}) = m_2 h_4 + m_3 h_8 - m_1 h_3$
Superheater	$m_g C_p (T_{11} - T_{12}) = m_2 (h_5 - h_4)$
Turbine	$w_T = \eta_T m_2 (h_5 - h_6)$
Condenser	$Q_C = m_2 (h_6 - h_7)$
Net output work	$W_{net} = W_T - W_P$

To consider the cost of heat exchangers, the total heat transfer is defined as:

$$UA_{tot} = \frac{Q_{vg}}{\Delta T_{mvg}} + \frac{Q_{sh}}{\Delta T_{msh}} + \frac{Q_{ph}}{\Delta T_{mph}} \quad (2)$$

$$\Delta T_m = \frac{\Delta T_{\max} - \Delta T_{\min}}{Ln \frac{\Delta T_{\max}}{\Delta T_{\min}}} \quad (3)$$

Where ΔT_m is the logarithmic mean temperature difference, and $\Delta T_{\max}$ is the maximum temperature and $\Delta T_{\min}$ implies the minimum temperature at the end of each heat exchanger.

Since the turbine size is a significant factor in analysis of the power cycles, defined as:

$$SP = \frac{\sqrt{\upsilon_{2s}}}{\sqrt[4]{\Delta H_s}} \quad (4)$$

In which υ_{2s} is the volume exit and ΔH_s is the enthalpy drop across the turbine.

III. Results and Discussion

For the thermodynamic analysis of the proposed cycle, the simulation is done based on the working conditions which is shown in Table 2.

Table 2: Working conditions for the APC

Parameter	Value
High pressure of the cycle (bar)	20
Low pressure of the cycle (bar)	2
Exhaust gas temperature (˚C)	400
Exhaust gas mass flow rate of the engine (kg s^{-1})	0.07
Temperature of inlet ammonia water of superheater, T_4 (K)	545
Temperature of outlet exhaust gas of superheater, T_{12} (˚C)	200
Temperature of outlet exhaust gas of engine, T_{13} (˚C)	130
Rich solution mass fraction (%)	45
Rich solution mass flow rate (kg s^{-1})	2.8573
Ammonia vapor mass fraction (%)	72.86
Ammonia vapor mass flow rate (kg s^{-1})	1
Weak solution mass fraction (%)	0.30
Weak solution mass flow rate (kg s^{-1})	1.8573
Pump isentropic efficiency (%)	85
Turbine isentropic efficiency (%)	85
Specific heat capacity of exhaust gas (kJ kg^{-1} k^{-1})	1.108
Vapor mass fraction, q, at state points 1,2,8,7	0

Fig. 2 shows that increasing the heat source temperature leads to a slight increase in the thermal efficiency of the cycle. The reason is that when the heat source temperature increases, T_5, thus h_5 increases. The slight increase in thermal efficiency is due to the low mass flow rate of the exhaust gas.

Fig. 3 reveals that the thermal efficiency of the cycle increases when the high pressure of the cycle increases. The reason for this behavior is that when the high pressure of the cycle increases, T_4, T_5 thus h_4 and h_5 increases. Moreover, an enhancement in the turbine output work and the thermal efficiency is shown.

Fig. 4 shows the changes in the thermal efficiency of the APC in different rich solution mass fractions. It is shown that the thermal efficiency of the cycle increases when the rich solution mass fraction increases. This increase in thermal efficiency is owing to an increase in rich solution mass fraction, and the ammonia vapor mass fraction increases; therefore, the working fluid can receive more heat from the heat source, thus T_5, and thus, h_5 increase.

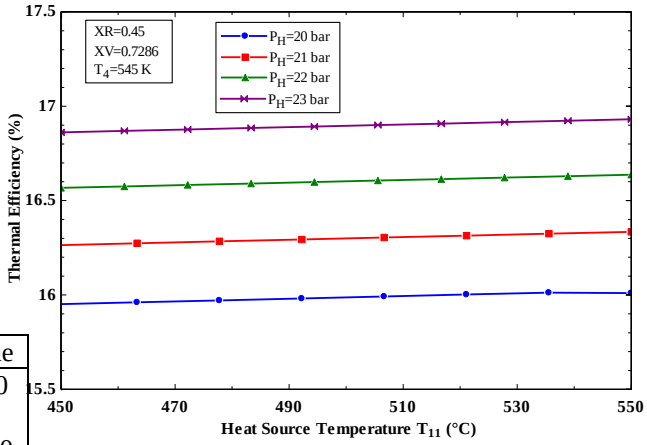

Fig. 2. Effect of heat source temperature on the thermal efficiency.

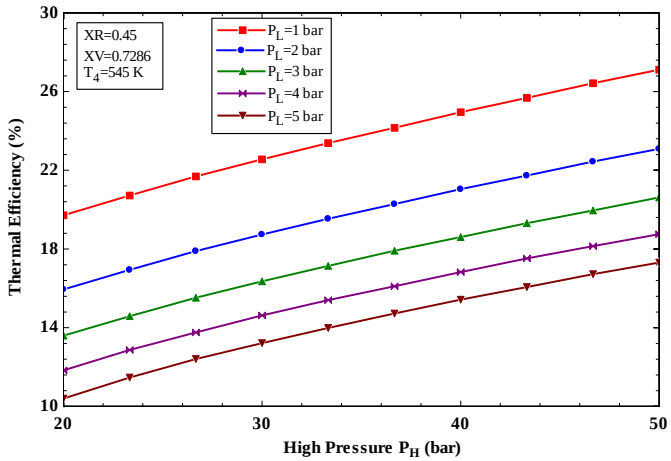

Fig. 3. Effect of high pressure on the thermal efficiency.

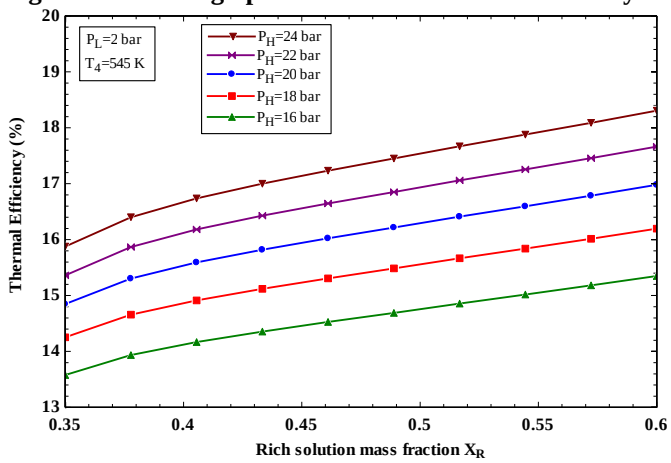

Fig. 4. Effect of rich solution mass fraction on the thermal efficiency.

From Fig. 5, it can be seen that when the heat source temperature increases, and the net output work of the cycle increases. The reason for this behavior is that heat source with the highest temperature can give more heat to the working fluid; therefore, this causes the highest temperature for T_5, h_5 and turbine work, but does not affect the pump work, thus net output work of the cycle enhances

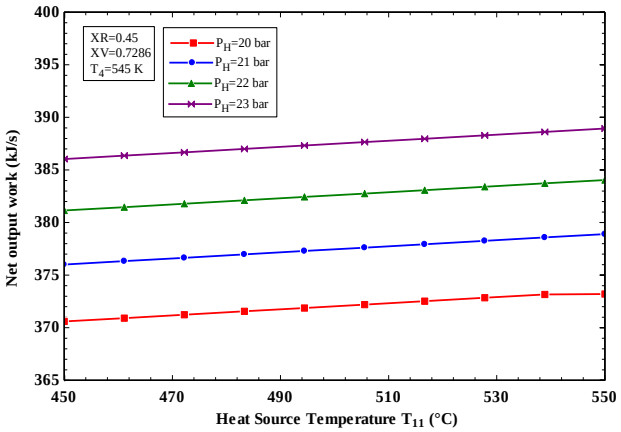

Fig. 5. Effect of heat source temperature on the net output work.

Fig. 6 demonstrates that augmenting in heat source temperature do not have effects on the turbine size. The reason for this behavior is that with changes in the heat source temperature, changes in isentropic enthalpy difference in the turbine are not tangible and due to equation (12), the factor of turbine size remains constant. However, for a specific heat source temperature, turbine size decreases with increasing in ammonia\water pressure in the turbine entrance. The cause of this decrease is that change in pressure has more effect than the heat source temperature on the isentropic enthalpy difference in the turbine. Fig. 7 clearly shows these changes in turbine size with an increase in the high pressure of the cycle.

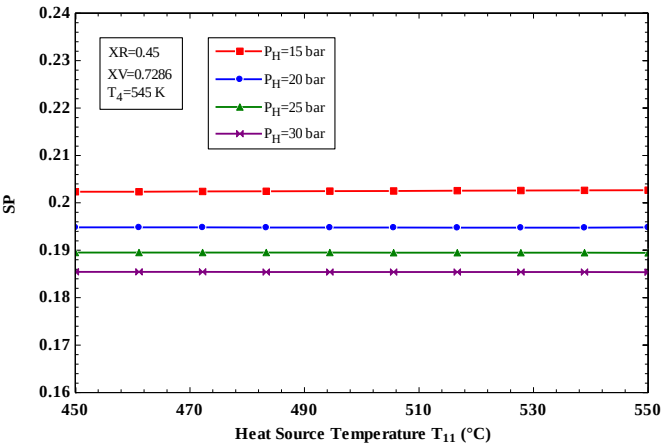

Fig. 6. Effect of heat source temperature on the factor of turbine size.

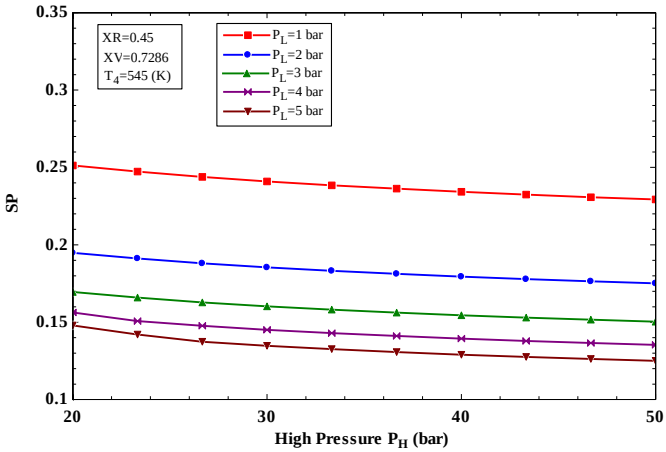

Fig. 7. Effect of high pressure of cycle on the factor of turbine size.

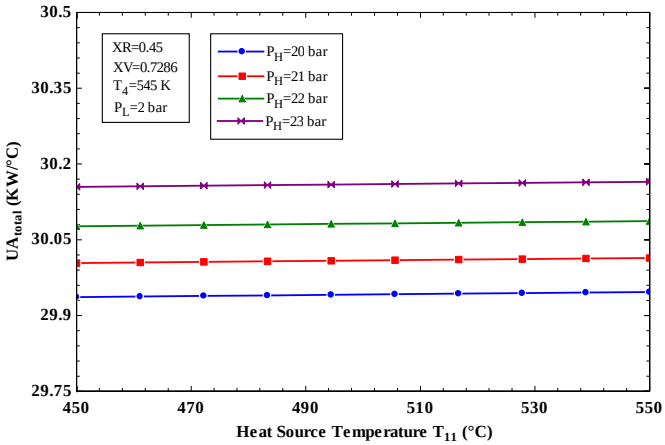

Fig. 8. Effect of heat source temperature on the total heat transfer.

One of the important parameters in power cycle evaluation is the cost of heat exchangers that should also be considered. Economically, utilize of the heat exchanger with a small size is more commodious than the large-sized heat exchangers. As the results in Fig. 8 show, total heat transfer remains constant with changes in the heat source temperature. This is because for the typical working condition, when the temperature of the exhaust gas increases, the parameters in the calculation of total heat transfer almost does not change. Assuming that the temperature of exhaust gas is constant, total heat transfer increases when the high pressure of the cycle increases. That's because the changes in enthalpy of the state of the cycle are more with changes in pressure. So, with augmenting in the high pressure of the cycle, the enthalpy of the state increases, and the heat transfers in heat exchangers increase.

Table 3: Performance of the APC

Parameter	Value
Turbine work (kJ s^{-1})	376.8
Pump work (kJ s^{-1})	7.69
Net-work (kJ s^{-1})	369.11
Size factor of the turbine, SP	0.19
Total heat transfer requirement, UA_{tot} (KW K^{-1})	29.93
Thermal efficiency (%)	15.92

CONCLUSION

In this paper, an APC was proposed to recover the waste heat energy by the exhaust gases from the internal combustion engines utilized in commercial vehicles. This cycle was analyzed from energy and economical viewpoints based on a typical working condition. Thermal efficiency, net output work, turbine size, and the cost of heat exchangers are parameters that were investigated, and the main conclusions are summarized as follows:

1) The thermal efficiency of the APC on the typical working condition is 15.92% that is a high-efficiency rate for this work.

2) The thermal efficiency of this cycle increases as the heating source temperature, the high pressure, and the rich solution ammonia mass fraction increase.

3) The net output work of the proposed power cycle in the assumed working conditions is 369.11 (kJ s-1) and improves with an increase in heat source temperature.

4) Improvement in heat source temperature does not affect turbine size due to the changes in enthalpy drop in the turbine, which is negligible with changing exhaust gas temperature.

5) Total heat transfer and the cost of heat exchangers remain constant with enhancing the heat source temperature. But, because of the effect of the pressure on the enthalpy of the ammonia/water, the cost of heat exchangers increases with an increase in the high pressure of the cycle.

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Non-Linear Oberbeck Electroconvection In A Chiral Fluid Flowing In A Vertical Channel With Permiable Boundaries

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Abstract: Flow response of the chiral fluid confined in a vertical channel bounded by the permeable rigid boundaries is investigated in the presence of transverse magnetic field and applied electric field. The conservation of momentum, energy equation combined with Maxwell, equations are used in developing the model. The nonlinear coupled momentum and energy equations are solved analytically using a regular perturbation method and numerically using finite difference method. The effect of various dimensionless parameter W_{emt}electromagnetic thermal number,W_{em} electromagnetic number ,G_rGrashof number , W_eElectric number , N buoyancy parameter and chirality parameter γ on velocity and temperature distributions are computed and depicted graphically.

1.0 INTRODUCTION

In recent years, there has been an immense growth in new materials with a wide variety of properties and characteristics which include. nanomaterials, smart materials, biomaterials, nano-composites, metamaterials, liquid crystals and stimuli responsive polymers, chiral materials, chiral polymers, etc., by an appropriate combination and processing of these materials, a very wide range of desired material characteristics can be obtained and are being used for specific applications.

Molecules or objects that are not super imposable on its mirror image are regardedas chiral. Materials composed of chiral molecules or chiral inclusions are regarded as chiral materials.

Fluids such as sugar solution, sugar cane juice, turpentine, proteins, nutrients amino acids,carbohydrates, glucose, body fluids and so on chiral. Chiral materials are electromagnetically activematerials; these materials have ability to rotate electromagnetic waves or polarized light to a desiredangle depending on orientation of the molecules or inclusions and the length of the medium. In recentyears considerable attention has been given on the study of the effect of the chirality of the moleculesor inclusions on the propagation electromagnetic waves through the chiral fluid confined in a channelbounded by the rigid boundaries in the presence electromagnetic field [1]-[4]. Further in literatureflow response of fluids such as magneto rheological fluid, Ferro fluid, nano fluids, electrically poorlyconducting fluids confined in a horizontal/vertical channel bounded by rigid boundaries maintained atdifferent temperature in the presence of

electromagnetic fields were studied by determining thevelocity and temperature distribution between the rigid boundaries [5]-[8]. But in literature much attention has not been given to study the flow response of a chiral fluid confined in a channel in thepresence of applied electric field in spite of its importance in many practical applications such inself – assembly, the optimum arrangement of charged molecules in nano-technological and nano-biotechnological applications, in the development of biomaterials for artificial organs and bio-interface materials based on chiral polymers, in development of radar absorbing materials,and in magnetic/electromagnetic targeted drug delivery using micro and nano fluidics since aboutmore than half of the drug currently in use are chiral compounds, and so on [9]-[12]. Thus, in thispresent paper it is intent to study the flow response of chiral fluid confined in a vertical channel inbounded by rigid bounder maintained at the different temperature in the presence of the appliedelectric and magnetic fields at the boundaries by depicting velocity and temperature distributions with suitableconclusions.

2. MATHEMATICAL FORMULATION:

The physical configuration considered in this paper consists of a chiral fluid confined in an infinite vertical channel bounded on both sides by the rigid isothermal plates embedded with electrodes located y=±b at different temperatures with x-axis in the axial direction and y-axis perpendicular to the plates. T_1 and T_2 respectively denote the temperature of the hotter and the cooler plates. An electric field $\vec{E}$ and a transverse static magnetic field B is applied by maintaining an electric potential of $\varphi = Vx/b$ at cooler plate and $\varphi = V(x - x_0)/b$ at hotter plate. The velocity of the fluid 'u' is considered in the x-direction. The difference in temperature in the presence of electromagnetic field accelerates the charged particles in the direction of the field which results in the motion of charged particles producing a convection electric current $\rho_e \vec{q}$ ($\vec{q}$ velocity of fluid particles) and displacement current. For mathematical formulation, a two-dimensional motion is considered with the x-axis along the vertical direction and the y-axis normal to it. Then the required basic equations governing the flow of a Boussinesq incompressible chiral fluid in a chosen physical configuration are:

Continuity equation:

$$\nabla \cdot \vec{q} = 0 \qquad (1)$$

Equation of state

$$\rho = \rho_0 \left(1 - \alpha \left(T - T_0\right)\right), \qquad (2)$$

Momentum equation

$$\rho_0 \left(\frac{\partial \vec{q}}{\partial t} + \left(\vec{q} \cdot \nabla\right)\vec{q} \right) = -\nabla p + \rho \vec{g} + \mu_f \nabla^2 \vec{q} + \rho_e \vec{E} \qquad (3)$$

Energy equation

$$\rho_0 c_p \left(\frac{\partial T}{\partial t} + \left(\vec{q} \cdot \nabla\right) T \right) = K \nabla^2 T + \mu_f \left(\nabla \vec{q}\right)^2 \qquad (4)$$

Conservation of charges

$$\frac{\partial \rho_e}{\partial t} + \nabla \cdot \vec{J} = 0 \qquad (5)$$

where $\vec{J} = \sigma \vec{E} + \rho_e \vec{q} + \frac{\partial \vec{D}}{\partial t}$ the current density and

Maxwell's equations

$$\nabla \vec{E} = -\nabla \phi, \quad \nabla \cdot \vec{E} = \frac{\rho_e}{\varepsilon} \qquad (6a,b)$$

In chiral materials, the electric field and magnetic field are cross coupled, so the electromagnetic for chiral materials assuming time harmonic fields are [1]-[4]:

$$\vec{D} = \varepsilon \vec{E} + i\gamma \vec{B}, \quad \vec{B} = \mu \vec{H} - i\gamma\mu \vec{E} \qquad (7a,b)$$

The above equations are simplified using following thermo electromechanical assumptions:

i) A Chiral fluid is considered as incompressible Boussinesq, a fully developed

unidirectional steady flow is assumed in x-direction.

ii) The hydrostatically balanced flow is assumed in the x-direction. Therefore $-\partial p/\partial x - \rho_0 g = 0$

iii) Electric current approximation: In chiral fluids like sugar solution, turpentine, and body fluid, etc. have low relaxation time where the convection electric current $\rho_e \vec{q}$ (caused by the fluid velocity $\vec{q}$) dominates over displacement current and conduction current. Therefore, in the present paper only convection electric current density ($J = \rho_e \vec{q}$) is considered whereas the conduction current and displacement current is neglected [4],[13].

iv) The gravity acts vertically downwards.

Then simplified equations governing flow of a Boussinesq incompressible chiral fluid confined in a vertical channel in the presence of applied electric field are:

$$\nu \frac{\partial^2 u}{\partial y^2} + g\beta_T (T - T_0) + \vec{J} \times \vec{B} + \frac{\rho_e E_x}{\rho_0} = 0 \qquad (8)$$

$$\kappa \frac{\partial^2 T}{\partial y^2} + \frac{\nu}{C_p}\left(\frac{\partial u}{\partial y}\right)^2 = 0 \qquad (9)$$

Equations (8) and (9) are nondimensionalized using dimensionless quantities $y^* = y/b$ for length, $u^* = \left(\nu / g\beta b^2 \Delta T\right) u$ for velocity, $\theta = \left(T - T_0\right)/\Delta T$, $\Delta T = T_1 - T_0$ for temperature, $\rho_e^* = \rho_e b^2 / \varepsilon V$, for charge density, $E^* = bE/V$ for electric field and the nondimensionalized form of equations (8) and (9) are:

$$\frac{\partial^2 u^*}{\partial y^{*2}} - \mathrm{Re}\frac{\partial u^*}{\partial y^*} + \theta + \frac{\rho_e^* W_{em}}{\rho_0}\left(1 - \eta\gamma\right) + \frac{\rho_e^* E_x W_e}{\rho_0} = 0 \qquad (10)$$

$$\frac{\partial^2 \theta^*}{\partial y^{*2}} - Pe\frac{\partial \theta^*}{\partial y^*} + N\left(\frac{\partial u^*}{\partial y^*}\right)^2 = 0 \qquad (11)$$

where the dimensionless quantities are represented by asterisks (*), $W_e = \varepsilon V^2 / \rho_0 g \beta_T \Delta T b^3$ is the Electric number [8] $W_{emt} = \dfrac{W_{em} R_e^2}{Gr}$ is electromagnetic thermal number $W_{em} = \dfrac{\varepsilon_0 V \mu_m H_0}{b\rho_0 \nu_0}$ is electromagnetic number $N = \rho_0 g^2 \beta^2 \left(T_1 - T_0\right) b^4 / K\nu$, is the buoyancy parameter and $R_e = \dfrac{v_0 b}{\nu}$, $P_e = \dfrac{v_0 b}{\kappa}$ are sectional Renolyds number and Peclet number respectively [8,14].

3. BOUNDARY CONDITIONS:

The governing equations governing the response of a chiral fluid in a vertical channel in the presence of the applied electric field are solved analytically and numerically using following boundary conditions:

The no-slip conditions on velocity

$$u = 0 \ \ at \ \ y = \pm 1, \qquad (12)$$

Isothermal conditions on temperature

$$\theta = 1 \ at \ y = 1, \ \theta = -1 \ at \ y = -1 \qquad (13)$$

and for potential difference [8&13] $\varphi = x$ at $y = 1$, $\varphi = x - x_0$ at $y = -1$ (14)

4. ELECTRIC CHARGE DENSITY AND POTENTIAL DIFFERENCE:

In a chiral fluid with low electrical conductivity Electric charge density ρ_e is assumed to be decreases continuously between the hotter plate to the cooler plate and takes the form:

$$\rho_e = -\rho_{e0} e^{-\alpha y} \qquad (15)$$

Using Eqs (6a) and (15) in (6b) making the equation dimensionless following equation is obtained:

$$\frac{d^2\varphi}{dx^2} + \frac{d^2\varphi}{dy^2} + \rho_{e0} e^{-\alpha y} = 0 \qquad (16)$$

solution of Eqn(16) satisfying the boundary conditions for potential difference Eqn (14) is

$$\phi(x,y) = x - \frac{x_0}{2}(1-y) + \frac{\left(e^{-\alpha} - e^{\alpha}\right)}{2\alpha^2} + \frac{2e^{y\alpha} + e^{\alpha y} - e^{\alpha} y}{2\alpha^2}$$

(17)

from Eqs. (6a), and (17) the electric field in the x direction is given by

$Ex = -1$ (18)

Then expression for the electric force $\rho_e E_x$ is obtained by Eqn (15) and Eqn (18) is

$$\rho_e E_x = \rho_{e0} e^{\alpha y} \qquad (19)$$

5. ANALYTICAL SOLUTION:

Equations (10) & (11) are the coupled non-linear momentum and energy equations. Analytical solutions of which are obtained using regular perturbation technique with buoyancy parameter N (<<1) as perturbation parameter. In this technique, dimensionless velocity in x-direction u and dimensionless temperature θ are computed in the series.

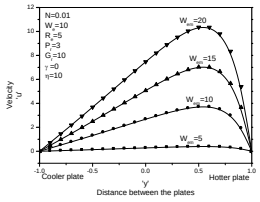

Figure .1 Depiction of velocity distribution for various values of Wem

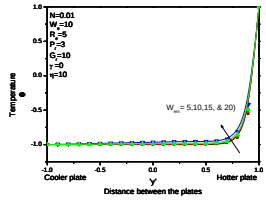

Figure. 2 Depictionof temperature distribution for various values of Wem

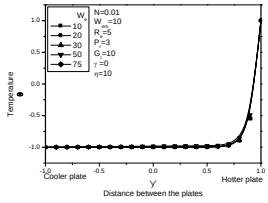

Figure .3 Depiction of velocity distribution for various values of We

6. NUMERICAL SOLUTIONS:

The numerical solutionof Eqs (10) and (11) using the Finite Difference Technique and compared with the analytical solution obtained in section 3.

The solutions of Eq. (10) and (11) are computed for various values of the dimensionless parameters and the results are depicted graphically along with the analytical results and suitable conclusions are drawn in the final section.

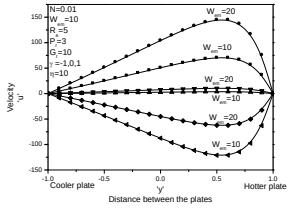

Figure .4 Depiction of temperature distribution for various values of We.

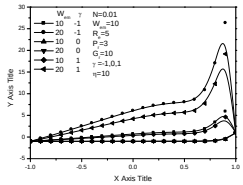

Figure .5 Depiction of effect of chirality parameter of the fluid (γ =0,1,-1) on temperature distribution for various values of Wem.

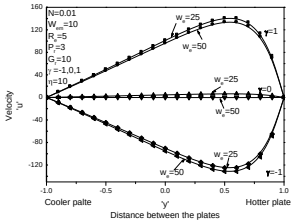

Figure .6 Depiction of effect of chirality parameter of the fluid (γ =0, 1,- 1) on velocity distribution for various values of *We*.

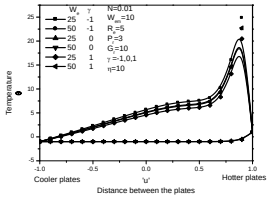

Figure .7 Depiction of effect of chirality parameter of the fluid (γ =0,1,-1) on Temperate distribution for various values of We.

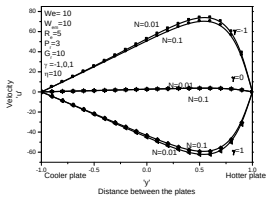

Figure .8 Depiction of effect of chirality parameter of the fluid (γ =0,1,-1) on velocity distribution for various values of N.

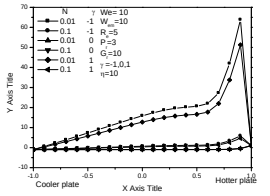

Figure .9 Depiction of effect of chirality parameter of the fluid (γ =0,1,-1) on temperature distribution for various values of N.

7. RESULTS AND DISCUSSION:

The velocity profile for various values of Wem (We=5,10,15,20) when N = 0.01, Re = 5, Pr=3, We =10 Gr=10, α =0.1 and η =10 is plotted in Figure .1. From this Figure, it is found that the effect of an increase in the value of Wem is to increase the velocity distribution. This implies that the of the transverse magnetic field interacts with the free charges in chiral fluid producing the convective current $\rho_e \vec{q}$ which augment convection in a chiral fluid. Physically this is attributed to the fact that, in a chiral fluids layer in the presence of temperature gradient and electromagnetic field, the fluid molecules or particles are accelerated in a rotary path or along a loop, which intern generates the electric current. The direction of current depends upon the chirality of molecules or particles. This current interact with the electromagnetic field generates an electromagnetic force which augments convection which in turn creates a small-scale turbulence in a chiral fluid layer.

The temperature distribution for various values of Wem (We=5,10,15,20) when N = 0.01, Re = 5, Pr=3, We =10 Gr=10, α =0.1 and η =10 is plotted in Figure. 2. From this plot, it is clear that the effect of magnetic force term has a negligible effect on temperature distribution.

Figure .3 and Figure .4 depicts the velocity andtemperature distributions for various values of We (We =10, 20, 30, 50, & 75) when N=0.01, α =0.1, η =10, Re=5, Pr=3, Gr =10, Wem=10. Figure .3 shows that with the increase in the value of electric force term We velocity distribution decreases, i.e. the resistance to the flow of a chiral fluid increase. By proper selection of the value of the electric potential difference between the plates, it is possible to control the flow of a chiral fluid with this chosen physical configuration. Whereas the Figure .4shows that electric force term has a negligible effect on the temperature distribution.

Figure .4 and Figure .5 Depicts the effect of chirality parameter of a fluid (γ =0, 1,-1) on velocity and temperature distributions for various values of Wem when N=0.01, α =0.1, Re=5, Pr=3, Gr =10, We=10, η =10. In figure .4 velocity is plotted against the distance between the plates. From the plot, it is clear that with an increase in *Wem* velocity distribution increases when γ =-1 and reversal of velocity distribution occur with a change in the value of

γ from -1 to 1. This flow reversal is due to the change in the orientation of the molecules or fluid particles which lead to the change in the direction of the electromagnetic force. Whereas the Figure .5, depict the temperature distribution in a chiral fluid layer, from this figure, the temperature distribution increases with increase in Wem, this increases in minimal when γ =1 compared to γ =-1.

Figure .6 and Figure .7 shows the velocity and temperature distributions for various values of We (We = 25 & 75) when N=0.01, α =0.1, Re=5, Pr=3, G= =10, Wem=10. Figure .6 shows that as the We increase the velocity distribution decrease. Figure .7 shows that with an increase in We the temperature distribution increases, this increase is higher for when γ =-1 compared to γ =1.

Figure .8 and Figure .9 depict the effect of chirality parameter of the fluid on velocity distribution and temperature distribution respectively for various values of N (N=0.01 and 0.1) when We=10, α =0.1, Re=5, Pr=3, G= =10, Wem=10. From these Figures, it is clear that the variation in velocity and temperature distribution with N is very minimal.

The flow response a chiral fluid flowing in a vertical channel bounded by permeable boundaries was studied in the presence of the applied transverse magnetic field and the applied electric field the temperature gradient. Bothe the magnetic force term $\vec{J} \times \vec{B}$ and the electric force $\rho_e \vec{E}$ effect was considered in the conservation of the momentum equation.

In this present work, it is concluded that resistance to the flow of a chiral fluid decreases with increase in *Wem* and, resistance to the flow of chiral fluid increases with increase in *We.*Variation in temperature distribution between plates is minimal with an increase in *Wem* and *We*. Flow reversal occurs with a change in the value of chirality from γ =-1 to γ =1. The temperature distribution is maximum when γ =-1 and minimal when γ =1.

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Review on Dialect Analysis

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***Abstract*—**Human communication system is a complex system. Communication signal generated by humans demonstrates variations due to acoustic effect, dialect and accent. Dialect and accent are two different yet closely coupled aspects of a spoken language. Dialect is much more expansive, composite and important feature of language than accent. Dialect basically represents specific form of a spoken language that has regional or social impact. Accent on the other hand represents style of language pronunciation. Dialect analysis involves study of phonetic and/or acoustic features of human speech signal. Dialect analysis plays crucial role in different domains of speech-based applications. Few to mention but not limited to are business, health-care, education, remote access, security, recognition systems etc. Phonotactic and spectral approaches are being used for dialect and accent recognition. Different feature extraction and modeling techniques are available to perform recognition task effectively. Due to advancement in speech technology lots of recognition studies are available covering language, speaker and emotion recognition etc. Among them dialect recognition studies are limited. In turn there are very less attempts for specific dialect of respective language. Such dialectal studies are carried out based on language resources. Extent of availability of language resources makes it either low resourced or high resourced language. This paper is organized around four different languages such as Arabic, Chinese, Spanish and Hindi, their experimental and key observations, performance aspects, challenges/opportunities to perform recognition.

Keywords— dialect, recognition, low and high resource languages

I. INTRODUCTION

Dialect can be recognized by different features of speaker. It includes phonemes, pronunciation, and traits such as tonality, loudness, and nasality. If dialect is identified accurately it helps improve certain applications and related services. Working on dialect identification is more difficult than just recognizing a specific language or speech.Dialect recognition system is composed of segmentation, feature extraction and modeling [1]. Based on extent at which language resources are available languages are termed as low-resourced (under resourced) languages and high resourced (rich resourced)languages. Resources include web appearance of language, linguistic knowledge, text transcriptions and acoustic speech corpora, articulation lexica and morphology etc. [2]. With machine learning identification of under resourced language is a very difficult [3]. Majority of Indian languages such as Tamil, Telugu, and Gujarati [4] are a low resourced language. Marathi is also one such regional language falling under category of under resourced language having limited linguistic resources. [5]. Building speech dataset/corpus is challenging and sometime infeasible task when working with under resourced languages [6]. Performance of well known and most prominent Mel Frequency Cepstral Coefficient (MFCC) and Dynamic Time Wrapping (DTW)feature extraction techniques are also not satisfactory for low resourced languages in comparison with high resourced languages [7].

Dialectology initially evolved as a classificatory discipline. It mainly focuses on the speech patterns of the most conservative speakers. Basic concepts of dialectology include:

- ✓ *Mutual intelligibility*

With mutual intelligibility language and dialect can be differentiated. Mutual intelligibility is act as a criterion that may specify in psychologically relevant way whether two languages are similar or not. Dialects of the same language should be mutually intelligible, and is not applicable for dialect of different languages. In simple words, mutual intelligibility gives reflection of the similarities between different varieties of speech. Mutual intelligibility is an overall criterion that may tell us in a psychologically relevant way whether two languages are similar/close. Mutual intelligibility is an overall criterion that may tell us in a psychologically relevant way whether two languages are similar/close.

- ✓ *Diglossia*

The term diglossia was first used in English by linguist Charles Ferguson in 1959. In sociolinguistics, diglossia can be described as a condition where, within the same speech community people speak two different varieties of a language.

- ✓ *Dialect continua*

A dialect continuum is also known as dialect chain or dialect area. It is growth of language varieties spoken across some geographical area. In these neighboring varieties differs to some extent, however the differences accumulate over distance. Such widely separated varieties may not be mutually intelligible.

- ✓ *Pluricentrism*

A single genetic language that has two or more standard forms is known as a pluricentric language. Example languages are Hindustani with two forms of Urdu and Hindi, another Dutch language with two forms including Netherlandic Dutch and Belgian Dutch.

- ✓ *Dialectleveling*

Dialect levelling is a process where local features are replaced by others with a wider geographical currency. In a given spoken language, dialect levelling leads to reduced structural differences among dialects. In terms of dialect characterization, levelling is a nuisance variable that adversely affects recognition accuracy: the more similar two dialects are, the harder it is to set them apart.

Theory of voice identification is based on fact that every voice has individual features which distinguish it from other. Dialect based system has huge scope in broad range of applications [8]. Dialect identification of a language is almost treated same as language identification. Dialect recognition is an emergent research area in the speech technology due to fact that dialect is one of the most important factors after gender recognition and emotion recognition. Dialect certainly makes impact on speech recognition performance [9]. Here most important is to understand and then model each and every variation in spoken language [10].

Through this review we aim to present recent work done in dialect identification system, their performance measures, limitations and challenges as a part of future work.Paper organized as follows section II presents basics of language recognition, section III gives overview of speech corpus, section IV to VII presents Arabic, Chinese, Spanish and Hindi language-based aspects of dialect recognition respectively. This study focuses on presenting recent studies in these low resource languages, their major dialects, experimental observation in recent years, some key observations and future scope.

II. MODELING TECHNIQUES

In language recognition, the phonotactic and acoustic approaches are the most effective approaches. Thus, these have received the most attention from researchers. Automatic speech recognition system adopts different contextual and linguistic features to perform recognition of regional language dialects. It helps to improve performance of recognition. Additionally, dialect identification provides the origin and ethnicity features of native speaker that becomes useful in identifying the regional speaker identification. From [10], Spectral and phonetic approaches for dialect identification are represented below:

- ✓ *Spectralmodeling*

The spectral modeling approach for dialect and accent recognition is based on the assumption that dialects or accents differentiate in terms of their acoustic features. In addition lexical features from transcripts of the speech data can also provide significant evidence of a speaker's accent type.The maximum likelihood during recognition can be representedas

$$\arg\max_{i} \pi\, P(FVt \mid TDi)$$

FV_t is feature vector at frame t, TD_i is target dialect i, P ($PH|TD_i$) is a conditional probability of occurrence of FVt given TD_i and T is the total no of frames.

- ✓ *Phonetic modeling*

The phonotactic approach is motivated by the belief that a spoken language can be characterized by its lexical–phonological constraints. The phonotactic approach in dialect and accent recognition is based on the assumption that dialects or accents differ in their phone sequence distributions. Phonotactic-based approaches have been the baseline system of some new conducted research in dialect and accent recognition area .A simple method to deal with accent problem is to build multiple models of smaller accent variance and then use model selector for adaption. Here recognition problem can be representedas

$$\arg\max_{i} P(PH \mid TDi)$$

Where; PH is sequence of phonemes, TD_i is target dialect i and P ($PH|TD_i$) is a conditional probability of occurrence of PH given TD_i.

III. SPEECH CORPUS

Dialects are always spoken rather than written/textual varieties. Development of Automatic speech recognition system requires adequateamounts of dialectal speech

data[11]. To train sucha spoken languagesystem, language specific and good quality, properly annoted speech data corpus is needed. In order to consider intra language variability such as speaker, content, recording device, communication channel, and background noise, it is desirable to have sufficient data demonstratingintra-language variation effects [12]. Most of corpus for English is available additionally languages such as Arabic, Spanish, French, Russian, Japanese, German, Korean, Bulgarian, Farsi, Portuguese, Hindi, Tamil, are also available. TABLE I below gives details of well-known Indian language corpus and TABLE II present characteristics for non-Indian languages identified from literature.

TABLE I
INDIAN LANGUAGE CORPUS

Sr. No	Database	Speaker count	Language
1	TIFR &IIT Bombay	1500	Marathi
2	Marathi Speech Data-ASR	1500	Marathi
3	LDC-IL	650	Hindi
4	IIIT Hyderabad and HP Laboratoris , Bangalore	559	Marathi, Tamil & Telugu
5	KIIT, Bhubaneswar	200	Hindi & Indian Spoken English
6	TIFR and C-DAC	100	Hindi
7	IIIT Hyderabad	96	Telugu
8	IIT Kharagpur	92	Hindi, Telugu, Tamil, & Kannada

TABLE II

SPEECH CORPUS CHARACTERISTICS FOR NON-INDIAN LANGUAGES

Sr. No	Database	Speaker count	Language
1	MACROPHONE SRI under LDC sponsorship.	5,000	English
2	PhoneBook: NYNEX Isolated Words	1,358	English
3	TIMIT Acoustic-Phonetic Continuous Speech Corpus	630 each reading 10 sentences	
4	NTIMIT	630	English
5	Switchboard-1 Release 2	543, 2400 conversations	English
6	TDIGITS, Texas Instruments, Inc. (TI)	326, each reading 77-digit sequences	English
7	Miami	84	Spanish-English bilingual speech
8	CALLFRIEND Korean	60 telephone conversation	Korean
9	OGI Multilanguage Corpus	Not known	Multilingual

There are different software's available which are used to record the speech of humans [13]. Dialectological corpus is an efficient means to store, preserve and examine dialect data. Dialect speech data is very scarce [14] there are only a few good qualityannotated audio datasets available.

IV. ARABAIC DIALECT RECOGNITION

Arabic is a composite language. Being composite it acts as a challenge for natural language processing respective applications[15]. Arabic language has different dialects. Egyptian is most widely spoken Arabic dialect after MSA (Modern Standard Arabic). Gulf also known as Peninsular is closest to MSA however MSA is the most widely studied dialect. From review it is found that there have been several studies published on MSA being a formal written standard of language. However, there are other informal Arabic dialects those are Maghrebi, Gulf, Iraqi, Levantine and Egyptian. These Arabic dialects differ substantially from MSA. PRLM approach to language identification proposed by Zissman in 1996 proven to be successful, an extension to this; as a first attempt to analyze effectiveness of phonetic approach in automatically identifying the colloquial Arabic dialect of Gulf, Iraqi, Levantine, Egyptian and MSA (Modern standard Arabic) parallel PRIM was used with effective overall accuracy of 81.60%. This study employed different classifiers such as logistic regression, SVM and neural network. Among all logistic regression classifier came out as superior to rest [1]. As a first attempt based on prosodic information study of recognition of Algerian Arabic dialects was carried out with machine learning technique. Prosodic information used was intonation and rhythm. SVM binary classifier used for modeling with satisfied results. However, to handle discriminative features

such as nasalization, allophones; information from acoustic and prosodic level can be used [16]. Another study presentedapplication of different machine-learning algorithms such as logistic regression, Naive Bayes, neural networks, and Support Vector Machines (SVM) using linear and string kernels at word level and character level features. SVM classifier with a linear kernel had proven to be finest model. [17]. One another approach of machine learning algorithm using three ensemble methods of plurality, median probability, and mean probability ensemble was identified. Study was carried out for Egyptian, Gulf, Levantine, and North African regional Arabic dialects. Mean Probability Ensemble system outperform the rest ensemble methods[18]. In a dialectal study of Gulf, Egyptian, Levantine, North African and Modern Standard Arabic (MSA)dialects; Support Vector Machines (SVMs), Logistic Regression (LR) and Convolution Neural Networks (CNNs) used as model building classifier. System accuracy for system combination was approximately 73% [19]. Deep learning tool have proven to be very effective in processing social media dialectal text. CNN, LSTM, Bi-directions LSTM, and Convolution LSTM deep neural networks were used. For Egyptian and Gulf BLSTM performed well. For LevantineLSTM offered best accuracy [20]. Study of Arabic dialect identification based on probabilistic-phonetic modeling obtained classification rate of 93% [21]. Use of a Multinomial Bayes classifier for word and character n-grams with the language model probabilities macro accuracy score of 67.73% is achieved [15]. In one of the recent Arabic dialectal studies, use of X-vector presented potential results. The performance improvement of 0.697 achieved when combined with i-vectors, bottleneck features, and word uni-grams. Study concluded X-vectors superior over i-vectors [22]. TABLE III below presents findings of Arabic dialect recognition.

TABLE III
FINDINGS FROM LITERATURE OF ARABIC DIALECT RECOGNITION

Major dialects	Major studies are with MSA as standard formal dialect and Maghrebi (Western Arabic), Gulf (Peninsular), Iraqi, Levantine, Egyptian (Masri or Masry) as informal dialects of Arab
Limitation	Arabic dialect identification with short messages may often be impossible. [21][22]
Future scope	Future studies with powerful recurrent neural networks can be carried out over word and character to properly capture the proper differences between the dialects [17]
	To identify different techniques that can directly map the raw acoustic waveform to the respective language dialect. [19].
	To study effect of adding dialectal data of social media sources during the model building to improve the system [19]
	Arabic dialects have become increasingly noticeable as informal communication language on the web. Use of deep learning tool can be effective in processing such social media dialectal data [20]

V. CHINESE DIALECT RECOGNITION

Chinese language is tone rich language. It has eight major dialect groups. Mandarin Chinese is the most widely spoken regional language in the world. Main dialects of Chinese language are Mandarin and Cantonese. In the study of the identification of three Chinese dialects, Mandarin, Cantonese and Shanghainese using Gaussian Mixture Modeling (GMM) with the combination of pitch flux features and MFCC features the error rate is reduced by more than 30%, compared with those using MFCC feature stream only [24]. In a study of semi-supervised learning based Chinese dialect identification, labeled and unlabeled samples used to train the discriminative classification. Feature based performance for phonetic was 91.6%, prosodic 68.2% and with fusion it was 93.5%. Classifier based accuracy was 92.2% with GMM and 93.5% with SVM [25]. An approach to dialect recognition presented with an assumption that particular phones are treated differently across dialects. Study of target-aware lattice rescoring concluded that the accuracy of the dialect recognition is improved by rescoring lattice with dialect-dependent language models [26]. Variations to supervector pre-processing for phone recognition–support vector machines-based dialect, dialect salience measure used in supervector dimension selection and compared to a common N-gram frequency-based selection. The results identified a strong association between dialect-salience and frequency of occurrence in N-grams [27]. In a unique study, two representative disorders of speech production are investigated: dysphonia and aphasia. Automatic Speech Recognition (ASR) experiments are carried out with continuous and spontaneous speech utterances from Cantonese-speaking patients. The results present feasibility and potential of using natural speech for acoustical measure of voice and speech disorders, and gives the challenging issues in acoustic modeling and language modeling of pathological speech [28]. In one of the studies, two types of unsupervised deep learning methods used. An unsupervised bottleneck feature extraction solution with no secondary transcribed data and two types of latent variable learning algorithms based on generative autoencoder model were introduced for speech feature processing. A relative + 58%

improvement is achieved for a 4-way Chinese dialect corpus. Its notable that under noisy conditions too, the unsupervised bottleneck solution consistently outperforms MFCCs [29]. Ina language identification (LID)system of two stage approach for Chinese dialect using a shallow ResNet14 followed by a simple 2-layer recurrent neural network (RNN) architecture and compared with a result of a three-stage system. This comparison yields that two-stage system can achieve high accuracy for Chinese dialects recognition under both short and long utterance with less training time [30]. TABLE IV below presents findings of Chinese dialect recognition.

TABLE IV
FINDINGS FROM LITERATURE OF CHINESE DIALECT RECOGNITION

Major dialects	Putonghua/ Mandarin, Yue/Cantonese, Wu/ Shanghainese, Minbei/ Fuzhou, Minnan /Taiwanese, Xiang, Gan and Hakka
Performance	Combination of pitch flux feature and MFCC feature proved to be good to reduce error rate [24].
	Fusion of prosodic and phonetic approach offered best results over stand alone phonetic and prosodic approach [25].
	The variational autoencoder stands superior over the adversarial autoencoder for Chinese dialect identification [29].
Limitation	Traditional I-vector with bottleneck feature extraction has a major limitation. For acoustic modeling itdemands for additional outside transcribed speech information [29].
Challenges	Most critical factors for low accuracy are not only acoustic models but speaking style mismatch and the short of good language models for pathological speech are also countable [28].

VI. SPANISH DIALECT RECOGNITION

Spanish language has ten major dialects. One of the studiescheckedsuitability of using a single multidialectal acoustic model for all the Spanish variants being spoken in Europe and Latin America. Study intended to use all the available databases to jointly train and to enhance the same system. Then use of a single system for the entire Spanish speaker. Rule- based phonetic transcription used for each dialect. The choice of the shared and the specific phonemes trained in a multi-dialectal system. The results of a multi-dialectal system dealing with dialects in and out of the training set [31]. Spanish as spoken in Spain, Colombia and Venezuela are transcribed in SAMPA symbols. A new approach proposed to find the multidialectal models using a decision tree-based clustering algorithm to evaluate similarity directly on contextual models using an entropy-based measure. Recognition results using this multidialectal approach overcome the mono dialectal ones [32]. In another multi- dialectal study of Spanish dialect recognition, acoustic model is used with two techniques of distillation and MultiTask Learning (MTL). The study concluded that both techniques are superior to the jointly-trained model that is trained on all dialectal data, with reduced word error rates by 4:2% and 0:6%, respectively. No degradation in the performance by more than 3:4% [33]. The availability of the CIEMPIESS corpus is a good resource to work for Spanish dialects over other datasets of Mexican Spanish as they are not easily or freely available for study[34]. TABLE V below presents findings of Spanish dialect recognition.

TABLE V:
FINDINGS FROM SPANISH DIALECT RECOGNITION

Major Dialects	Castilian, Andalusian, Rioplatense (Argentine), Caribbean Spanish, Andean, Mexican/ Central American
Key observation	System with multi-dialect can be treated as a single system to work with all Spanish dialects [31]
	Acoustic model performance degrades when dialectalvariation of the same language is considered. Similarly, model if trained on a group of dialects also results into low performance of dialect-specific models [33].
	Some dialect differentiations may not be visible at the acoustic level [35].
Future Scope	To devise a unification technique that can work better on each dialect than the dialect-specific acoustic model [33].

VII. HINDI DIALECT RECOGNITION

In a wide variety of Indian language, Hindi acts as the initial and most common language of communication along with status of preferred official language.It has several dialectal variations. To be specific at least 50 variations can be listed. Some of them areAwadhi, Bagheli, Braj Bhasha,Bundeli, Bhojpuri, Chhattisgarhi, Garhwali, Haryanawi, Kanauji, Khari Boli, Kumayuni, Magahi, and Marwari. In a study for prominent dialects of Hindi; Chattisgharhi, Bengali, Marathi accented Hindi, General Hindi of Northern region and Telugu auto-associative neural network (AANN) model and Support Vector Machines (SVM) used. Performance of

SVM observed better than AANN [36]. In a 2-layer feed forward neural network-based classifier study of Hindi dialect recognition, four major dialects of Hindi namely Khariboli Bhojpuri, Haryanvi, and Bagheli was considered. The recognition was carried out using spectral and prosodic features. System performance observed was 79% [37]. In another study, the problem of dialect classification of the spoken utterances in Hindi is considered for four Hindi dialects; Bhojpuri, Khariboli, Haryanvi and Bagheli. Use of a multi layer feed forward neural network with combined spectral and prosodic features presented 82% recognition of dialect [38].TABLE VI below presents findings of Hindi dialect recognition.

TABLE VI:
FINDINGS FROM HINDI DIALECT RECOGNITION

Major Dialects	Awadhi, Bagheli, Braj Bhasha, Bundeli, Bhojpuri, Chhattisgarhi, Garhwali, Haryanawi, Kanauji, Khari Boli, Kumayuni, Magahi, and Marwari
Observation	Prosodic features contain more dialect specific information compared to spectral features [36]
	Phonemic duration contains essential information for dialect discrimination. It can be used for strong speech and speaker recognition system [39]
	System performs increases when spectral and prosodic features are combined together [37][38]
	In Accented Hindi, only accent modeling is not a ideal approach to handle accent variation however for better performance it can be combined with pronunciation variation dictionary [40]

VIII. OBSERVATIONS

It has been found that found that dialect is important in automatic Speech recognition system. It is because majority people of most of the countries speak in regional language than standard form of language. Regional dialect serves as a principal tool of cultural identity. It helps to investigate regional background of a person. Recognition at dialect level definitely improves certain applications of ASR in various domains of medical and health, education, forensic and investigation etc. Basically, language corpus are available in two forms namely text transcriptions and speech audio data. For a specific language, we can consider four forms of dialects such as regional, ethnic, Sociolect and accent. Acoustic modeling and phonetic modeling are two basic approaches in recognition system, but literature focuses on fusion of acoustic and phonetic modeling approach too. As a current state of dialect recognition its worth to mention that major work is done in high resource language such as English. In comparison with English there is limited work in Arabic, Spanish, Chinese and Hindi languages. In the process of feature extraction, for long run, MFCC has proven to be the best feature extraction technique with low computational complexity but is sensitive to noise. On other hand for classification task, classifiers namely Gaussian Mixture Model (GMM) and Support Vector Machine (SVM) made big positive impact in most of dialect recognition systems. With this review we can say that yet there is scope to do work in this area of dialect recognition with major reasons such as working on low resource languages, creating good quality dataset, building a good language model, handling case studies considering pathological speech, inventing techniques to work on every possible dialect instead of dialect-specific acoustic model, identifyingdifferent approaches that can convert the raw acoustic signal to the respective language dialect, observing effect of dialectal data originating from social media sources during the classifier. At the end, use of machine learning approach using ensemble methods, or deep neural network.

IX. CONCLUSION

Definitely there are some distinguished challenges when working with low resourced languages. Those are in the form of insufficient web existence, shortage of linguistic knowledge, limited acoustic and text transcription corpus, articulation lexica. However, with the expansion of recent technology in speech technology and current state of art of using deep neural network, dialect recognition of low resource languages willbe a challenging and emerging research platform.

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Design of Adaptation for E-Learning System by Analyzing Learning Preferences

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Abstract: ***The main motive of this present research is to develop learning content in e- learning environment based on learner behaviour. The learner's behaviour must be analyzed with the assist of certain technique. Following that for appropriate accessing of the developed learning content optimal learning path must be selected. The development of ideal learning path will help in designing effective learning system. The objective of the proposed work is as follows. The primary objective of the proposed work is to render online courses to the learning people related to their specified domain. Analysis the learning behaviour of the individual learner through learning model. Evaluate the skill of the learner by conducting aptitude test. Group the learner who has similar learning preference using clustering technique. Find the unknown learner sequence with the help of classification technique. Determine ideal learning path using SSO algorithm for designing effective recommendation system.***

Keyword: ***e-learning, learning style, RFCM clustering, DBN classifier, recommendation system, SSO***

I. INTRODUCTION

Recently, large number of people is relying on e- learning system for learning the essential information. Lot of people including students is profited through this e- learning system. The growth of e- learning system is found to be tremendous. Many techniques have been developed through various researchers for providing online courses to the people. Not only schools and colleges student are benefited through this e- learning but other people also can fetch their required information from these e- learning system. The traditional used system in e- learning is LMS. Using this LSM the gathered information will be stored and provided for access through the people. But this LSM will provide similar learning content without considering the learner preference. So, In spite of many advantages in e- learning there exist certain limitations too. Huge amount of data is present in this e- learning environment so, it is tedious for the individual to gather the essential information from this vast data. Following that same sort of learning content is provided for every learner without considering their learning preference. For solving these kinds of issue the learning behaviour of the individual must be analyzed. Based on their learning behaviour the learning content must be developed. At the same time to access the essential learning content by the learner effective recommendation system must be designed.

The process that is involved in e- learning environment are developing and storing the learning content of the learner, maintain the profile of the accessing learners, providing the learning content to the learners according to their capability, managing of exercise to be practiced, rendering effective learning path to the learner to get access to the essential content. The rendering of education by means of system is referred to as Computer-Based Education (CBE). Some sort of guidance regarding the education will be provided to the learner. Within CBE, the technique of artificial intelligence is combined along with web source [2]. Using this many educational systems have been emerged, such as massive open online courses (MOOC), personal learning environments (PLE), adaptive hypermedia educational systems (AHES), intelligent tutoring systems (ITS) , learning management systems (LMS) etc. Using those above mentioned computer related system the process of e- learning approach will be carried out. These are different platforms available in the web source for providing e- learning based education. This e- learning can be used for many purposes. The use of e- learning is referred to as dimension of e-learning. The various dimensions of e- learning will be explained in the following section.

The remaining part of the paper is planned as follows: in section 2 some of the article related to the e- learning system will be reviewed. In section 3 the detailed description regarding the proposed model will be explained. The step wise procedure related to the proposed system is given in section 4. The experimental analysis based on the proposed system will be carried out and the obtained results will be illustrated in section 5. Finally, the paper will be concluded in section 6.

II. LITURATURE SURVEY

Most of the studies in the area of web usage mining are very new, and the topic of clustering web sessions has recently become popular in the field of real application. The literature survey contain the different research on e-learning application domain with web usage mining which is useful to find the path for adaptive e-learning with user interface and contents.

A. Anitha and N. Krishnan (2011): World wide web is a tremendous data source, comprehensively utilized for adapting now-a-days because of adaptability of time, sharing of learning assets and framework and so forth., Most of online learning framework needs master student collaboration, evaluation of client exercises and students are getting suffocated by immense number of website pages in the learning site and they discover challenges in picking reasonable materials pertinent to their advantage. This work endeavors to draw in e-students at a beginning phase of learning by giving route proposals. E-learning personalization is finished by mining the web use information like late perusing chronicles of students of comparative premium. The proposed strategy utilizes upper guess based unpleasant set bunching and dynamic all unit request affiliation rule digging utilizing apriority for customizing e-students by giving learning alternate ways. The embodiment of brushing affiliation decide and grouping is that, utilizing bunched get to examples can decrease the informational collection size for affiliation rule mining task, and improves the suggestion exactness.

Valentina Caputi et.al, [19] had developed a technique employing Artificial Intelligence (AI) for providing learning content within Moodle on the basis of orientation of the students. The learning content will be enhanced according to the objectives and needs of the learner instead of giving the similar contents. The enhancement of content can be done through several technique but in this present work AI was utilized. The mapping process can be done effectively by means of the developed technique. The mapping process was done in term of cause and effect technique. Based on the established learning content the path for learning was developed. The developed path for learning can be accessed through both of the teachers and students. Some of the experiments were carried out to evaluate the performance of the developed method.

Aleksandra Klasnja- Milicevi et al., [20] had developed a recommendation system based on tag technique for enhancing e- learning system. The recommendation in e-learning must be developed in such a way that it meets the objectives of the specified learners. For enhancing the content of learning many technique have been developed in recent years. In the present work for enhancing the learning content according to user the tagging and collaborative technique was utilized. The clustering technique was utilized for decreasing the tag space on the basis of learning style. Through this approach the improvement in recommendation quality and execution time can be done as well as the memory necessity can be reduced. The evaluation was carried out on the developed recommendation model based on tag.

III. METHODOLOGY

Recently, large number of people is relying on e- learning system for learning the essential information. The growth of e- learning system is found to be tremendous. Many techniques have been developed through various researchers for providing online courses to the people. Not only schools and colleges student are benefited through this e- learning but other people also can fetch their required information from these e- learning system. In spite of presence of many advantages in e- learning there exist certain limitations too. It is very difficult for the individual user to acquire the necessary information for the numerous data. Most probably in every online courses similar sort of learning content is provided for every user without considering their learning knowledge. So, for solving these kind of issues the proposed system is designed. The ultimate aim of this proposed work is to develop learning content in e- learning environment based on learner preference as well as to design optimal learning path to achieve effective recommendation system. The recommendation system will make path to allow the user to gather essential information in spite of presence of huge amount of data. In the previous section the necessity for developing the proposed system was explained. Following that the architecture of the proposed method will be described in the upcoming section.

3.1. Architecture of the e- learning System

The development of learning content and offering online course to every user based on the requirement is considered as important in this modernized technology. Basically, every learner or individual has specified learning behaviour. They use different learning style as well as different Learning Object (LO). The learning behaviour of the individual learner must be analyzed and further the content must be developed based on their learning preference. For acquiring the learning content by the user effective recommendation system must be designed. In order to develop effective learning content and design efficient recommendation system sequence of steps are followed in the proposed system.

The initial step carried out in the proposed system is collection of data. The data necessary for performing the analysis is collected from web source. Much number of attributes will be included in the dataset. The second process adopted following the collection of data is pre- processing. The dataset that is obtained from the web source will also contain some unwanted information. For extracting the useful information from raw data pre- processing technique is utilized. Data cleaning and normalization are the two process performed in pre- processing technique. The third process is the utilization of Felder Silverman model. Different LO and various learning style are preferred through the learner. For matching LO to learning style this model is utilized. Based on their convenient learning behaviour the learners carry out their learning. The fourth process is conduction of aptitude test for analysis the skill of the learner acquired through learning. In the conducted test every individual learner will obtain different marks based on their capability. The schematic representation of the proposed model is provided in figure 1.

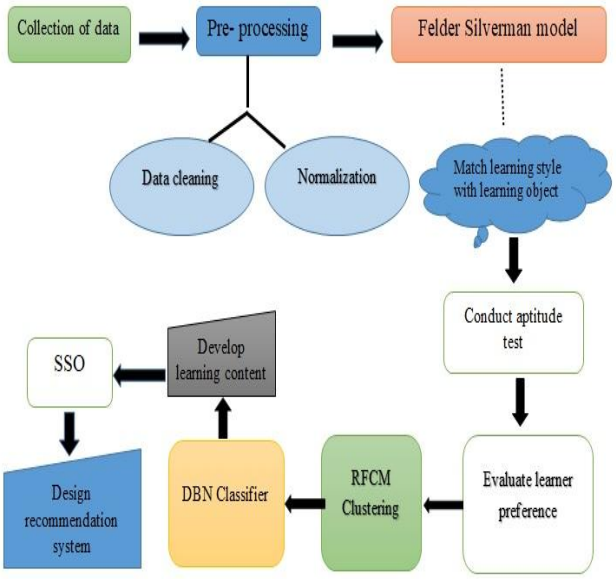

Figure 1: Schematic Representation of the Proposed System

In the above mentioned figure the process flow for the proposed system is illustrated diagrammatically. Following the aptitude test the learner preference will be evaluated based on the obtained marks. Then with the help of RFCM, the learners on the basis of obtained mark will be grouped together. After performing the clustering process the leaner sequence will be found. Further using this known learner sequence the unknown learner sequence can be found with the aid of classification technique in seventh step. DBN is used as classifier in the proposed model. Then, based on the learner sequence the learning content will be developed. For accessing this learning content the optimal learning path must be developed. For finding the optimal learning path SSO is used. Finally, essential learning content and recommendation system will be developed using the proposed model.

3.1.1 Description of the Proposed Model

The concept of e- learning technique seems to be beneficial for every people including students and other learning people. Lot of technique for supporting online courses has been developed. As coin has both sides every technique possesses certain limitation in spite of its advantages. So, in the proposed model developing of learning content on the basis of learner preference and designing of an effective recommendation system for accessing this learning content through the learner were performed. For performing the proposed model several processes were done. A brief

explanation of the various processes is provided in the following section.

3.1.2. Collection of Data

In every process the collection of data is considered as initial process. The data's according to the proposed system must be acquired. The learner along with their learning behaviour and obtained scores in the aptitude test is taken as dataset in this proposed work. The mark of the individual learner will vary on the basis of their learning behaviour. So, through this score the learner preference can be identified and finally the leaner sequence can be obtained. The dataset needed for analysis is obtained through conducting analysis on 115 students. These students were pursuing their under graduate degree. They use e- learning system to perform their learning. For evaluating their ability tests were conducted. Intermediate test and final exam was conducted. The student's marks along with their id were considered. Using this dataset the experimental analysis is carried out.

3.1.3. Pre- processing of Data

The raw data which is obtained from the source must be extracted to get the useful information. So, performing this process pre- processing technique is utilized. Many pre-pre-processing techniques were reported in data mining such as data cleaning, data transformation, data reduction and data integration

.

Data Cleaning

This process is referred to as sorting out the missing value and then filling those missing value using certain technique. In the proposed work for filling the missing value the technique called interpolation can be utilized. This technique functions more effectively in finding the missing values. Initially the linking between the attributes is made in order to predict the missing value more accurately. Through this approach the missing value can be sorted out.

Normalization

The process of rescaling of original data without altering the nature and behaviour of data is referred to as normalization. In this technique newer boundary will be developed and the data will be converted based on that boundary. Many technique is developed for performing the normalization. In the proposed work Min- Max normalization technique is used. They can be represented in the form of equation which is expressed as follows.

$$U_a = \frac{V_a - x_1}{x_2 - x_1}(y_2 - y_1) + y_1 \quad (1)$$

In the above equation x_1 and x_1 represents the minimum and maximum boundary of the attribute, y_1 and y_2 represents the new scale at which the normalization is carried out, V_a represents the value of attribute and finally, U_a denotes the normalized value. Following the pre-processing technique matching of LO to learning style will be carried out with the help of Felder Silverman model. A brief explanation related to this matching process is provided in the following section.

3.1.4. Matching LO to Learning Style

Every individual learner will make use of different LO as well as various styles for learning. Based on utilizing this LO and learning style the ability of the learner in grasping the knowledge will be quite different. In order to match different LO along with learning style Felder Silverman model is utilized [22]. The different LO utilized and various style of learning is explained briefly as follows.

Learning Object (LO): LO used by the learners are text, video, audio, images, PDF, PPT, demo, assignments, reference, charts, practical material, topic list and so on. These LO must be durable, accessible and reusable. The reuse of LOs helps the educational institutes, on one side, to decrease the cost of creating them and on the other side to find useful contents by looking for them in dedicated repositories which contain collected LOs.

Learning Style: The learning model is the most significant segment in a versatile e-learning framework, as a result of its capacity to speak to the attributes of the student as per which the instructive framework gives suggestions. Among significant trademark that a learning model can contain is that everybody has their own learning style. A Learning style alludes to the favored manner by which the student handle and treat data, and it is considered as one of the fundamental parts of the learning model. Since it can depict the student's conduct when he collaborates with the e-learning condition. As per the conduct of the students during the learning procedure it can arrange them into many learning style classifications; these classifications can be utilized to make a learning style model (LSM). Be that as it may, there are numerous LSMs, for example, Kolb, 4MAT, Visual, Auditory and Kinesthetic (VAK) and Felder-Silverman which is considered as the most well-known one gratitude to its capacity to measure understudies' learning style. The style used for learning may be visualized or sensed learning. Some learners may utilize certain material and have visualized learning and other learners may not use any material and learn with the help of the sensed information. For matching

LO with learning style Felder Silverman model is used. The detailed description regarding this model is given in the next section.

A. Felder Silverman model

This model is the most used in adaptive e-learning systems and the most appropriate to implement them. The model presents four dimensions with two categories for each one, where each learner has a dominant preference for one category in each dimension: understanding (sequential/global), input (visual/verbal), perception (sensing/intuitive) and processing (active/reflective).

Active (A) students like to process data by collaborating straightforwardly with the learning material, while reflective (R) students want to consider the learning material. Dynamic students additionally will in general investigation in gathering, while the intelligent students like to work independently.

Sensing (Sen) students will in general use materials that contain solid realities and genuine applications, they are sensible and like to utilize exhibited system and physical trials. While the intuitive (I) students want to utilize materials that contains unique and hypothetical data, they will in general comprehend the general example from a worldwide picture and afterward finding prospects.

Visual (Vi) students want to perceive what they realize by utilizing visual portrayals, for example, pictures, graphs, and diagrams. While the verbal (Ve) students like data that are clarified with words; both composed and expressed.

Sequential (Seq) students want to concentrate on the subtleties by experiencing the course bit by bit in a direct way.in the inverse, the global (G) students like to comprehend the master plan by sorting out data comprehensively.

3.2. Stepwise procedure of the proposed e- learning model

The e- Learning refers to the process of offering online courses to the learner. The traditional way of learning is overcome through using this e- learning system. The step wise procedure involved in the proposed model of e- learning system is given as follows.

Step 1: The initial process to be carried out in the proposed e-learning system is collection of data required for analysis.
Step 2: After the collection of data, pre- processing technique is employed. Data cleaning and normalization are the two process performed.
Step 3: Following pre- processing technique Felder Silverman model is used for matching the various LO with learning style.
Step 4: Conduction of aptitude test to check the skill of the learner using this learning model.
Step 5: Evaluation of learner preference based on obtained mark.
Step 6: Then, with the obtained mark the process of clustering will be carried out using RFCM.
Step 7: Following that the classification process using DBN is included to determine unknown sequence.
Step 8: Development of learning content based on analysed learning behaviour.
Step 9: For finding the optimal learning path SSO is utilized.
Step 10: Design of effective recommendation system based on SSO.

IV. RESULT AND DISCUSSION

The implementation of the proposed system is carried out in MATLAB platform and the results were obtained. The development of learning content on the basis of learner preference and designing of better recommendation system was carried out in the proposed work. For analyzing the learner behaviour Felder Silverman model was utilized. The individual learner is grouped based on their learning behaviour using RFCM clustering technique. Further to predict the unknown learner behaviour DBN classifier was utilized. Finally to find the ideal path for accessing this learning content SSO algorithm is used. In the following section the detailed description of the results obtained through execution of the proposed system will be explained briefly.

4.1. Description of dataset

The dataset for the performing the experiment is collected from the URI source. The detailed description of the dataset is given as follows. Around one hundred and fifteen engineering students were considered for the experiment. These students will prefer e- learning system to carry out their studies. Within the collected dataset activity of the students is monitored through six sessions by means of conducting intermediate exam in the subject of digital electronics. Then, following that the final exam were conducted. This final exam was conducted two times with different details. Some of the students joined the course did not appear for the exam. So, some of the students id were missing in the final exam. The dataset consists of 17 attributes starting with student's id. The mark obtained in the

final exam was evaluated to 100 points. Using this dataset the experimental analysis on the proposed system was carried out.

4.2. Implementation of proposed model

For performing the experimental analysis the proposed system was implemented in MATLAB and the results were described. After obtaining dataset the next process followed is pre- processing. In pre- processing two techniques were performed. One is data cleaning where the missed values were found and another is normalization where the approximate values for the missing data are found. Following that for matching the LO together with learning style Felder Silverman model is used. Then for evaluating the ability of learner and to find the learner sequence aptitude test was conducted. The individual learner will obtain mark based on their learning preference. The learners whose marks correlate were grouped together using RFCM clustering technique. The individual possessing similar learning preference were linked together. Only two attribute were considered for clustering. One is learner and another is mark obtained. The diagrammatic representation of the clusters formed is given in figure 2.

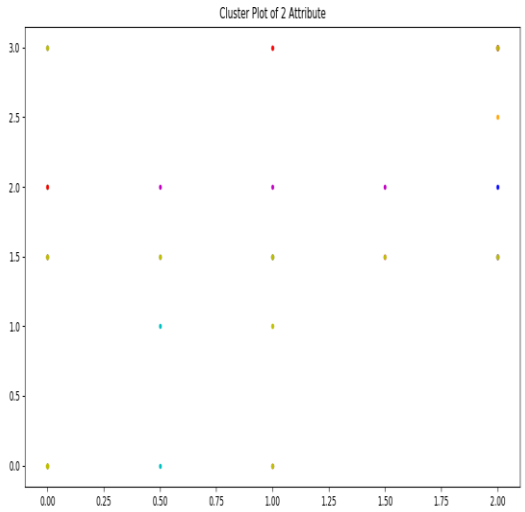

Figure 2: Formation of Clusters

The formation of cluster is provided in above illustrated figure. Initially the number of learners or students taken for analysis is 115. These 115 number of students were grouped nineteen cluster based on their learning behaviour. Many number of attribute were contained in the dataset out of which only two attributes were considered for clustering. The two attributes taken for clustering are student's id and their obtained mark in points. Based on their obtained mark the learner were categorized as low, very low, high, very high, average, below average and above average. The learners are grouped based on this category. The clusters are denoted in various colors like green, purple, blue, orange and red. The same coloured cluster in the figure represents the similar characteristic. Once the individual learners are clustered based on their learning behaviour. However for finding and testing the unknown learner behaviour DBN classifier is used. The obtained learner behaviour from clustering is taken as training set and the time taken for computing the training set is 20.3101 sec. the unknown sequence is given as testing set. With the help of the output obtained from the classifier the learning content is developed. Finally, using SSO the best learning path to access the content is found and effective recommendation system is designed. For evaluating the performance of the proposed system some of the statistical measurements were evaluated in the following section.

4.3. Performance analysis

The statistical measurements were used for evaluating the performance of the proposed system. With the help of the obtained statistical value the performance of any system can be analyzed. There are many parameters found in the statistical measurement used for various purpose. Some of the statistical measurement evaluated in the proposed system is recall, accuracy, precision and f- score. The detailed description regarding this statistical measurement is given below.

A. Precision

The ratio of true positive occurrence to the predicted positive case is termed as precision. The precision is also named as positive predicted value. The mathematical expression for calculating precision is given as follows.

$$p = \frac{TP}{TP+FP} \quad (1)$$

B. Accuracy

The rate at which the classification of record is performed correctly is named as accuracy. The mathematical expression used for calculating accuracy is given in equation 2.

$$A = \frac{TTP_{all}}{total\ number\ of\ classification} \quad (2)$$

C. Recall

The proportion at which the positive cases are appropriately identified as positive is referred to as recall. The recall is also termed as sensitivity. The mathematical expression for

calculating recall is provided in equation 3.

$$R = \frac{TP}{TP+FN} \quad (3)$$

D. F- score

In case of uneven distribution of class the measuring of F-score is considered as essential. The weighted average among recall and precision is referred to as F- score. The mathematical expression for calculating F- score is given as follows.

$$F_1 score = \frac{2(R \times P)}{R+P} \quad (4)$$

In the above represented equations (TP) denotes true positive, (TN) denotes true negative, (FP) denotes false positive, (FN) denotes false negative, (TTP) denotes total true positive. Using these above mentioned statistical measurement the performance of the proposed system is evaluated. The value of this statistical parameter is calculated for the proposed system and tabulated. The value of statistical measurement is provided in table 1.

Table 1: Statistical Value for the Proposed System

Class	Precision	Recall	F1 score	Support
1	0.69	0.92	0.79	12
2	0.57	0.50	0.53	8
3	0.40	0.67	0.50	6
4	0.50	0.29	0.36	7
5	0.00	0.00	0.00	7
6	0.62	0.80	0.70	10
7	0.94	0.91	0.93	34

In the above table the statistical value for the proposed system is represented. The various statistical measurement considered in this proposed method for analysis are recall, F-1 score, precision and accuracy. The accuracy of the proposed system was found to be 0.9285. Other statistical parameters were evaluated and given in the table. The precision for class 7 is found to be 0.94 which is high on comparison with other classes. The recall for class 1 is found to be 0.92 which is predominantly high on comparison with other classes. The F-1 score for class 7 is found to be 0.93. In the following section these statistical measurement were provided in graphical format. The separate individual graph is plotted for recall, F-1 score and precision. The graph is plotted against classes and the value of recall, precision and F-1 score. The various classes represents low, high, very low, very high, below average, above average and average. These classes were categorized on the basis of obtained mark. The learner after the completion of learning process was subjected to test in order to evaluate their ability. The MCQ based questions were prepared and the test was conducted. The mark of the individual learner is obtained after evaluation. For the purpose of performing the analysis in simple and effective manner the obtained marks were categorized as mentioned above. The detailed description regarding this evaluation of aptitude is provided in proposed section. In the following section the graphical representation of various statistical measurements is provided.

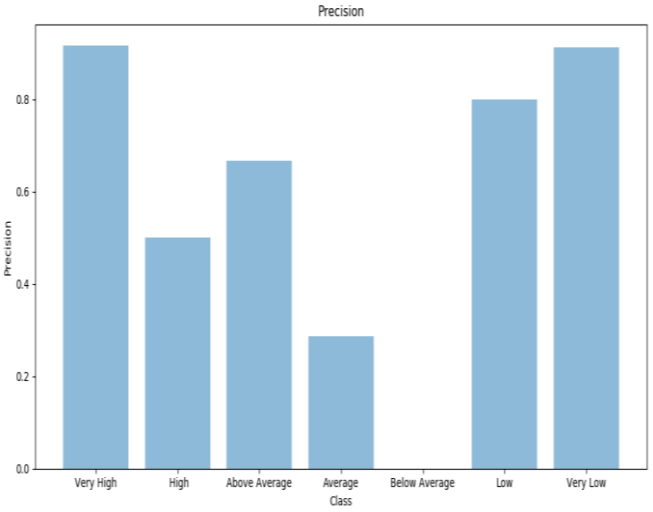

Figure 2: Analysis of Precision

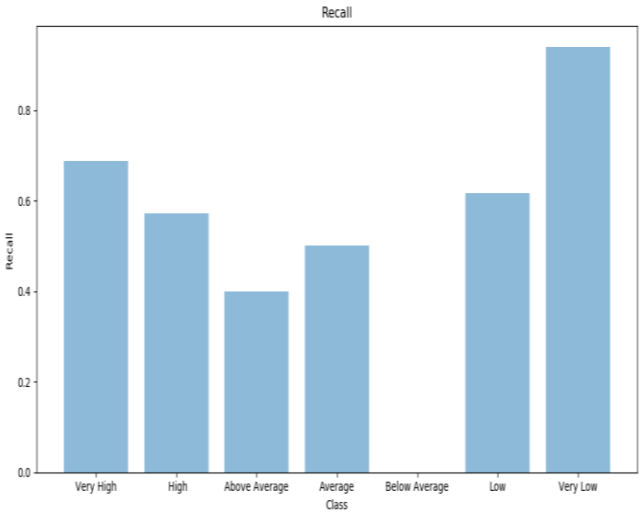

Figure 3: Analysis of Recall

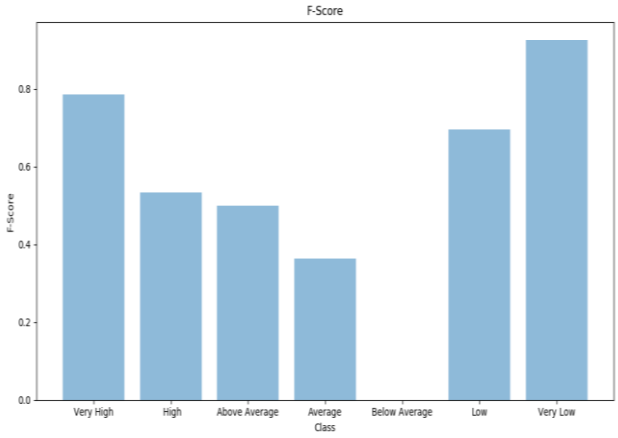

Figure 4: Analysis of F-1 Score

The graphical representation of different statistical measurement is provided in the previous illustrated figure. In figure 2 the analysis of precision is represented. In the x- axis the classes is represented and in y- axis the value of precision is represented. The value of precision for very low and very high category is found to be greater on comparison with other category. The second greater category is found to be low. The third greater category following that is found to be above average. Subsequent the next two category lies. The precision value for the category below average is found to be 0. In figure 3 the analysis of recall is represented. In the x- axis the classes is represented and in y- axis the value of recall is represented. The value of recall for very low category is found to be greater on comparison with other category. The second greater category is found to be very high. The third greater category following that is found to be low. Subsequent the next two categories lie. The recall value for the category below average is found to be 0. In figure 4 the analysis of F-1 score is represented. In the x- axis the classes is represented and in y- axis the value of F-1 score is represented. The value of F-1 score for very low is found to be greater on comparison with other category. The second greater category is found to be very high. The third greater category following that is found to be low. Subsequent the next two categories lie. The F-1 score value for the category below average is found to be 0. With the help of these statistical measurement the performance of the proposed system is evaluated. The classifier DBN which is used in the proposed system for classification purpose is taken for evaluation of performance. In the following section the graphical representation of the performance DBN is illustrated in figure 5.

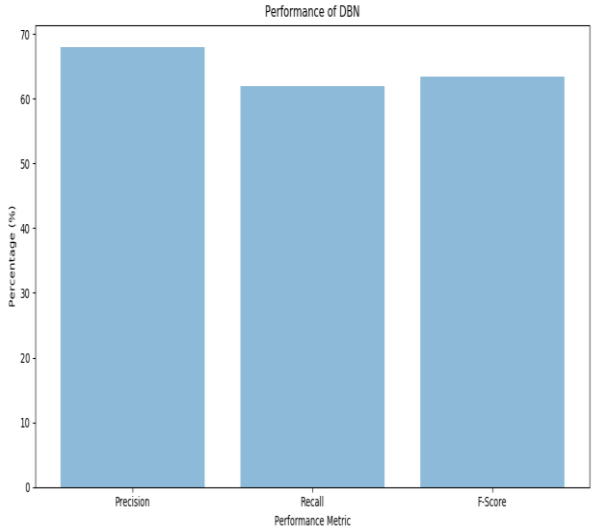

Figure 5: Analysis of DBN Performance

The above mentioned figure illustrates the performance of the classifier DBN. DBN is used in the proposed system for performing the process of classification. With the assist of this classification technique the unknown learner sequence can be obtained. The known learner sequence obtained from the previous process is taken as training set. The unknown learner sequence is considered as testing set. Using this concept the process were carried out. Some of the statistical measurement was evaluated for evaluating the performance. In the figure 5 the graph is plotted against performance metric and percentage. On comparisons with other two parameter such as F-1 score and recall the percentage of precision is found to be higher greater than 65%. The other two parameter percentage was also found to greater than 60%. From this it found that the performance of the proposed system is effective. For proving that the proposed system functions effectively on comparison with other existing method a comparison analysis is performed which is explained in the following section.

Comparison analysis

The comparison analysis is carried out in order to assure that the proposed method work effectively on contrast with other existing method. The other existing technique taken for analysis is Deep Neural Network (DNN) and Artificial Neural Network (ANN). The statistical parameter considered for analysis is accuracy. In the following figure 6 the comparison analysis is provided in graphical format.

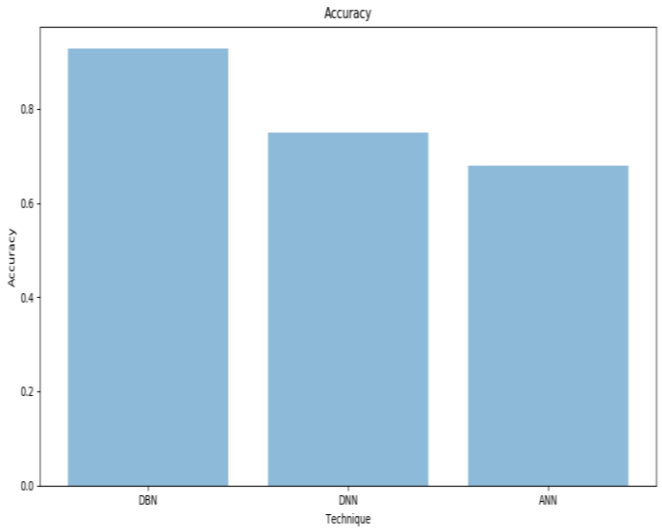

Figure 6: Comparison Analysis of Proposed and Existing method

In the above figure the comparison analysis between existing and proposed technique is illustrated. The graph is plotted against various techniques and the value of accuracy. The value of accuracy for the proposed technique is found to be higher equal to 0.9. The value of accuracy for other two existing technique like DNN and ANN is found to be lesser than 0.8. From the overall analysis it is proved that the proposed system functions effectively in developing the learning content relating to learner preference and designing of effective recommendation system.

V. CONCLUSION

This technique is developed employing the concept of e-learning system. Learning is considered as significant in every individual life. Many learners are not satisfied with traditional form of learning. So, for motivating the learner the online learning system was developed. The development of online learning system is referred to as e- learning. The learning content can be developed and stored in this e-learning system for future reference. Many techniques have been developed in recent year for creating the learning content for learner. But in every system there exist certain sort of limitations. For solving the issue proposed system was designed. The hybrid technique including clustering, classification and optimization was utilized in the proposed system. Further for evaluating the performance of the proposed system the statistical measurement was evaluated. To prove that the proposed system functions effectively on contrast with other existing technique a comparison analysis is carried out.

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Intuitionistic Fuzzy Sets Based Inpainting for Reconstruction of Heritage Images

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Abstract*—Image inpainting is a process of reconstructing damaged or missing part of an image. Initially the work of restoration was performed by skilled artists and was limited to paintings and other artwork of eminence but this process was very tedious and strenuous and therefore digital image inpainting was introduced. The application of inpainting in reconstruction of heritage images is garnering a lot of attention from researchers. The reconstruction of heritage images using inpainting poses a challenging task because of its very high resolution and high meaning full structure content. In traditional exemplar based algorithms the patch with the minimum distance or high similarity may not always be the best match patch. One of the characteristic functions of the Intuitionistic fuzzy set is its definition of degree of hesitancy. In the proposed paper this concept is used to find best exemplars. The mathematical model of intuitionistic fuzzy set is studied and a modified exemplar algorithm based on Intuitionistic fuzzy sets is proposed to solve image inpainting problem. The proposed intuitionistic based inpainting algorithm is applied to heritage images. The results are compared with existing and earlier proposed algorithms on the basis of subjective inpainting quality assessment method.

Index Terms—*Inpainting, exemplar, intuitionistic, inpainting quality assessment*

I. INTRODUCTION

Image inpainting is a process of reconstructing damaged or missing part of an image. Initially the work of restoration was performed by skilled artists and was limited to painting and other artwork of eminence but this process was very tedious and strenuous and therefore digital image inpainting was introduced. Image inpainting can be thought of as an interpolation problem in which information from known portion of image is interpolated to unknown part of image.

In recent years, research in image inpainting is been very active due to its immense importance where damaged images are restored from scratches, text overlays on images with reference to impaired image transmission or dis-occlusion in image based rendering (IBR), red-eye correction etc. This technique can also be used to interpolate the lost blocks in the coding and transmission of images. Image inpainting has also found importance in areas such as visual reconstruction of heritage sites, special effects in films, editing, medical image processing, image compression etc. Image inpainting can be thought as a unique problem without particular solution. It is therefore necessary to consider image priors. The inpainting technique can be categorized broadly as Diffusion based and Exemplar based on the basis of image priors such as smoothness priors, self similarity prior and sparse priors. In these methods an assumption is made that the known pixels and unknown pixels of the images have same geometrical structures or statistical properties.

Diffusion based inpainting works well for smaller damaged area but it creates blur for larger damaged area [1]-[4]. In order to deal with this blurring effect, exemplar based inpainting was introduced. In exemplar based inpainting approach, the region to be inpainted is filled by most similar patches from source region. The exemplar based inpainting approach considers both structural and textural information of image while filling up target region. A filling algorithm is said to be better when it gives higher priority of filling to those regions of the target or unknown area which lie on the continuation of image structures. The main advantages of this

approach are balanced region filling, speed efficiency, accurate propagation of linear structure and accuracy in synthesis of texture. The priority of the patch is decided by two terms namely confidence term and data term. Priority computation is biased towards those patches which are on the continuation of strong edges and are supposed to be surrounded by high confidence pixels.

The Exemplar based inpainting method [5] for inpainting bigger patches has received vast acceptance because of its simplicity and effectiveness through computation of priority value. But as the algorithm progresses towards the center of the unknown region with more number of unknown pixels, the overall confidence of the patch drops significantly, thus dropping the priority value. This results into less visually acceptable inpainting. In this paper the crisp nature of confidence values is converted into vagueness using the concepts of intutionistic fuzzy sets to give more visibly acceptable outputs.

The inpainting of heritage images where high amount of uncertainty is present is a challenging task. These images consist of complex textures and structures with greater amount of uncertainty. An intuitionistic fuzzy set based inpainting approach is applied to reconstruct heritage images.

II. EXEMPLAR BASED INPAINTING

A. Introduction to inpainting problem

The image to be inpainted is denoted by 'I'. This image is divided in two parts where undamaged region is called known region and damaged region or region to be filled is unknown region. Let the region to be inpainted be called as target region and is denoted as 'θ'. The known part of image also called as source region be denoted as 'ϕ'. The target region boundary is given by 'δθ' as shown in Figure 1(a). The task is to fill a patch Ψ_y, of a given window size, where $y \in \delta\theta$, with the best matching patch, Ψ_x, from the source region.

B. Exemplar based inpainting algorithm

Criminisi et al. in [5] proposed an algorithm which simultaneously propagates texture and structure information is single algorithm. The inpainting algorithm based on exemplar approach includes the following four main steps:

a) Initialization of the target Region 'θ':

The damaged region is selected. A mask is created by extracting the target region and representing it with proper data structure.

b) Identifying the fill front 'δθ' and computing filling priority:

c) Finding the best exemplar.

d) The algorithm is used to search for the most matching patch from the source region. The distance metric, d, is used to compute the similarity between the patches in source region and target region.

C. Selection of damaged region

The first step in inpainting is to select damage region or region to be removed. The damaged region can be selected manually or through segmentation techniques. The process of mask selection mostly done manually and require user interference. However, Rong-Chi Change [6] developed a new mechanism which can automatically detect defective portion in photo including damage by color in spray and scratch drawing. Hongying Zhang [7] proposed new algorithm for detection of arbitrary scratches for image inpainting and is based on uniform gray structural information of scratches. The scratches and other linear structures can also be detected using various edge detection techniques. Selecting damaged region manually makes inpainting technique semi-automatic. The process of object selection, removal and mask creation is shown in Figure 2. The image to be inpainted is given as Eq. no (1)

$$I^{n+1}(i,j) = I^{n}(i,j) * M(i,j) \qquad (1)$$

Where 'I^{n+1}' denotes the image to be inpainted after applying mask as shown in Figure 2(d) and 'M' is the mask of the damaged region. The value n = 2 for grayscale images (2-dimentional) or n = 3 for RGB color images (3-dimentional). Once the mask is created the user has to select patch size for processing. The patch size should be greater than the size of the texel for successful inpainting. Lizarraga-Morales et al. in [8] provides a method to find texel size.

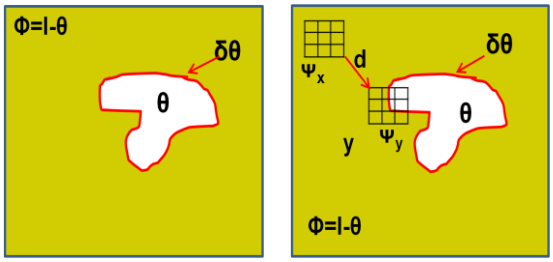
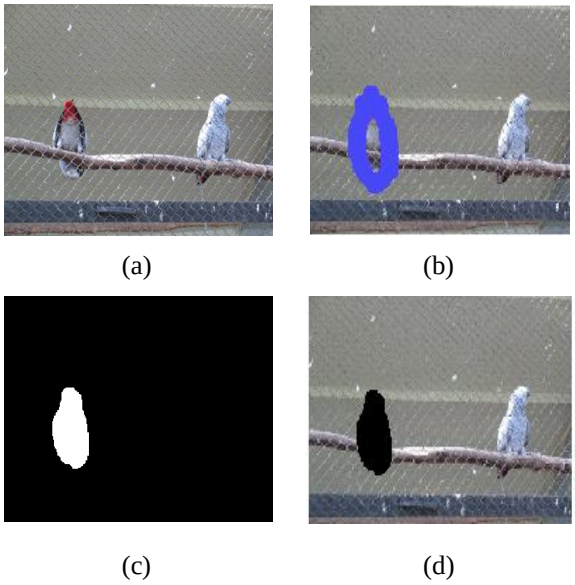


Figure 1: (a) Image *'I'* showing target region′θ′, source region 'ϕ' and fill front δθ. (b) Distance 'd' between the patch, Ψ_x, in source region and a patch, Ψ_y in the target region



(a) (b)

(c) (d)

Figure 2: (a) Original image 'Two birds' (b) Selection of object to be removed (c) Mask created (d) Image to be inpainted

D. Computing the patch priority

The initial fill front is obtained through boundary of the target region. A priority value is computed for a patch Ψ_y of given window size around every pixel on the boundary. The priority value is computed using predefined priority function given as Eq. (2),

$$P(y) = C(y) * D(y) \qquad (2)$$

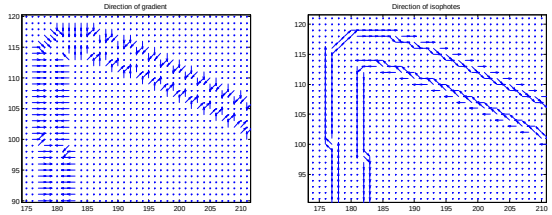
Where C(y) is the confidence term and the data term is given as D(y). For the pixel 'y' on the boundary, the confidence value is computed as, $|\Psi_y|$, which is the area of the patch surrounding pixel y. The data term is given as,

$$D(y) = \frac{|\nabla I_y^{\perp} . n_y|}{\alpha} \qquad (3)$$

$\nabla I_y^{\perp}$ - is direction perpendicular to the gradient called as isophotes

n_y- Unit vector perpendicular to each pixel on boundary.

The isophote direction and gradient direction is shown in Figure 3. 'α' is used for normalization and for grayscale images its value is 255.



(a) (b)

Figure 3 (a) Direction of gradient (b) Direction of isophotes.

The confidence of a patch is given as,

$$C(y) = \frac{\Sigma_{x \in \Psi_y \cap (I-\Theta)} C(x)}{|\Psi_y|} \qquad (4)$$

During initialization, C(y) has value 0 when y∈ θ (unknown region) and C(y) is 1 when y∈ ϕ that is source region. The confidence map is constructed by taking complement of mask. A search for matching exemplar is conducted using different similarity priors and the most similar is copied in the damaged region according to the priority value assigned.

E. Finding the best exemplar

The algorithm searches for best matching patch for the patch Ψ_y in the target region with the patch Ψ_x

from the source region. The similarity between two patches is computed through distance metric 'd' as given in Eq. (5)

$$\Psi_{\hat{x}} = \operatorname{argmin}_{\Psi_x \in \phi} d(\Psi_y, \Psi_x) \quad (5)$$

Where,

$\Psi_{\hat{x}}$ - is the best matched patch.

A quantitative measure of the degree of matching or similarity between two images, or image patches, A and B is provided by the distance metric 'd'. The similarity measures using distance metrics are broadly classified as, pixel based similarity measures and statistical based similarity measures. The distance function refers to difference between samples that are regarded as points in high dimensional space. The similarity measure is complement of distance measure. The minimum distance between two patches is considered as best matching for which similarity index is highest. In earlier work of exemplar based image inpainting [5], sum of squared difference (SSD) is used for similarity measurement. This similarity measure is based on pixel to pixel intensity differences between two images. The matching point can be determined by considering the location of minimum value in the image matrices. The sum of squared difference between two patches Ψ_y and Ψ_x can be given as Eq. (6)

$$d_{SSD}(\Psi_y, \Psi_x) = \sum [(R_{\Psi_y} - R_{\Psi_x})^2 + (G_{\Psi_y} - G_{\Psi_x})^2 + (B_{\Psi_y} - B_{\Psi_x})^2] \quad (6)$$

The minimum value of difference will give the best matching patch. But, in some cases it may occur that multiple patches may have numerically close SSD and the patch with the lowest value of SSD may not necessarily be the most visually plausible one. It is observed that SSD is biased towards uniform textures. This problem is answered in [9] where mean SSD distance is proposed to better reflect the average of similarity between the two patches. The mean SSD is given as,

$$\overline{d_{SSD}}(\Psi_y, \Psi_x) = \sum [(\overline{R_{\Psi_y}} - \overline{R_{\Psi_x}})^2 + \left(\overline{G_{\Psi_y}} - \overline{G_{\Psi_x}}\right)^2 + (\overline{B_{\Psi_y}} - \overline{B_{\Psi_x}})^2] \quad (7)$$

Where, $\bar{R}$, $\bar{G}$ and $\bar{B}$ denotes mean of image intensity of individual color channel. Sum of squared absolute difference (SSAD) of the two feature vectors is calculated for finding matching patches in [10] as given in Eq. [8] which is computationally less complex.

$$d_{SSAD}(\Psi_y, \Psi_x) = \sum [(|R_{\Psi_y}| - |R_{\Psi_x}|)^2 + (|G_{\Psi_y}| - |G_{\Psi_x}|)^2 + (|B_{\Psi_y}| - |B_{\Psi_x}|)^2] \quad (8)$$

F. Updating the fill front

The fill front 'δθ' is updated for each iteration after copying the matching patches to the target region. The confidence value of the new fill front is computed. As the algorithm propagates from outside to the inside of the region being inpainted the fill front goes on reducing in a onion peel fashion.

The steps are iterated until all the pixels in target area are filled.

III. INTUITIONISTIC FUZZY SETS FOR IMAGE INPAINTING

A. Introduction to intuitionistic fuzzy sets

Different variations of higher order fuzzy sets have been proposed by many researchers motivated from Zadeh's proposed fuzzy sets (FSs) theory [11]. Intuitionistic fuzzy sets (IFSs) are among one such notion proposed by Atanassov [12]-[16] which has turned out to be a suitable tool for modeling the hesitancy which arises from imprecise information. IFSs are defined by the characteristic functions, namely the membership and the non-membership, describing the degree of belongingness or non-belongingness of an element of the universe to the IFS respectively and degree of hesitancy.

In exemplar based inpainting a distance metric is used for finding the best matching patch

from the known region. In cases where two more patches are located at same minimum distance with respect to the target patch, hesitancy is created. In traditional confidence term as in [5] the pixel value for absence of data = 0. This results into fast dropping of confidence value when large amount of damage is present. This uncertainty is defined by using degree of hesitancy. It has been observed that the proposed IFS based inpainting approach gives visually acceptable results as compared to the most popular algorithm in [5].

B. Mathematical model of intuitionistic fuzzy sets

Let 'A' be the fuzzy set defined over finite set $X = \{x_1, x_2, x_3 \ldots..x_n\}$ be mathematically represented as given in Eq. (9)

$$A = \left\{\left(X, \mu_A(x)\right) | x \epsilon X\right\} \quad (9)$$

Where the degree of membership of an element $x \in X$ is given by the function as given by Eq. (10)

$$\mu_A(x): X \rightarrow [0,1] \quad (10)$$

$v_A(x)$ – is the non membership is considered as complement of the membership and can be given as Eq. (11)

$$v_A(x) = 1 - \mu_A(x) \quad (11)$$

The intuitionistic fuzzy sets proposed in [12] are generalized representation of fuzzy sets where each element is characterized by a membership and a non membership value.

An intuitionistic fuzzy set (IFS) in X is represented mathematically as given in Eq. (12)

$$A = \{(x, \mu_A(x), v_A(x), \pi_A(x) \mid x \in X\} \quad (12)$$

Where,
$\mu_A(x),\ v_A(x)\ :\ X \rightarrow [0,1]$

With the necessary condition
$0 \leq \mu_A(x),\ v_A(x) \leq 1.$

The second parameter which is hesitancy degree is can be defined as Eq. (13)

$$\pi_A(x) = 1 - (\mu_A(x) + v_A(x)) \quad (13)$$

Where the necessary condition of hesitancy degree is
$0 \leq \pi_A(x) \leq 1$

C. Proposed image representation using Intuitionistic fuzzy set

The intutionistic fuzzy generator is used for image reconstruction of intuitionistic fuzzy images [17], [18], [19]. In the proposed method instead of complete image, a patch Ψ_y and patch Ψ_x formed around the pixel y and x are considered as set A and set B respectively , where $y \in \delta\theta$ (boundary of target region) and $x \in \phi$ (source region). The patch Ψ_y which represents set A is IFS with membership function given as Eq. (14)

$$\mu_A(y) = \exp^{\left\{\frac{-(y-m)^2}{2\sigma^2}\right\}} \quad (14)$$

Where,
c - is mean of patch centered around pixel y on boundary
σ - is standard deviation (selected as 0.7)

The membership of set B is represented by Eq. (15)

$$\mu_B(x) = \exp^{\left\{\frac{-(x-m)^2}{2\sigma^2}\right\}} \quad (15)$$

The non membership of set A and B is represented by Sugeno non-membership function and is given as Eq. (16) and Eq. (17) where the value of $\lambda = 1$.

$$v_A(y) = \frac{1-\mu_A(y)}{1+\lambda * \mu_A(y)} \quad (16)$$

$$v_B(x) = \frac{1-\mu_B(x)}{1+\lambda * \mu_B(x)} \quad (17)$$

The hesitancy value for set A and B is defined by using Eq. (13) .

A similarity measure is crucial for measuring the similarity degree between two objects. Similarly, distance measure is a vital tool which is used to describe the differences between two sets and is duality of similarity measure. Yingjie Yang et al in [20] compared 2D and 3D distances as extended to IFS. Szmidt et al in [21] provided a generalization of existing 2D and 3D distance metrics as applied to IFS

Computational complexity of the algorithm should also be considered while selecting a distance metric where the quality is also not compromised. In this paper a generalization of 3D Sum of Absolute Difference (SAD) is used as a distance measure to find the similarity between IFS A and IFS B as given in Eq. (18).

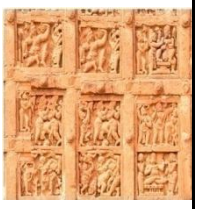
$$d_{n+1(A,B)} = \sum_{i=1}^{n}[abs(\mu_A(y_i)-\mu_B(x_i)) + abs(v_A(y_i)-v_B(x_i)) + abs(\pi_A(y_i)-\pi_B(x_i)) \quad (18)$$

The heritage sites all around the world have undergone damage due to a number of natural calamities, destruction due to war and damage from visitors, resulting in their damages. Thus many sites have been restricted for visitors and are declared as UNESCO world heritage sites.

An effort is made here to reconstruct the damaged images of Bishnupur heritage sites. A database is available in [22] where images of different temples of Bishnupur are catalogued. The heritage images are a challenge for reconstruction because of its high structure contents and uncertainties. The traditional exemplar based algorithm is structure driven and gives priority to the structures lying on the boundaries on region being inpainted. But the patch with highest priority may not be the suitable candidate for inpainting . This uncertainty is considered in the proposed IFS based inpainting algorithm .

IV. SIMULATION AND RESULT

The result of the proposed algorithm in reconstruction of 'Jorbangla' images is shown in Figure 4. The images jb1, jb6 and jb5 are obtained from 'Jorbangla' temple image from BHID database. Various portions of the 'Jorbangla' image are cropped to create the images for inpainting. Patch size of all three images is different.

Image Name	Original image	Mask of damaged region	Damage selection	Criminisi [5]	Proposed IFS based Inpainting
jb6					
jb1					

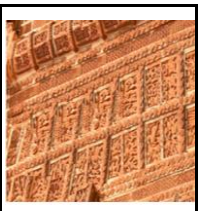
jb5					
	(a)	(b)	(c)	(d)	(e)

Figure 4: Inpainting result of Heritage images Bishnupur Heritage image database [2] (a) Original image (b) Mask (c)Damage selection (d) Reconstruction using [5] (e) Reconstruction using proposed IFS based method

For jb6 a patch size of 50X50 is selected. For the image jb1 patch size of 9X9 is selected whereas for jb5 the patch 25 X 25 is selected. The quality assessment methods for inpainting are broadly categorized as subjective and objective [23], [24]. The Objective methods can further be classified as full reference [25], [26], [27]. This type of IIQA method knowledge about original image before damage and inpainted image is required. In a full-reference metric proposed by Wang et al. in [28], assessment is done using modified SSIM index. This index is composed of three aspects: luminance, definition and gradient similarity which evaluates the blur artifacts produced during inpainting. This approach is suitable only when the reference image is available.

In this paper, a subjective analysis is conducted for the quality assessment of the inpainted region. A survey was conducted on 16 observers out of which 8 were female. All the observers had normal or corrected vision. The observers were selected on the basis of gender, age, profession and knowledge. The observers were provided with the inpainted results using existing and proposed method along with the original image to compare. The time limit was not set and they were allowed to observe for any duration of time before responding. This is done so as to remove existing lacunas in the subjective assessment such as fatigue of the observer, attention span and other environmental conditions. The questionnaire for observer's survey is shown is Table 1. The Qualitative analysis through subjective method is shown in Figure 5.

CONCLUSION

The problem of reconstructing heritage images is analyzed and a possible solution is proposed using intuitionistic fuzzy sets. The heritage images have high structure content with non uniform backgrounds. The use of IFS has been found to give better results than the existing algorithms.

The quality analysis of the existing and proposed algorithm is done using qualitative approach. The quantitative IIQA measures were give insufficient measures and were found to be inaccurate hence a subjective analysis is conducted. The subjective assessment is obtained through observer score and is more accurate as human perception is found to be the best judge. In cases where the object being removed is overlapping with another Instance and semantic segmentation can be used to separately label the object and remove it. Deep learning algorithms and artificial intelligence can be used to build human perception model to produce quantitative methods for IIQA.

Table1: Observer's survey for inpainted result

Sr. no.	Questionnaire for observer survey	Observer score (1-poorest, 2-poor, 3-satisfactory, 4-very

		good, 5-best)
1	Is the object marked as black color removed successfully? (1- poorest, 2-poor, 3-satisfactory, 4-very good, 5-best)	
2	How is the continuity of structures in the reconstructed region ? (1-Very bad, 2-Bad,3-Good,4-Very good, 5-Excellent)	
3	Does the reconstructed region mix well with rest of the picture? (1- poorest, 2-poor, 3-satisfactory, 4-very good, 5-best)	

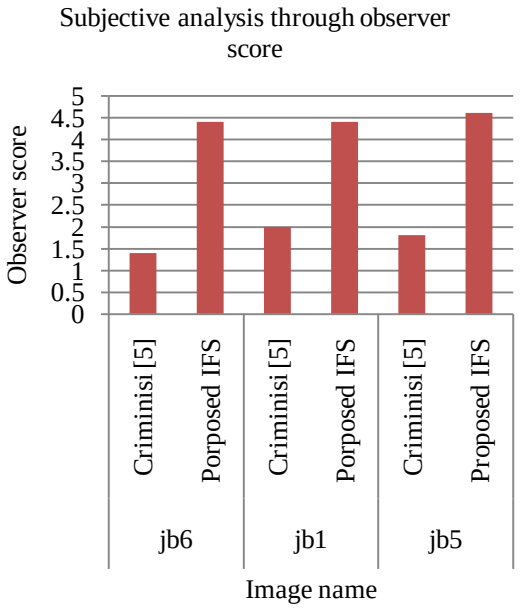


Figure 5 Subjective analysis through average observer score of proposed IFS based inpainting with the most popular algorithm Criminisi [5].

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A Comparative Analysis of ECG Signal De-Noising Using Different Methods

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***Abstract*—** Electrocardiogram (ECG) offers various scientific details on heart failure. High-quality ECG signals are still needed for proper diagnosis of cardiac disorders. Owing to several sources of noise, this signal needs to be denoised and displayed in a simple waveform. Noise causes can involve power line intrusion, external electric fields, spontaneous body motions, or respiration. In this article, numerous essential denoising methods are introduced and applied to actual ECG signals polluted with different amounts of noise. The identification of ECG signal disturbance and noise reduction is one of the most critical aspects of the evaluation and examination of multiple deceases. Signal processing plays an important part in the reduction of noise from the ECG signal. As we all note, the heart is diagnosed in the modern age with ECG. Here, the ECG signal is the recording of the electrical activity produced by the human heart. Now any time, owing to any electrical problem, there might be a risk of producing any inaccurate ECG signal information that is potentially too risky for the patient. There is also a need for certain efficient filtering software that can process the performance of the ECG signal and produce a true ECG signal to better diagnose human health. So in this article, we offer a comparative analysis of all current filters. Many of these processes are linked to machine learning. Machine learning is an essential aspect of the identification of cancer cells in blood images.

Simulation of a method for measuring non-stationary acoustic impulse responses by the NLMS algorithm

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Abstract:
In this work, we present a method of measurement of non stationary a coustic impulse response identified by the fast version of the Normalised Least Mean Square algorithm (NLMS),using professionalacoustic equipment. This measurement benchrealized in a deaf roompresents several tests of capability of adaptive algorithm to tracking the nonstationarities of true system to beidentified. This method of performance analysis of Stochastic Gradient type algorithms, in twotransient and permanent regimes, ispresented.
The testsof trackingcapabilityobtained are strongercompared to whatisencountered in real life and canbeused in several applications.

Key words: impulse response, acoustic channel, identification, adaptive algorithm, normalised least mean square, non stationary, tracking capability.

Prediction of Rainfall using Artificial Neural Network's Back Propagation Technique with Regression technique of Data Mining

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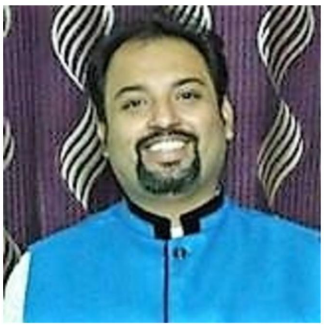
Abstract:

In this paper an optimized data regression model has been proposed to predict the Rainfall for the next day in one day advance of a city on the basis of few selective environment parameters like maximum and minimum day temperature, water vapour, air speed, air direction, air pressure. Data regression technique of data mining approach has been used to build up the data model. Weights of the input to hidden layer and hidden to output layer of neural network have been updated on the basis back propagation technique of Artificial Neural Network. Data model has been trained on a pre-set data collected from the meteorological department of the city. The proposed data model is capable to deliver result with 98.57% of accuracy.

Key words: Artificial Neural Network, Regression, Back Propagation, Data Mining.



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