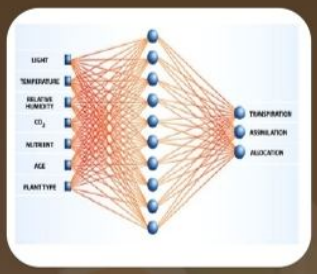
ISSN NO
2454-7719

International Journal of Computer Research & Technology (IJCRT)

A Blind Peer Reviewed Half Yearly Research Journal

Vol -8 Issue -2
July-December,2023



Special Issue

Proceeding of the 9th National Conference on "Emerging Trends in Computer & Information Technology" held on 15th September 2023

Editor in Chief
Prof. Dr. B.H. Barhate

।। विद्या दानम् महत् पुण्यम् ।।
Tapti Education Society's
Dept. of Computer Science and Information Technology
Bhusawal Arts Science & P.O.Nahata Commerce College,
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NAAC Reaccredited (*Fourth Cycle*) "A" Grade with CGPA 3.17
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IJCRT
ISSN 2454-7719
International Journal of Computer Research & Technology
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023

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About Publisher of IJCRT

Bhusawal, as recalled and noted down in records has a prominent place on the map of the nation; proudly housing two ordnance factories, a thermal power station in the region, and itself being one of the major railway junctions of Central Railway from where, residents proudly say, you may visit any corner of India. A mixture of farmers, tribal people from adjoining are as with the servants from all over India, Bhusawal serves as a slice of the nation; and honorably has unity in diversity. It is 25kms away from the district, Jalgaon, famous as a city of gold; and few Kms away from Yawal and Raver tehsils, famous all over nation for bananas. It is the only "A" graded Municipal Corporation in the district. Another identification as well as benefit of thecity is that it is situated at the bank of the Tapi river, the only river that flows from east to west. The city of Bhusawal has been ahome place for the British authorities, and it is famous for railways since British rule. It is historically remarkable for the grave of Major Robert Gill, who invented world famous Ajanta caves; and for the tomb of Sant Gadgebaba, a famous and truly a leading social reformer in Maharashtra. The world famous Ajanta caves are just 60kms away from the city. It is believed that the parental home of Rani Laxmibai (famous as Queen of Jhansi) is situated at Parola, 50kms away from the city. Bhusawal is also famous for many mythological stories like that of Shravana, coming from Ramayana who is said to be killed at Hartala, which is near to the city. Besides, the city was once famous in Bollywood for film distribution companies as well known "Rajashri" pictures.

Summing up the physiognomies of the city, Bhusawal stands as a glorious city in the eyes of everyone. However, it was the time-besides all assets of the city-when Bhusawal was a degenerated city in terms of higher education even after a long time from independence. There were few schools imparting high school level education but none of the colleges. It was only in1958, under the motivation of Late Honorable Madhukar rao Chaudhari, ex-speaker of Maharashtra Legislative Assembly, a groupof social well-wishers came together and established the Tapti Education Society in 1958. Simply having the wish in mind to provide potential students higher education facilities near their home, they started the Bhusawal College of Arts and Commerce in 1963. Their philanthropic view may be seen in the motto: *Vidya danam mahat punyam.* Yet difficulties were innumerable. The college with two faculties was started in the place of rent of a high school in the city.

It is wisely said that *vidya danam* is *mahat punyam*. The dedicated faculty, the sublime view of the management soon started to produce good academicians. Inspired by the results the trust purchased a barren land of 7 acres out of the city which is soon to be developed as a centre of imparting quality higher education in the area. The barren land with sustaining hard work, and devotion was then transferred into a naturally beautiful campus. The college is then shifted to a new place in 1972 with the introduction of Science stream. The philanthropist Late Mr. Poonamchand Nahata donated to the college, hence the college is renamed and which today itself is a brand as **Bhusawal Arts, Science and Poonamchand Omkardas Nahata Commerce College, Bhusawal.**

The college is then marching forward with a goal to **creatively contribute the society through the pursuit of learning at higher level of excellence**. The institute has contributed in many ways for economic, social and cultural uplift of the society by offering quality education. Since the inception it has been known for academic excellence, inventive pursuits and athletic dynamism. The college is a multi-stream institute catering to the needs of the young minds primarily from the rural areas.Our society runs not only the college but also the Institute of Management and Career Development and much sought Tapti Public School (affiliated to CBSE Board, New Delhi) within a minimum space of 7.3 acres. The institute is developing vertically in all of the fields.

The Tapti Education Society's, Bhusawal Arts, Science and P. O. Nahata Commerce College was accredited as **four stars (****) in 2001**, reaccredited as **"A" Grade** with CGPA **3.28 in 2008 and reaccredited 3rd cycle as "A" Grade with CGPA 3.30 in 2015,** as the **first College** in Kavayitri Bahinabai Chaudhari North Maharashtra University jurisdiction. It is also the first college to get register for the fourth cycle of accreditation in the jurisdiction of the university and reaccredited as **"A" Grade** with CGPA **3.17 in 2023 with new framework**. It is also recognized by UGC as **College with Potential for Excellence**. Recently, the society is certified as ISO 9001:2008 institute. Our institute is one of the renowned institutes in the adjoining area. We welcomed the upcoming students from rural areas who made remarkable progress and set theirs and college's image in society. Many of the students of this institute secure top position in various fields. This make us feel great. The college achieves 'A'grade in three subsequent cycles of Re-accreditations and it brings the college towards autonomous status.

Initially the college was affiliated to the Pune University, and got permanent affiliation in 1990. Since the inception of Kavayitri Bahinabai Chaudhari North Maharashtra University in 1991, the college is permanently affiliated to the same. The university spreads all over three districts: Jalgaon; Dhule; and Nandurbar, being on the boundaries of Gujrat and Maharashtra and one being the district of tribal people. The university is trying hard to uplift the downtrodden, while keeping in touch with the rapidly changing world.

Last but not least, the college has the advantages of developing youth coming from rural area, and forming them into sensible youth as they are mixed in the cosmopolitan society. The college is aware that every coin has two sides: hence students coming from rural areas have inferiority complex, their vernacular background being most disadvantage for them. The college has faced challenges to improve their communication skills, to boost their confidence to bring them into modern current while making them aware of great Indian culture. As the college has celebrated its golden jubilee, it will be a golden, in fact aplatinum moment for us when the students coming from different backgrounds will be essentially Indian serving for the welfare of humanity. With this view the college is making progress towards quality excellence so that it will be a lead college that will stand as a light house for the bewildered.

IJCRT
ISSN 2454-7719
International Journal of Computer Research & Technology
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023

PublishedBy
Department Of Computer Science and I.T,
TES's Bhusawal Arts,
Science and P. O. Nahata
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The International Journal of Computer Research and Technology "IJCRT" is issued half yearly.
The College assumes no responsibility for the statements and opinions advanced by contributors.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-01

Machine Learning Methods for Sentiment Detection in Code-Mixed Languages: A Review

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Abstract -*Code-mixing on social media and networking platforms provides a convenient means for people to express themselves globally with minimal effort. However, these expressions can often include rude language, offensive comments, and trolling, which can disrupt social coherence. To address this issue and curb the spread of negative sentiments, it is essential to analyze such instances thoroughly. This paper delves into the efforts made by researchers to analyze sentiments in code-mixed languages. It comprehensively covers various stages of sentiment analysis in code-mixing, encompassing dataset preparation, feature extraction techniques, and classifier implementations. The study presents a generalized model for preparing datasets tailored to sentiment analysis in code-mixed languages. It addresses pertinent issues, such as class imbalance and the inter-annotator agreement approach. Moreover, the paper highlights the best-performing classifiers and conducts a comparative analysis with other classifiers, offering valuable insights to researchers in this rapidly evolving research area. To aid comprehension, the study utilizes charts and tables to visualize the analysis and interpretation of the comparative study. This extensive survey includes relevant research articles in the domain, and its outcome is poised to significantly benefit researchers and developers seeking to grasp the technical nuances of sentiment analysis in code-mixed languages. The generic functional approach of this study can serve as a valuable resource for the development of sentiment analysis models in code-mixed languages.*

Keywords— *Code-mixing, Machine learning, deep learning, SVM, MNB, RFC, DTC, CNN, LSTM, etc.*

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I. INTRODUCTION

In the twenty-first century, social media platforms such as YouTube, Facebook, Twitter, WhatsApp, Instagram, and others have become significant drivers of the continuous growth of Internet users worldwide. In India, statistics indicate that approximately 448 million people, roughly 32% of the total population, are active social media users. Additionally, last year saw a notable increase of 31.2% in new social media users [1]. These figures underscore the substantial reliance of the Indian population on social media platforms. Indians extensively utilize these platforms to express their emotions, ideas, and opinions on a wide range of topics. Indeed, the expressions shared on social media platforms are often casual in nature and can take various forms such as comments, reviews, posts, tweets, etc. These online platforms offer individuals the freedom to communicate in either their native language or English, employing monolingualism to express their views on state or national issues. However, a significant portion of the Indian population faces challenges expressing themselves fluently in English, while using native languages might limit the reach of their views on national matters. To address this dilemma, many individuals resort to using mixed languages [2], code-mixing, or code-switching as a solution.

A mixed language refers to a language that incorporates elements from two or more different languages, typically spoken by a bilingual group. On the other hand, code-mixing or code-switching refers to the practice of mixing two or more languages in speech or writing. Linguists often use these terms interchangeably, considering them to be essentially the same. However, there is a subtle distinction between code-switching and code-mixing. In code-switching, the speaker intentionally switches between languages to make a point or convey a specific meaning, whereas in code-mixing, the language mixing occurs without any deliberate intention due to a lack of vocabulary in one of the languages. Table 1 provides examples of code-mixed languages along with different sentiments expressed in them. Using mixed languages or code-mixing is generally more straightforward than strictly adhering to a monolingual approach and it allows for more productive and creative expression in real-time [3]. As people engage in day-to-day conversations that involve multiple languages and heavily utilize them on social media platforms, code-mixing becomes more prevalent. The use of code-mixed languages has contributed to an increased number of social media users worldwide. In the case of India, several factors contribute to the potential growth in social media users, such as the existence of 22 scheduled languages, the freedom of speech and expression granted to all Indians, the substantial proportion of the population below the age of 35 (65%), and the ease with which Indians use code-mixed languages. These factors collectively contribute to the popularity and expansion of social media usage in the country.

Views and comments on social media platforms can be both positive and negative. Negative comments often include hate speech, offensive language, and absurd statements that can harm individuals or communities. Unfortunately, social media also provides a platform for violent individuals to publicize their actions. Several incidents around the world have demonstrated the dangerous consequences of such negative content. In India, in 2020, an offensive Facebook post about Prophet Muhammad played a critical role in inciting brutal conflicts in Bengaluru. This is just one example, as there have been other incidents with similar outcomes [4]. In Germany, attacks on refugees have been strongly linked to anti-refugee Facebook posts [5]. Myanmar experienced the use of social media by military leaders and Buddhist nationalists to insult the Rohingya Muslim minority, contributing to further tensions [6]. In Sri Lanka, anti-Muslim riots were stimulated by rumors spread online in 2018 [7]. In the United States, in 2015, an attack on black clergy by white supremacists was part of the online self-learning process [8]. These are just a few of the cases where hate speech on social media has led to crowd violence, lynching, communal riots, and other dreadful incidents. In response to these alarming incidents, many countries have implemented strategies to address hate speech content on social media. The Law Commission of India, for instance, has introduced non-legal measures to monitor the dissemination of hate speech [9]. The aim is to mitigate the harmful effects of such content and promote a safer and more harmonious online environment.

Indeed, detecting hateful content from social media text is a crucial task. While significant work has been done to detect hate content in social media text written in monolingual languages, there has been relatively little effort made in detecting such content in code-mixed social media text. Researchers have focused on detecting hate content in various monolingual languages such as English, Danish, Russian, German, and Indonesian. Similarly, in the context of Indian languages, languages like Hindi, Bangla, Tamil, Telugu, and others are considered to have hate content. However, code-mixed languages present an additional layer of complexity. For example, languages like Chinese-English, Hindi-English, Bengali-English, Tamil-English, Telugu-English, and Malayalam-English are considered in hate content detection and sentiment categorization tasks. The combination of two or more languages in code-mixed text introduces linguistic variations, unique expressions, and grammatical patterns that make it challenging to develop effective algorithms and models for sentiment analysis. Following code-mixing unique characteristics makes sentiment analysis in code-mixed languages a demanding task.

Some of the characteristics of code-mixed are:

i. Difficulty in detecting the start and end of a sentence
ii. Word order is not followed in a sentence
iii. Mixture of grammar of mixed languages
iv. Variations in spellings, high proportion of spelling mistakes
v. Creative spellings using abbreviations [10].

This survey paper holds significant value for several reasons. Firstly, it provides detailed information about constructing code-mixed datasets that encompass different sentiments, including positive, negative, and hate

speech, as well as non-hate speech. This is crucial as it facilitates the creation of new datasets in code-mixed text, helping researchers with data preprocessing and labeling techniques specific to sentiment analysis. Secondly, the paper discusses various techniques for extracting and selecting features. This comprehensive insight enables researchers to make informed decisions when choosing the most suitable feature extraction technique for their code-mixed text analysis tasks. Thirdly, the paper presents experimental results involving a diverse range of machine learning, deep learning, and transfer learning classifiers. This extensive evaluation allows novel researchers in the field of classifiers to gain a panoramic view of the entire landscape, understanding the strengths and weaknesses of different classifiers in handling code-mixed text sentiment analysis. By covering these essential aspects, the survey paper not only contributes to advancing research in code-mixed language sentiment analysis but also serves as a valuable resource for researchers, providing them with essential guidance and understanding of the methodologies and tools available in this field. This holistic approach makes the paper a significant reference for the research community, aiding in the progress of sentiment analysis in code-mixed languages.

This paper is organized as follows: Section 2 comprises tools, annotation methods, and social media platforms used to create datasets in code-mixed languages. This section also has feature selection techniques and different classifiers used to categorize the datasets. Section 3 presents the results and discussions, and finally, the conclusion is discussed in Section 4.

Table 1. Code-mixed Examples along with sentiments

Code-mixed Language	Examples of Code-mixed language	Sentiment
Bengali-English ***English Translation***	Script ta khub tiring chilo amar mote, aro onek better hote parto *The script was very tiring according to me, could have been much better*	**Negative**
Tamil-English ***English Translation***	yematha arambichitanunga nambathinga *(It is unbelievable to start cheating)*	**Not Offensive**
Hindi-English ***English Translation***	Aisa PM naa hua hai aur naa hee hoga. [Aditya Joshi, 2016] *Neither there has been a PM like him, nor there will be*	**Positive**

II. CODE-MIXED DATASETS

As mentioned previously, the task of sentiment analysis is still untouched in many code-mixed Indian languages and code-mixed foreign languages. In India, out of 22 scheduled languages, only 5 code-mixed datasets are available for sentiment analysis. This section will explore different tools and techniques used to create datasets in code-mixed languages. Along with this, it will also discover the classifiers and features used for categorising the dataset into sentiments.

Vyas et al., 2014 [11] have developed a Hindi-English dataset using popular Facebook public pages of Amitabh Bachchan, Shahrukh Khan, Narendra Modi, and the BBC Hindi news. The collected posts were pre-processed and thus the dataset has 6,983 posts, which are then annotated. Annotation is done at the language, word, transliteration, and POS levels. On the annotated dataset, the authors applied language identification, normalization, and POS tagging.

In 2015, Sophia and Zhongqing [12] used the Chinese social media platform Weibo to collect posts in English, Chinese, both, and mixed languages. The posts were collected from different domains such as: life, finance, service, celebrities, products, and politics. From the collected dataset, noise and advertisement posts were removed. Annotation is divided into five categories: happiness, sadness, fear, anger, and surprise using a designed annotation tool. To check the annotation quality, 1000 posts were annotated by two people, and then inter-annotator agreement between the posts was calculated using Cohen's Kappa coefficient. From the collected dataset, 50% of the data is considered as training data and the rest is considered as test data. Unigrams for each post were extracted as features. FudanNLP is used for segmenting Chinese words. A Maximum Entropy (ME) algorithm is used for training and is trained using extracted unigrams. Experimentation is done with the MALLET Toolkit.

Aditya Joshi et al., 2016 [13] have performed sentiment analysis on a Hindi-English code-mixed dataset into three classes: positive, negative, and neutral. The dataset has comments from the Facebook pages of two popular Indian icons: Narendra Modi and Salman Khan. Their pages have millions of followers and have lots of comments. The comments in Roman script and in English sentences were removed. Comments having a length over 50 words were also eliminated. The comments with more than one sentence were also removed. Then annotation is applied by two annotators to the above classes. The

final dataset has 15% negative, 50% neutral, and 35% positive comments. On the developed and annotated dataset in the code-mixed Hindi-English dataset, Aditya Joshi et al., 2016 applied sub-word level representation. In the sub-word level feature, the individual total of the words in a given sentence is counted and combined. This score is used to determine to which class the sentence belongs, i.e., positive, negative, and neutral. This character embedding is fed to the CNN-1D layer with a filter and a bias, resulting in a sub-word level feature map. The sub-word level is submitted to the globalMaxPooling layer, which in turn is submitted to the LSTM layer, so that it can predict the class of the sentence. The Subword-LSTM system gives an F-score of 0.658, which is better than Char-LSTM, which has an F-score of 0.511.

Souvick et al., 2017 [14] performed sentiment analysis by classifying the English-Bengali posts into positive, negative, and neutral classes. They used a dataset from a shared task on POS tagging of transliterated social media text, conducted by ICON-2015. The dataset has Facebook posts in English-Bengali with a few Hindi words, which are annotated by two annotators into the above mentioned classes. The inter-annotator agreement is measured using the Kappa co-efficient. The posts were preprocessed by removing punctuation, multiple character repetitions, and expanding the abbreviations. At a later stage, different features were extracted. Four sets of lists of words were found by matching with Sentiwordnet, opinion lexicon, English sentiment words, and Bengali sentiment words. Other features were also extracted, like: the number of colloquial Bengali sentiment words; bad words; all uppercase words; exclamation points; question marks; smiley matches; character repetitions; and part-of-speech tags. The experiments were performed using WEKA by dividing the dataset into training and testing sets. The features extracted were grouped into word-based, syntactic, and style-based. Experiment shows that a combination of word-based and syntactic features produces the best results.

In the year 2017, a Shared task named as SAIL (Sentiment Analysis of Indian Language) [15] conducted with the goal to identify the sentiment categorization of the code-mixed Hindi-English and Bengali-Hindi-English languages. The common Bengali and Hindi words in Roman format were searched and collected. These common words were then searched using the Twitter4j API and tweets were collected. The incomplete tweets, tweets not having Bengali or Hindi words, and spam tweets were totally removed. Hashtags and URLs are kept as it is. The labelling of the tweets into positive, negative, and neutral categories is done manually. The dataset is split into training and test sets. The authors performed a random baseline system with a macro average f-score of 0.331 and 0.339 for the Hindi-English and Bengali-Hindi-English datasets, respectively. A total of 40 participants registered, but only nine teams have submitted results. The techniques used by the teams are discussed below.

Experimental setup performed by participants: Team, "BIT Mesra" [15], participated only in predicting sentiment in the Hindi-English dataset. Before feature extraction, they preprocessed the tweets by removing words with URLs, UN language tags, hashtags, and user mentions. Along with this, an Emoji dictionary was created with sentiment tags. Features like unigram and bigram were prepared on which the machine classifiers like SVM and Naive Bayes are trained. The team got an F-score of 56.4 and placed second. The team "NLP CEN AMRITA" [15] has used different distributional and distributed representations. They used a document term matrix with N-grams varying from 1 to 5 for the representation and Support Vector Machines (SVM) as a classifier to make the final prediction. Using the linear kernel, their system performed well for n-gram range 5 and minimum document frequency 2. The team "CFIL" [15] used simple deep learning for sentiment analysis on code-mixed data. The fastText tool is used to create word embeddings on sentiment corpora. Additionally, convolutional neural networks were used to extract sub-word features. A bi-LSTM layer is used on word embedding and sub-word features, together with max-pooling at the output, which is again sent to a softmax layer for prediction. No additional features are used, and hyper-parameters are selected after dividing the training corpus into 70% and 30%. The "Subway" [15], team submitted systems for the HI-EN dataset only. Initially, words other than HI and EN tags are removed during the cleaning process. Then, a dictionary with bi-grams and tri-grams is collected from training data, and sentiment polarity is annotated manually. The TF-IDF scores for each matched n-grams are calculated, and weights of 1.3 and 0.7 are assigned to bi-grams and tri-grams, respectively. Finally, the Naive Bayes classifier is used to get the sentiment.

Pruthwik Mishra et al. [16] named their team "IIIT-NBP", and they got the first rank with a macro average f-score of 0.569 for the HI-EN dataset and for the BN-EN dataset 0.526. They used different features for both datasets, such as TF-IDF vectors for character n-grams ranging from 2 to 6, and GloVe word embedding with 300 dimensions. On the extracted features, two models were applied: the first is an ensemble model having classifiers such as linear SVM, logistic regression, and random forest, and the second is a linear SVM. Along with this, the authors also applied MultiLayer Perceptron (MLP), Bi-LSTM trained using Glove, and TF-IDF. The team JU_KS [17] used n-gram and SentiWordNet features. For the Bengali language, they collected 1700 positive and 3750 negative words, and for the English language, 2006 positive and 4783 negative words were collected. Finally, the Naive Bayes classifier is used to classify the tweets into the mentioned

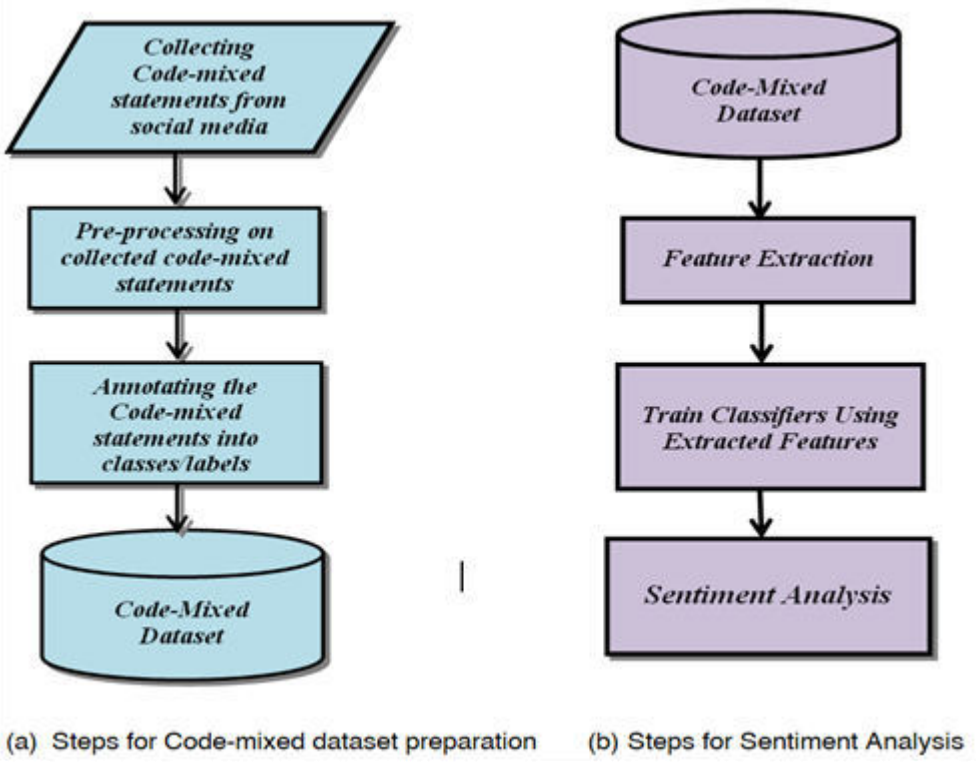
categories. With an F-score of 50.4 for Bengali-Hindi and 56.2 for Hindi-English, the team achieves the 3rd rank.

Soumil Mandal et al. created a Bengali-English code-mixed dataset for sentiment analysis in March 2018 [18]. For data collection, they created a list of positive and negative Bengali words. With the help of these words, tweets were collected using Twiter4j. Around 89,000 tweets were collected, out of which spam, incomplete tweets, and tweets with conflicting sentiments were removed. Thus, after filtering, 10,000 tweets were available. Out of these, 5000 code-mixed tweets were manually selected. Annotation is done by humans, and it is divided into two stages. In the first stage, a single annotator with Bengali as their mother tongue and a computer science background is used, and in the second stage, five experts carry out the final evaluation process. These tweets are annotated using a hybrid system. The newly developed hybrid system has a rule-based and supervised method for language and sentiment tagging. In language tagging, a tweet is labelled at word level as: Bengali (BN), English (EN), or Unknown (UN). In sentiment tagging, a tweet is labelled as positive, negative, or neutral. In the supervised method, different classifiers such as Gaussian Naive Bayes (GNB), Bernoulli Naive Bayes (BNB), Multinomial Naive Bayes (MNB), Linear Regression (LRC), and Stochastic Gradient Descent (SGDC) were used. Using a manually annotated dataset, they trained these classifiers and found that SGDC got the best F1-Score of 78.70.

For sentiment analysis, Madan and Arpita, 2018 [19] used a code-mixed Hindi-English dataset developed by Aditya Joshi et al., 2016 for sentiment analysis. The dataset is preprocessed by removing punctuation, stop-words, and lowercasing the sentences. Word unigrams, word bigrams, and character trigrams were extracted as features. Machine learning classifiers, SVM and MNB, were trained using word unigram and word bigram features. Character trigrams were used as a sub-word feature for training the LSTM network. The authors developed a model by collaborating (Ensemble) machine learning model (MNB) and a deep learning (LSTM) model. MNB is trained using word n-grams and for training LSTM, character trigrams were used. The outputs of both these models were used to categorise the sentences into positive, negative, and neutral classes. The ensemble approach's results were compared to SentiWordNet [66], Vowel-Consonant [18], and Sub-word composition [13] models. The result of the ensemble approach is the best among all and gives an F1-core of 0.661.

Aditya Bohra et al., 2018 [20] constructed the dataset containing tweets in Hindi-English code mixed. Tweets are collected by picking hashtags and keywords that are inclined towards hate speech using the Twitter Python API. After collection, the process of cleaning is applied by removing the timestamp, URL, text, user, re-tweets, replies, full name, id, and likes. Later on, tweets in pure English or pure Hindi language were removed. Due to this

Figure 1:



Generalized model / Structure to analyse sentiments from Code-mixed languages

thorough processing; they got the dataset with 4575 code-mixed tweets. In the next step, annotations are being done at two levels: word level and hate speech or normal speech. At the word level, annotation is done as per language, i.e., three tags were applied: "eng", "hin" and "other" as per the words in the tweets. In the hate speech or normal speech annotation, 1661 tweets are annotated as hate speech and 2914 tweets are annotated as normal speech. The process of hate speech or normal speech annotation is done by two human annotators. The quality of annotation is calculated using inter-annotator agreement (IAA). For extracting the features, they used five different ways, such as: character n-grams, word n-grams, punctuation, negation words, and Lexicon. For character n-grams and word n-grams, they applied the n-gram range, varying from 1 to 3. In the case of punctuation marks and negation words, the same strategy is used. For punctuation, the number of times punctuation occurs in a sentence is counted, and for negation words, the number of times a negation word occurs in a sentence is counted, and thus both are considered as separate features. Negation words are taken from Christopher Pott's sentiment tutorial. In the Lexicon-based feature, 177 Hindi and English hate words were detected and used as a feature. On these extracted features, two supervised machine learning approaches are implemented as: SVM and RFC. The extracted features are huge in number, so chi-square feature selection was implemented, and it reduced the size to 1200 vectors. SVM with character n-gram and with five features altogether, almost produces the same accuracy of 71.6. RFC gives the highest accuracy of 69.9 with word n-grams as compared to other features.

Shalini et al., 2018 [21] created a code-mixed Kannada-English dataset using Facebook comments. They used the Graph API to crawl comments and then annotate them into positive, negative, and neutral sentiments. Alongside authors used the SAIL 2017 dataset for sentiment analysis. The dataset is divided into train (80%) and test (20%) sets and experimented with different models such as: SVM trained using Doc2Vec, Fasttext, CNN, and Bi-LSTM. All the models were tuned using hyper parameters and the results were measured in terms of accuracy. For the Hindi-English and Bengali-English datasets, the Bi-LSTM model produced the highest accuracy of 60.20% and 72.20%, respectively, whereas for the Kannada-English dataset, the CNN model got the highest accuracy score of 71.50%.

Kamble and Joshi, 2018 [22] use the dataset created by Aditya Bohra et al. They downloaded 3849 tweets using the Twitter API, of which 1436 were hateful. The same feature extraction techniques and machine learning algorithms were implemented and the results are compared. In another way, the team created domain-specific word embeddings. Domain-specific word embeddings represent the semantics of hate speech. For creating the domain-specific word embeddings, the Twitter API is used to search for tweets having Hindi profane words. It creates a dataset with 255,309 tweets; using this tweet dataset, word-embeddings are trained. For training, the word-embedding gensim library is used. Also, the average quantity of Hindi words in a tweet is counted using the Google Translate API. Three different deep learning models were used and hyperparameters were tuned on these domain-specific word-embeddings: CNN-1D, LSTM, and BiLSTM. For the CNN-1D model, filter size 3 is used, and convolve over the embedding creates feature maps. Following this, a globalMaxPooling layer with a droupot of 0.5 and sigmoid as an activation function is applied, which results in a single feature vector. The second model LSTM feeds with word-embeddings, resulting in the returned sequences that are further inputted to the globalMaxPooling layer, which is passed to the output layer with a sigmoid activation function. As like LSTM, BiLSTM is also feed with word-embeddigns, but the sequences are processed in both directions and the results of both the directions are combined together which are further passed to globalMaxPooling layer, and finally passed to output layer with sigmoid activation function. After comparing the results, it is found that to capture the sentiments, domain-specific word-embeddings help and improve the results sustainably.

Mathur et al., 2018 [23] designed a Multi-Input Multi-Channel Transfer Learning-based Model (MIMCT) to detect offensive tweets in the Hinglish language. The authors used an English offensive tweet dataset collected from CrowdFlower, which is used to pre-train the MIMCT model. They also designed Hinglish offensive tweets collected using the Twitter Streaming API. The collected tweets are selected from the Indian subcontinent and manually annotated. In the preprocessing of URLs, punctuation, user mentions, and numbers were removed. Hash tags and emoticons were converted into their text. Words which provide less information were removed using NLTK's stopwords corpus. The text is lowercased followed by transliteration and translation into English words using the Hinglish dictionary. Thus, the tweets from both the datasets were distributed into English Offensive (EOT) and Hinglish Offensive (HOT) and tweets were labelled as non-offensive, abusive, and hate-inducing. For experimentation purposes, an 80:20 train-test split was applied. For baseline, SVM and RF machine learning models were implemented by tuning their hyperparameters. For training machine learning classifiers, features were extracted using character n-grams, bag of words, and TF-IDF countvector. CNN and LSTM transfer learning models were trained using 10-fold cross validation by identifying the best hyper-parameters. The MIMCT model is a combination of CNN and LSTM, which is trained using different word embeddings such as Glove, word2vec, FastText and their concatenation. In the

baseline, SVM and RFC were implemented with character n-grams, TF-IDF and a bag of words. The results of the MIMCT model were compared with baseline models and found MIMCT achieved good results.

Santosh and Aravind, 2019 [24] experimented sentiment analysis on Hindi-English using dataset created by Aditya Bohra et al., 2018 They downloaded the dataset containing 3800 tweets, of which 2300 are labelled as hate and 1500 are labelled as non-hate tweets. In the preprocessing stage, they remove the '#' and separate the token. Further URLs, user-mentions, stop words, emoticons, and punctuation were also removed. The same baseline is followed and implemented, which is used by Aditya Bohra and his team. In addition to the baseline, phonemic sub-words were used as a feature to implement the sub-word level LSTM model and the hierarchical LSTM model. Experiments are performed using 10-Fold Cross Validation and accuracy is measured using, recall and F1-scores. The extracted features using baseline are huge in quantity, hence the chi-square feature selection

Table 2: Datasets in code-mixed languages

Year	Language Dataset	Social media platform for Dataset / Dataset details	Pre-processing on raw data	Dataset Size	class / labels	Annotators & Method for Inter-annotator agreement	Class balance / Class Imbalance
2014 [11]	Hindi-English	Facebook	Username were removed, but the names in the comments were kept.	6,983	Languages: Hindi, English	02 Linguist Annotated	Not Applicable
2015 [12]	English, Chinese, Both, and Mixed languages	Weibo	Advertisement and noise posts are deleted	1000	Happiness, Sadness, Fear, Anger, Surprise	02 persons Annotated Cohen's Kappa coefficient	---
2016 [13]	Hindi-English	Facebook	Roman script comments, English sentences, Comments having more than one sentence, comments over 50 words, eliminated.	3879	Positive, Negative, Neutral	02 persons Annotated. Cohen's Kappa coefficient	Classes are highly Imbalanced
2017 [14]	English-Bengali	Facebook	Punctuations and multiple character repetitions were removed, abbreviations expansion.	882 posts	Positive, Negative, Neutral	02 persons Annotated Kappa co-efficient	---
2017 [15]	Hindi-English and Bengali-English	Twitter4j API	Incomplete tweet, tweet not having Bengali or Hindi words and spam tweets were removed. Hashtags and URLs are kept.	Hindi-English Training :12936 Test: 5525 Training :2500 Test: 3038	Positive, Negative, Neutral	Manually annotated	---
2018 [18]	Bengali-English	Twitter4j API	Tweet having minimum length as 8 and minimum 5 Bengali words were kept, rest are omitted. spam tweets, incomplete tweets, tweets with conflict sentiments were removed	5000	Language tagging: BE/EN/EU Sentiment tagging : positive or negative or neutral	Manually annotated	---
2018 [20]	Hindi-English	Twitter	Removing URLs, Punctuations and replacing User Names and Emoticons	4575 tweets	Hate speech , Normal speech	02 persons Annotated Cohen's Kappa coefficient	Classes are Imbalanced but nothing is mentioned.
2018 [21]	Kannada-English	Facebook	Comments in native script and mixed script were removed	7005 comments	Positive, Negative, Neutral	Manually annotated	Classes are Imbalanced

2018 [23]	English & Hindi-English	English: Online site (CrowdFlower), Hindi-English : Twitter	URLs, punctuations, user mentions and numbers were removed. Hash tags and emoticons were converted into its text. Text is lowercased and transliteration and translation is done.	14509 3189	Non-offensive, Abusive, Hate-inducing	Manually Annotated Cohen's Kappa coefficient	Classes are not severely imbalanced
2019 [25]	Hindi-English	Bohra et al.,2018, [20] Mathur et al.,2018, [23] shared task HASOC Dataset	Removing URL's, Usernames, Hashtags, emoticons, punctuation marks, unwanted characters, and extra white spaces. Text is lowercased.	10000	Hate, non-hate	Manually Annotated	No Class Imbalanced
2020 [26]	Hindi, English and Hindi-English	Facebook and Twitter	Removing the RT, #, URLs, Twitter Mentions, Emoji's, stopwords and Smileys. Tweets were tokenized, Stemmed.	2000 tweets	Task A : HOF or NOT Task B : HOF into : HATE or OFFN or NOT Task C : HOF into TIN or UNT	03 students Annotated Cohen's Kappa coefficient	No Class Imbalance
2020 [27]	HASOC-Offensive Language Identification-Dravidian CodeMix Malayalam-English Tamil-English	YouTube & Helo App	*No details were mentioned.*	Task1: 3600 code-mixed Malyalam comments Task2: 4000 Manglish & 4000 Tanglish	Task1: offensive or not-offensive Task2: offensive or not-offensive	No information Available Krippendorff's alpha	Task1 has imbalance dataset of Malayalam-English
[28]	Sentiment Analysis of Dravidian Languages in Code-Mixed Text Malayalam-English Tamil-English	YouTube	Comments other than code-mixed were totally removed Comments with less than 5 and greater than 15 words were removed. Emoticons, emoji's were removed	6739 comment 15744 comment	Positive, Negative, Neutral, Mixed feeling and other language	Manually Annotated Krippendorff's alpha	Classes were highly imbalanced.
2021 [65]	Telugu-English	Twitter & Facebook	URLs, markup text and comments less than five words were removed	19,857 sentence	Positive, Negative, Neutral	Manually annotated using Telegram Bot API Cohen's Kappa coefficient	Positive and Negative classes have near about equal distribution but neutral sentences are less in comparison

Table 3: Showing Factors - Feature Extraction, Classifiers and Results

Year / Team name	Further processing on Dataset	Feature Extraction techniques	Classifiers / Models	Results
2015 [12]	----	Unigrams for all words, Unigrams for Chinese, Unigrams for English, Combine results of Chinese and English	Maximum Entropy	Combine results of Chinese and English classifiers gives better performance
2016 [13]	----	Character-level features	Char-LSTM, Subword-LSTM, MNB, SVM	Subword-LSTM performs better than Char-LSTM, MNB and SVM
2017 [14]	----	Word based features, Syntactic features, Style based features	Machine learning algorithms, Artificial neural network	Artificial neural network model performed best. Word based and syntactic features yield the best results.
2017 [15]	----	*No details were mentioned*	Random baseline system is implemented.	More instances in Hindi-English than Bengali-English dataset, which directly influence the result.
2018 [18]	----	Word N-Grams, Negation words, Tagged words, Tagged phrase, Tagged acronyms, SentiWordNet, SOCAL lexicon and NRC Emotion Lexicon.	GNB, BNB, MNB, LRC and SGDC	SGDC got the best F1-Score of 78.70
2018 [19]	Used dataset created by Aditya Joshi et al., 2016. Punctuations and stop words were removed. Sentences were lowercased.	Word unigram, word bigram, character trigrams.	SVM, MNB, LSTM, Ensemble approach.	In Ensemble approach, MNB model assist to overcome shortcomings of LSTM model.
2018 [20]	----	character n-grams, word n-grams, Punctuation, negation words and Lexicon	SVM and RFC	SVM with character n-gram and with other features performed well.
2018 [21]	----	Doc2Vec	SVM trained using Doc2Vec, Fasttext, CNN and Bi-LSTM	For Hindi-English and Bengali-English dataset Bi-LSTM and for Kannada-English CNN performed well
2018 [22]	Used dataset created by Aditya Bohra et al.,2018 Downloaded 255,309 tweets having Hindi cuss words	Downloaded tweets were used to train word embeddings using gensim library.	CNN-1D, LSTM and BiLSTM	Domain-specific word-embeddings helps in capturing the sentiments and improve the results.
2018 [23]	----	Glove, word2vec, FastText and their combination.	CNN, LSTM and Ensemble of CNN and LSTM	Ensemble along with combine embeddings gives better results than baseline.
2019 [24]	Used dataset created by Aditya Bohra et al.,2018 Remove the '#', URLs, user-mentions, stop words, emoticons and punctuations. Tokens were Separated.	phonemic sub-words	Sub-word level LSTM model Hierarchical LSTM model implemented on phonemic sub-words.	In all the models SVM performed better.

2019 [25]	----	FastText , word2vec, Doc2vec	SVM, RF	Machine learning classifiers trained sing FastText performs better.
[26]	----	TF-IDF	MNB, SGD, Linear SVM and LR. Also applied on datasets developed by Davidson et al. [68] and FIRE 2019 HASOC track dataset [67]	Dataset (PEI-2019) performed better because it concerns with specific domain. SGD performed well,
2020 [27]	----	TF-IDF	SVM	
siva sai et al.,[29]	Removing URLs, emojis from, special characters, numbers, user mentions and punctuation. Task2: Lowercasing Manglish & Tanglish comments	XLM-RoBERTa	XLM-RoBERTa, mBERT, Ensembling of XLM-RoBERTa, XLM-RoBERTa base + XLM-RoBERTa large and XLM-RoBERTa base + mBERT	For task1 XLMR-B and XLMR-B + mBERT, In task 2 for Tanglish XLMR-B + mBERT and for Manglish XLMR-B, XLMR-B + mBERT, XLMR-B + XLMR-L performed well. For Task1: got 1st rank (0.95). For Task 2: Manglish got 2nd (0.77) and for Tanglish got 1st (0.90) rank.
CUSAT NLP [30]	URLs, hash in hashtags, repeated characters, unwanted numbers, usernames were removed. Lowercasing and tokenization is done.	One-hot vector and paragraph vectors for text representation	LSTM	Model got F-Score of 0.54 for Manglish Subtask and got 10th rank.
Varsha pathak et al., [3]	Unnecessary, stop words, white spaces, digits, special characters, extra spaces, @USER, @RT and TAG etc. are eliminated.	TF-IDF, Custom WordEmbedding	SVC, MNB, LR, AdaBoost, DTC and RF. Neural Network	For Manglish MNB and for Tanglish SVC performed well with TF-IDF and got 2nd (0.77) and 3rd (0.87) place respectively
Gaurav arora [31]	Removing @username mentions etc. and lower-casing comments.	Generated Markov process using Markov chains	ULMFiT	ULMFiT model for Task 1 got 3rd rank (0.91), in Task 2, for Manglish 5th (0.74) and for Tanglish got 2nd rank (0.88).
SSNCSE [32]	No pre-processing details were mentioned.	char n-gram, TFIDF and fine-tuned BERT	MLP, RF and NB	For both tasks RF trained using TF-IDF performed better than others. For Task 1 got 2rd rank (0.94). In Task 2, for Manglish 4th (0.75) and for Tanglish got 2nd rank (0.88).
CENMates [33]	Punctuation, emojis and special characters were removed. Tokenzing and lowercasing comments.	TFIDF	LR, XGBoost, LSTM and Attention with LSTM	TF-IDF with character level n-gram performed well with machine learning classifiers and for Task 1 got 2rd rank (0.93), in Task 2, for Manglish 1st (0.78) and for Tanglish got 4th rank (0.86).
NITP-AI-NLP [34]	Removing letter word and punctuation. Translating &, @ and numbers (1-10) into and, at and English numbers resp. Lowercasing comments.	TF-IDF	CNN and Bi-LSTM SVM, LR, NB, RF and DNN	LR for Manglish and Dense Neural Network for Tanglish performed well with character n-gram. For Task 1 got 3rd rank (0.93). In Task 2, for Manglish 7th (0.69) and for Tanglish got 6th rank (0.84).
YUN[35]	Removing emotional symbols, @username and so on. Lowercasing the comments	sub-word representation	BiLSTM	Model for Task 1 got 3rd rank (0.93), for Task 2, for Manglish 9th (0.67) and for Tanglish got 5th rank (0.85).
Zyy1510 [36]	Noise like usernames, emoticon, hashtags were removed. Transliteration is performed.	CNN layer for local features and maximum pool layer is used to extract the essential features	Ensemble of basic CNN, BiLSTM and an LSTM layer + Convolution layer	Ensemble model for Task 1 got 3rd rank (0.93), for Task 2, for Manglish 3rd (0.87) and for Tanglish got 9th rank (0.67).

Ajees [37]	No pre-processing details were mentioned.	CountVectorizer & BERT	MLP, BiLSTM with BERT, CNN-BiLSTM	For Task 1 got 7th rank (0.44). In Task 2, for Manglish 8th (0.68) and for Tanglish got 7th rank (0.83).
CFILT IIT Bombay [38]	Removing @mention from, RT, URLs, digits and extra spaces.	---	Ensemble of multilingual BERT	Ensemble model for Task 1 got 2nd rank (0.94), in Task 2, for Manglish 6th (0.72) and for Tanglish got 4th rank (0.86).
WLV-RIT [39]	Removing punctuations, emojis and lemmatising the English words	Bag-of-words	MNB, SVM, RF, XLMRoberta and Multilingual-BERT	XLM-R with transfer learning in Task 1 got 5th rank (0.89).
IIITG-ADBU [40]	No pre-processing details were mentioned.	Character n-gram and word n-gram	XLM-RoBERTa model and SVM	SVM trained using TF-IDF character and word n-grams performed well with Manglish and for Task 1 got 1st (0.95) and for Task 2 got 3rd (0.76) rank. for Tanglish in Task 2 got 3rd rank (0.87) using XLMRoBERTa.
FIRE 2020 Malayalam-English [28]	----	TF-IDF and pre-trained word embeddings: Word2Vec and fastText	LR, SVM, DT, RF, MNB, KNN on TF-IIDF and on pre-trained word embeddings : DME, CDME, 1DConv and BERT	Machine learning classifiers successfully categorized the comments into all classes. FastText in combine with word2vec for DME and CDME offers local and global context.
FIRE 2020 Tamil-English [28]	----	TF-IDF and pre-trained word embeddings: Word2Vec and fastText	LR, SVM, DT, RF, MNB, KNN on TF-IIDF and on pre-trained word embeddings : DME, CDME, 1DConv and mBERT	Machine leaning and Deep learning classifiers not produced satisfying results because of nature of dataset
JUNLP [41]	Training and validation dataset were added.	Language tags using NLTK	Bidirectional LSTM with and without language tag, LSTM with and without language tag	Bi-Directional LSTM model with language tag features produced 0.58 f1-score
MUCS [42]	No pre-processing details were mentioned.	n-grams, word vectors using Word2Vec, and sub-words	Ensemble model of MLP, MNB and BiLSTM	Ensemble model got 4th rank (0.62) and 6th rank (0.68) in Tamil-English and Malayalam-English respectively
bits2020 [43]	Replace all emojis with their meanings in Malayalam & Tamil	sub-word level representation	LSTM	LSTM model got rank of 5th (0.61) and 12th rank (0.60) in Tamil-English and Malayalam-English respectively
CMSA One [44]	No pre-processing details were mentioned.	fastText, ELMO and TF-IDF	Transformer and GRU model	Model got F1-score of 0.58 for Tamil-English and 0.66 for and Malayalam-English
HIT_SUN [45]	Train and development datasets were merged	---	pretrained BERT and fine-tuned BERT	BERT model got 2nd rank in the Malayalam-English and 4th in the Tamil-English
JudithJeyafreeda [46]	No pre-processing details were mentioned.	TF-IDF	SVM, LR, NB and RFC	NB classifier got highest F1-score of 0.54 for Tamil-English and 0.58 for and Malayalam-English among other classifiers.
SSN_NLP_MLRG [47]	Numerals, punctuation, were removed and replace the noisy strings	---	AWD-LSTM model with ULMFiT framework	F1-score of 0.60 for both languages using the AWD-LSTM model.
IRLab [48]	Removing continuous repeating characters in word, exclamation, punctuations, non-ASCII, emoticons, symbols, numbers, special characters	---	BERT, DistilBERT and fasttext	Fasttext outperforms BERT & DistilBERT. Got 8th (0.58) rank in Tamil-English & 11th (0.63) in Malayalam-English

PITS [49]	emojis & smiles removed using tweetpreprocessor	TF-IDF	LR, DT, SVM, XGBoost, Catboost	LR showed best F1-score of 0.62 in Tamil-English & 0.71 in Malayalam-English amongst all.
SRJ [50]	No cleaning of text	---	XLM-Roberta	XLM-Roberta got F1-score of 0.65 in Tamil-English & 0.74 in Malayalam-English
SSNCSE_NLP [51]	No pre-processing details were mentioned.	TF, TFIDF, BERT, fastText, one-hot embedding /vector	LR, MLP, NB, RFC, BiLSTM	MLP with char-count(2,3) vectorizer got F1-score of 0.61 in Tamil-English & LR with TF-IDF char n-gram(1,5) got 0.71 in Malayalam-English
YUN [52]	No cleaning of text	---	XLM-RoBERTa,	XLM-RoBERTa, got rank of 3rd (0.63) and 1st rank (0.74) in Tamil-English and Malayalam-English respectively
CIA_NITT [53]	Removing special characters & repeating characters, lowercasing text, replacing emojis with meanings	Manglish sentiment words collected from YouTube	Sentence BERT	Sentence BERT achieved Rank of 4th (0.71) in Malayalam-English.
LucasHub [54]	Symbols, numbers and emoticons were translated into its meaning	---	XLM-RoBERTa and m-BERT	3rd (0.63) and 2nd rank (0.73) in Tamil-English and Malayalam-English respectively
NITP-AI-NLP [55]	Removed multiple spaces, Symbols, numbers translated into its English word	one-hot embedding /vector	CNN, Bi-LSTM and their hybrid approaches	Hybrid CNN-CN xnetwork got F1-score of 0.61 in Tamil-English & 0.69 in Malayalam-English
SA-SVG [56]	Removed special symbols	Tokenizing dataset	Bi-LSTM	Bi-LSTM model got rank of 14th (0.10) in Tamil-English.
IRLab [57]	Removed multiple spaces & punctuation symbols. Symbols, numbers and emoticons were translated into its meaning. Lowercasing and stemming words.	BERT	BERT-based pretrained model	BERT-based model got F1-score of 0.59 and 0.60 in Tamil-English and Malayalam-English respectively
UMSNH-INFOTEC [58]	---	---	language-independent (μTC), Byte-Pair embeddings, language-specific Byte-Pair embeddings, Character Embeddings and linear combination	For Malayalam-English linear combination and for Tamil-English language-independent (μTC) got 3rd and 6th rank respectively.
TADS [59]	No cleaning of text	CountVectorizer	SVM, LR, Perceptron	LR performed best among all classifiers.
Parameswari_faith_nagaraju [60]	Removed stop words, punctuations, numbers and non-unicode characters	TF-IDF	MNB	MNB got F1-score of 0.55 and 0.48 in Tamil-English and Malayalam-English respectively
YUN111 [61]	removed unwanted characters, emoticons	---	mBERT	mBERT got 2nd rank with F1-score of 0.64 & 0.73 in Tamil-English and Malayalam-English respectively
Theedhum Nandrum [62]	Spellings were normalized using Indic Library	Sentiments of emojis, soundex to harmonise speeling variants of same word, language tagging, document length rage	SGD, LSTM	SGD got 4th (0.62) and 9th rank (0.65) in Tamil-English and Malayalam-English respectively
NUIG-Shubhanker [63]	----	----	auto-regressive XLNet	Model achieves 0.49 & 0.35 accuracies and 0.52 & 0.32 F-scores on both the datasets.
2020 [64]	----	TF-IDF	SVM, KNN, MNB, DT and CNN	CNN performed best.

2021 [65]	----	N-Grams, TF-IDF	SVM, RF, LR, NB, MLP	Results of all classifiers were improved using normalized data.

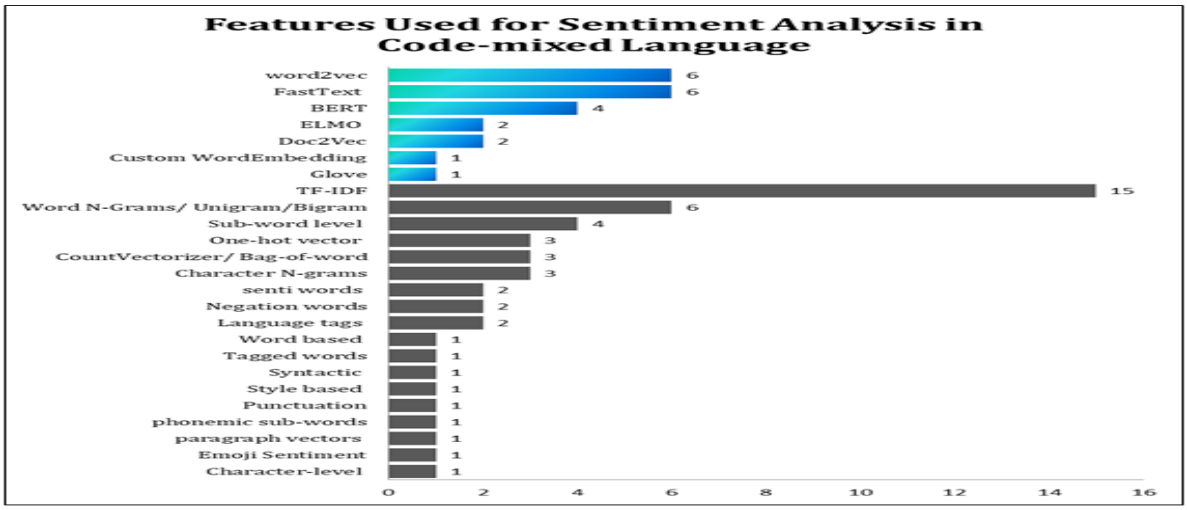


Chart 1: Usage of Various Features

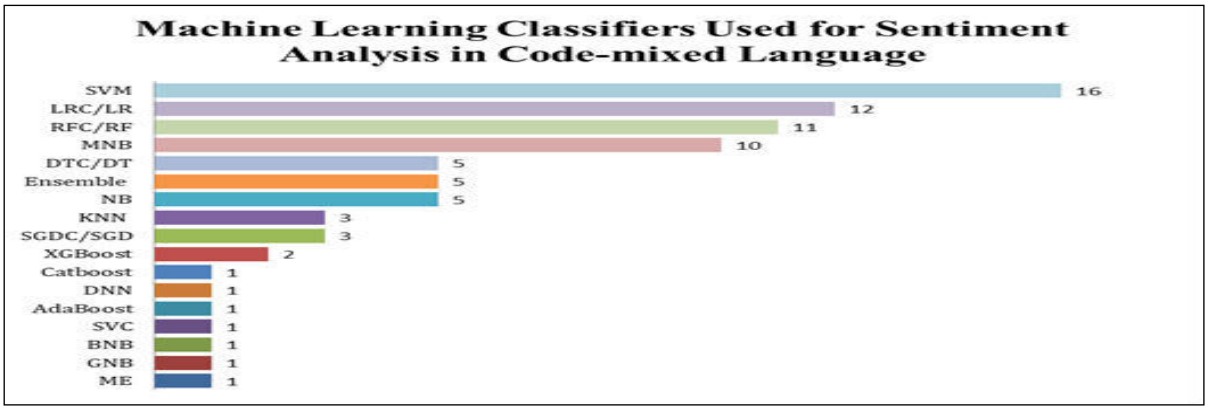


Chart 2: Usage of Machine Leaning classifiers

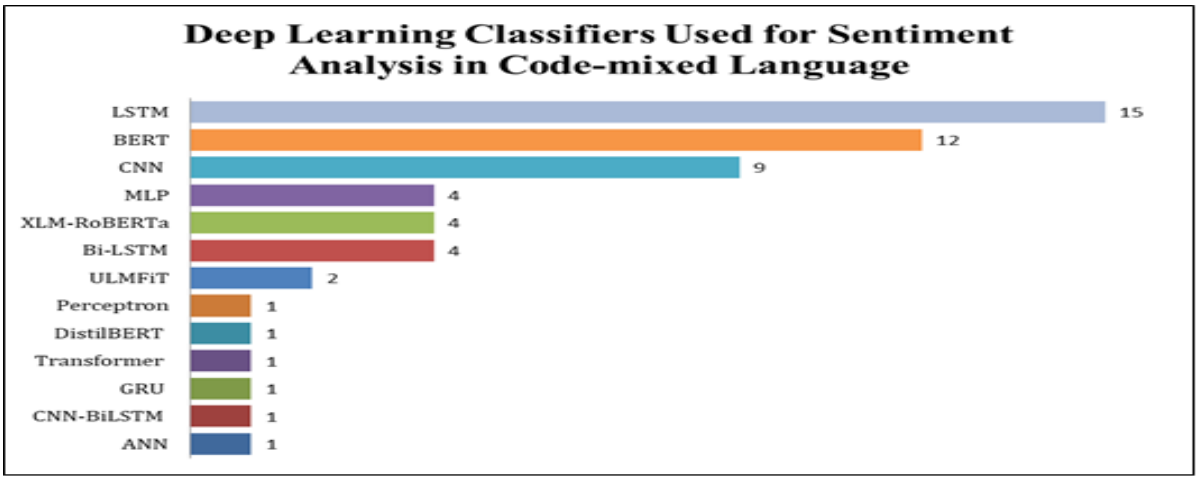


Chart 3: Usage of Machine Deep Leaning Classifiers

algorithm was used, which resulted in a feature size of 1200. For machine learning classifiers, the Scikit-learn library and for deep learning, Keras, are used. For training the deep learning models, the Adam optimizer with a batch size of 32 is used. In the sub-word level LSTM model, to get the feature map, the sub-word representations are submitted to the CNN-1D layer with a filter and a bias. Then sub-word representations are submitted to the LSTM layer, so that the model can distinguish between hate and non-hate tweets. To build a hierarchical attention-based LSTM model with phonemic sub-words, the words are segmented into phonemic sub-words. The segmentation is done using consonant-vowel sequences. The hierarchical attention-based model has an embedding layer, syllable encoder, word encoder, word attention layer, and output layer. In baseline, character n-grams, word n-grams, negation words, and punctuation mark features were trained using SVM and RFC. In the results, the SVM overshadows the RFC performance. Though the hierarchical LSTM model with attention based on phonemic sub-words produced less accuracy, it gave good recall and an F1-score by a huge margin.

K Sreelakshmi et al., 2019 [25], performed hate speech detection on code-mixed Hindi-English language by using three different datasets. The datasets used are Bohra et al., 2018, Mathur et al., 2018 and the dataset from shared task HASOC. Mathur et al., dataset has three labels, but for the task, hate-inducing classes are labelled as hate, and non-offensive as non-hate. Thus, the final dataset has hate and non-hate categories, each containing 5000 records. The dataset is preprocessed by removing URL's, usernames, hashtags, special characters, etc. and further, the dataset is used for training the pre-trained models- fastText and domain-specific word embedding. The team performed experiments in three different ways. In the first experiment, machine learning classifiers SVM and Random Forest were trained using features extracted using the CBOW of Doc2vec. In a second way, domain-specific embedding using word2vec was used for feature extraction and trained using the same set of machine learning classifiers. From both the experiments, word2vec outshines Doc2vec, but both the feature extraction techniques are not able to tackle words that are out of vocabulary. So they used the FastText pre-trained model and trained the same set of machine learning classifiers in the third experiment. The results of the third experiment are better as compared to the first two experiments.

For data collection, Anita Saroj and Sukomal Pal, 2020 [26] used the parliamentary election (PEI) event conducted in 2019. They collected social media posts from Facebook and Twitter in Hindi and English languages and some of them were code-mixed. For Twitter, they used different hashtags and for Facebook they used the Facepager tool and collected more than 10,000 posts. Out of these posts, only 20% were related to hate speech and offensive content. To detect whether the post is offensive or not, they created three tasks: Task A, Task B, and Task C. In Task A, posts are classified into Hate and Offensive (HOF) and Non-Hate, or offensive (NOT). Task B classifies the Hate (HOF) posts of TASK A into 3 ways, i.e., Hate speech content (HATE), Offensive (OFFN), and non-hate or non-offensive (NONE). Lastly, Task C checks the type of hate and offensive (HOF) from Task A and classifies them into Targeted Insult (TIN), Untargeted (UNT), and Non-Hate or Non-offensive (NONE). Annotations of posts into the given categories are done by undergraduate students. For Tasks A, B, and C, the average score is calculated using Cohen's Kappa. They preprocessed tweets using the tweet preprocessing library by removing the Retweets(RT), hashtags, URLs, Twitter Mentions, emojis, and Smileys. Tweets were tokenized, stemmed, and stop-words were removed. For extracting the features, language independent TF-IDF is applied for both languages. Machine classifiers such as Multinomial Naive-Bayes (MNB), Stochastic Gradient Descent (SGD), Linear Support Vector Machine (Linear SVM), and Linear Regression (LR) were applied to the extracted features. While conducting the experiments, they used other datasets developed by Davidson [68] and another dataset by the FIRE 2019 HASOC track [67]. They applied the methodology to these two datasets and compared the results. The results are measured in terms of precision, recall, F1-Score, and accuracy. In the results, they found that their dataset performs better because it concerns a specific domain.

In the year 2020, the Forum for Information Retrieval Evaluation (FIRE) runs several shared tasks, among which two tasks are related to code-mixing, named as: HASOC-Offensive Language Identification-DravidianCodeMix [27] and Sentiment Analysis of Dravidian Languages in Code-Mixed Text [28]. The details about the tasks and techniques used by the participants are elaborated below.

HASOC-Offensive Language Identification-DravidianCodeMix [27]: The goal of the task is to recognize offensive language from a code-mixed dataset of Malayalam-English and Tamil-English. The task is further divided into Task 1 and Task 2. Task 1 has code-mixed Malayalam comments collected from YouTube, and participants have to classify the comments as offensive or not-offensive. The YouTube comment scrapper is used to collect the comments and was collected from movie trailers in 2019. The dataset contains all types of code-mixing. The dataset has 3200 training data containing 2633 not-offensive and 567 offensive comments, and 400 development data containing 328 not-offensive and 72 offensive comments, thus

representing class imbalance. Task 2 has Tanglish (Tamil-English) and Manglish (Malayalam-English) comments, and participants have to classify them as offensive or not-offensive. The comments are in Latin characters only and are annotated as offensive (OFF) or not-offensive (NOT). For collecting Tanglish comments, YouTube and the Helo app are used, whereas for Manglish comments, only YouTube is used. Training data is provided with 4000 comments for both languages. For the Manglish language, 2047 not-offensive and 1953 offensive comments were provided, and for Tanglish, 2020 not-offensive and 1980 offensive comments were provided. The baseline system has an SVM classifier trained using TF-IDF features.

Experimental setup performed by Participants: For both the tasks, Siva Sai et al. [29] performed selective translation and transliteration methods to convert the romanized dataset into its native language. On the transliterated dataset, transformer networks like XLM-RoBERTa and Multilingual BERT were applied. CUSATNLP [30] used a one-hot encoding vector and a paragraph vector for representing the Malayalam dataset. On these n-dimensional vectors, the LSTM network is applied. Varsha Pathak et al. [3] participated in task 2 and used different machine learning models such as MNB, SVC, LR, RFC, and ensemble model. These models were trained using character n-grams, word n-grams, and combining both character and word n-grams of different ranges for both the languages. Gaurav Arora [31] generated a code-mixed dataset as a Markov process using Markov chains and then implemented a pre-trained ULMFiT on it. He applied the same approach to both the tasks. For both the tasks, SSNCSE [32] used character n-gram, count vectorizer, and BERT models for feature extraction. On the basis of these extracted features, machine learning classifiers like RF and MLP were implemented. CENMates [33] implemented four different classifiers for both the tasks, of which LR and XGBOOST classifiers were trained using TF-IDF character n-gram, and the other two classifiers are long short-term memory networks and attention networks. NITP-AI-NLP [34] implemented a fine-tuned pre-trained BERT for Task 1 and two different models for Task 2. The first model has deep learning models like CNN and Bi-LSTM, while the second model has machine learning classifiers like SVM, LR, NB, RF, and DNN using TF-IDF character and word n-gram features. YUN [35] participated in both the tasks and designed a self-attention based on the BiLSTM and the sub-word representation learning. Zyy1510 [36] implemented an ensemble approach consisting of
basic CNN, BiLSTM, and an LSTM layer + convolution layer for both the tasks. Ajees [37] used three classifiers: MLP, CNN-BiLSTM, and BiLSTM for both the tasks. They used CountVectorizer and BERT word embedding techniques to convert the text into features. CFILT IIT Bombay [38] designed an ensemble of multilingual BERT models for both tasks and developed a novel training strategy comprising data augmentation using random transliteration. WLV-RIT [39] used two models: the first model has traditional machine learning classifiers like MNB, SVM, and RF, and the second model uses transformer models like XLMRoberta and Multilingual-BERT. IIITG-ADBU [40] used the XLM-RoBERTa model and SVM classifier for both the tasks. A SVM was trained using character n-grams of range (1, 6) and word n-grams of range (1, 3) and a combination of both.

Sentiment Analysis of Dravidian Languages in Code-Mixed Text [28]: Organizers created code-mixed dataset for Tamil and Malayalam languages. Dataset is created from social media platform: YouTube. YouTube comments were collected using YouTube Comment Scrapper. 184753 Tamil sentences were collected regarding 2019 Tamil movie trailer and 116711 Malayalam sentences were collected regarding keyword: Malayalam movie 2019. Among these statements many of the non-code-mixed statements were filtered out using language identification library: langdetect. Pre-processing is also done for both languages which apply a sentence length-filter and removing emoticons. For length-filtering sentence less than 5 words and more than 15 words were removed. Thus 15,744 code-mixed Tamil-English (organizers refereed as Tanglish) and 6739 code-mixed Malayalam-English (organizers refereed as Manglish) sentences were collected. Each sentence is annotated by atleast 3 annotators into five categories: Positive, Negative, Neutral, Mixed feeling and other language. Finally for Tamil language the corpus of 15,744 sentences were randomly shuffled and categorized into training, validation and test set containing 11335, 1260, 3149 sentences respectively. For Malayalam language, the corpus of 6739 sentences were selected and categorized into training, validation and test set containing 4717, 674, 1348 sentences respectively. The task for participants is to develop system which classifies the comments into the five mentioned categories. After creating both the datasets, for benchmark system organisers used traditional TF-IDF for feature extraction and machine learning approaches like : Logistic regression (LR), Support vector machine (SVM), Decision tree (DT), Random Forest (RF), Multinomial Naive Bayes (MNB), K-nearest neighbours (KNN) on code-mixed Malayalam-English dataset. Along with this pre-trained word embeddings like: Word2Vec and FastText were used with different deep learning models viz. Dynamic Meta-Embeddings (DME), Contextualized DME (CDME), 1D Dimensional Convolution (1DConv), Bidirectional Encoder Representations for Transformers (BERT) were also

implemented. On the Tamil-English code-mixed dataset the same experimentation, but the only change is for deep
learning instead of BERT they applied MultilingualBERT (mBERT). Total 32 participants for Tamil and 28 for Malayalam participated. The evaluation is done weighted average F1 score.

Experimental setup performed by Participants: JUNLP [41] designed LSTMs and bi-directional LSTMs with and without language tagging, but finally the results of bi-directional LSTMs with language tagging were considered as the final model to be categorised as Tamil comments. MUCS [42] employed three distinct features, including n-grams, word vectors (word2vec), and sub-word vectors. For training, a voting classifier is an ensemble classification model that works based on majority voting, including MLP, MNB, and BiLSTM. They were trained using n-grams, word vectors (word2vec), and sub-word vectors, respectively. bits2020 [43] used a sub-word level representation of the dataset and implemented an LSTM network on both datasets. CMSAOne [44] used a combination of fastText, ELMO, and TF-IDF for meta-embeddings. On these meta-embeddings transformer and GRU model is implemented. HIT_SUN [45] used the BERT model implemented in two parts: pretraining and fine-tuning. JudithJeyafreeda [46] used different machine learning models, viz. SVM, LR, NB, and RFC, trained using TF-IDF features. SSN_NLP_MLRG [47] designed language model using AWD-LSTM model with ULMFiT framework using the FastAi library for Malayalam-English and Tamil-English comments. IRLab [48] created three different word embeddings using BERT, DistilBERT, and fastText, which were trained using multinomial logistic regression. PITS [49] implemented TF-IDF character and word n-gram range and were trained using logistic regression. SRJ [50] used the XLM-Roberta model for sentiment analysis of both datasets. SNCSE_NLP [51] used different feature extraction techniques such as TF, TFIDF, BERT, and fastText. These extracted features were trained using different machine learning classifiers: MLP, NB, and LR. Along with these, Bi-LSTM is also trained using one-hot encoded vectors. YUN [52] designed a model based on the multi-language model XLM-RoBERTa and used the K-folding method for both the languages. CIA_NITT [53] worked on Manglish comments by implementing Sentence BERT, Sentence BERT with Manglish features, and Sentence BERT with Class Balanced Loss; out of these, SBERT with CBL shows better results. LucasHub [54] implemented a model combining fine-tuned m-BERT and fine-tuned XLMRoBERTa for categorising Malayalam-English and Tamil-English comments. NITP-AI-NLP [55] used one-hot vectors to get character and word embedding. The first model was built using two CNN networks and was trained using character embedding and word embedding. The second model has CNN trained using character embedding and Bi-LSTM trained using word embedding. SA-SVG [56] tokenized the Tamil dataset and used a Bi-LSTM model to train and to categorize the sentiments. After preprocessing the dataset, IRLab [57] used a pretrained BERT-based model for classification. Five models are used by UMSNH-INFOTEC [58]. Those models are language-independent (μTC), Byte-Pair embeddings, language-specific Byte-pair embeddings, character embeddings, and linear combinations TADS [59] used three machine learning models: SVM, LR, and a Perceptron trained using vectors for classification purposes. Parameswari_faith_nagaraju [60] extracted TF-IDF features trained using MNB for both the datasets. YUN111 [61] implemented an mBERT-based model for sentiment categorizing. Theedhum Nandrum [62] trained SGD and LSTM classifiers on various features such as emoji sentiment, language tags, word vectors, and document length. NUIG-Shubhanker [63] implemented an auto-regressive XLNet model for sentiment analysis.

Priya et al., 2020 [64] studied hate speech detection on code-mixed Hindi-English using three different datasets. The first dataset was designed by Bohra et al., 2018 and collected from the Github repository. The second dataset is available from a Shared Task named HASOC, organised at FIRE 2019 (Mandl et al., 2019). The third dataset designed by Kumar et al., 2018 is also considered for the training and testing system. The first two datasets were already annotated; hence, the third dataset was annotated into hate and non-hate categories. Annotation is made in two phases, and the validity of annotation is checked using interannotator agreement, which was calculated using Kripendorff's alpha. The experiments were conducted using machine learning and deep learning classifiers. Different machine learning classifiers like support-vector machine (SVM), K-Nearest Neighbours (KNN), multinomial naive Bayes (MNB) and decision tree (DT) were trained using Term Frequency (TF) features. For deep learning, a character-based convolution neural network (CNN) is used. Among the applied classifiers, character-based CNN performed best. The results were compared with Bohra et al.2018, and it was found that character-based CNN and Bohra et al.2018 SVM produced the same accuracy.

Varma et al., 2021 [65] introduced a new dataset in Code-Mixed Telugu-English Text (CMTET). To collect data, they used the Twitter API and YouTube Comments API in the sports and movie domains. From collected dataset URLs, markup text and comments of less than five words were removed. The cleaned dataset is annotated into positive,

negative, and neutral sentiments, and word-level annotation is also done using language tags. After word-level annotation, comments in only English or only Telugu were also removed. Annotation is carried out by five Telugu native speakers using the Telegram Bot API. An Inter Annotator Agreement score is calculated using Cohen's Kappa score. The authors found challenges in the dataset, such as informal transliterations, informal language, and spelling and typing errors, so they applied an unsupervised data normalization technique. In that elongation normalization, normalization of English and Telugu words was done. After normalization different classifiers like Logistic Regression (LR), Naive Bayes (NB), Support Vector Machine (SVM), Random Forest (RF), and Multi-Layer Perceptron (MLP) were trained using N-Grams and TF-IDF features. All classifiers were trained using normalized data and without normalized data and authors found that the performance of every classifier was improved using normalized data. Among all MLPs, one performs better with 80.22% accuracy.

III. Results & Discussion

Table 2 shows the dataset created in code-mixed languages so far. The table contains, social media platform used for collecting data and preprocessing techniques applied to the collected data. It also includes information about the dataset's size, labels or classes into which it is classified, the annotation method used for labelling or classification, and the nature of the classes, such as balanced or imbalanced.

dataset in column 2. The columns 3 and 4 mention feature extraction techniques and classifiers applied, respectively. Finally, the results obtained were stated. While declaring the results, the best-performing classifiers were given along with their accuracy score, or F1-score, in the round parenthesis. In the case of shared tasks, teams' results were mentioned along with their rank. Likewise, in Table 2, the same colour scheme is implemented in Table 3 for distinguishing between the datasets.

We used the charts to quantify the use of feature extraction techniques and classifiers used by the researchers. It will help the researchers the classifiers and techniques frequently used. In total three charts were used. In Chart 1, the feature extraction techniques were split into pre-trained word embeddings and other techniques, and those were represented on the y-axis while the x-axis shows the number of times they were used. The ocean colour represents the pre-trained word embeddings BERT, FastText, ELMO, word2vec, Glove, and Doc2Vec, while the rest of the techniques are black in colour.

In Table 2, the datasets that were created by researchers are shown in a dark blue background, while the datasets that were created using existing datasets are shown in a white background.

From Table 2, we can see that researchers frequently used English as the second language with their primary language, and for collecting raw data in code-mixed languages, different social media applications and online sites were used. Before annotating, almost all researchers had done exhaustive data preprocessing. They removed noisy information such as usernames, URLs, hashtags, special characters, English stopwords, and incomplete sentences other than code-mixed sentences. They also select sentences of a specific length so as to maintain consistency in data. For annotating data, mostly manual annotators were used, and some of them used a combination of mechanical and manual annotation. The manual annotators selected had knowledge of the primary language for proper classification, and inter-annotator agreement with the annotated dataset was also calculated by most of the researchers. To handle the imbalanced classes, researchers used deep learning classifiers because of their capability to handle imbalanced classes, and to train machine learning classifiers, they used different over-sampling and under-sampling methods. The dataset is classified into different sentiments, such as: positive, negative, neutral, hate, non-hate, offensive, not-offensive, abusive, happiness, sadness, fear, anger, surprise, etc.

Table 3 shows the other factors of the research. It includes further processing techniques applied to the

The charts 2 and 3 represent the machine learning algorithms and the deep learning algorithms, respectively. The names of the algorithms appear on the x-axis of both charts, and the count in front of them indicates the number of times the algorithms have been used so far. The transfer learning classifiers like BERT, DistilBERT, and XLMRoBERTa were considered under the deep learning classifiers.

IV. CONCLUSION

The language independent feature extraction techniques like bag of words, TF-IDF, word n-grams, character n-grams, one-hot vectors, CountVectorizer, and Sub-word level were found useful for extracting the features, and other language dependent feature extraction approaches like negation words, senti words, language tags, and phonemic sub-words were supportive for handling sentiments in code-mixed Indian languages. Alongside the pre-trained word-emneddings like Word2Vec, Gensim, FastText, BERT were also useful. Among these, BERT, DistilBERT, XLMRoBERTa, etc., were trained on more than 100

languages, including many Indian languages. To develop the framework, traditional machine learning classifiers are still helpful, together with deep learning classifiers found helpful for classifying the sentiments into desired labels. In the case of machine learning classifiers, SVM, LR, RF, and MNB were mostly used, and in the case of deep learning classifiers, LSTM, BERT, and CNN were mostly used. The newly invented transfer learning classifiers like BERT, DistilBERT, XLM-RoBERTa, IndicBERT, etc. are proving their importance in sentiment detection.

A number of approaches were offered by different researchers for identifying hate speech from social media content. Most of the work is done and still going for detecting such hateful content in monolingual languages, but a limited amount of work is done in Indian code-mixed languages for detecting such hateful content considering the importance of the topic. Hence, more focus is needed in this area.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-02

Predictive solution using various Machine Learning Algorithms on historical Agricultural and Meteorological dataset.

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Abstract: *In data science machine learning is a tool that extracts meaning from data by transforming it into knowledge, to achieve this several algorithms have been developed for learning patterns acquiring insights and forecasting from previous historical data sets. We utilised modern tools and techniques such as anaconda Jupiter notebook and python to carry out predictions of rainfall and crop yield for upcoming years on the available data set. For on-going research Linear Regression, Support Vector Model, Bayesian Linear Regression, Decision tree and Random Forest algorithms are used for meteorological historical dataset (Annual Rainfall data of hundred years) as well as we have collected and used dataset viz "All India level production of principal crops from 2001-02 to 2016-17" The whole dataset was for production of principal crops from 2001-to 2017 having '35' types of crops, from where we worked only on "Cotton" production. The Idea behind the selection of 'Cotton' is because Cotton is the crop which is linked with world market and India is the biggest producer of Cotton. This basic research is an attempt to go through meteorological as well as agriculture historical data sets for the extraction of hidden patterns and development of predictive solutions using ML tools and techniques.*

***Key words**: Machine Learning, Linear Regression, Support Vector Model, Bayesian Linear Regression Decision tree and Random Forest algorithms, Anaconda, Jupyter Notebook, Python etc.*

. INTRODUCTION:

An important and established reality is that, machine learning algorithms such as *Linear Regression, Support Vector Model, Bayesian Linear Regression,* decision tree and random forest are basically used for analysing various data sets as well as for appropriate or probable predictions on datasets. Additionally data classification, complex pattern recognition, predictions, intelligent decisions and clustering are some of the specific characteristics of Machine Learning techniques [1].In current stage of research we used agricultural well as meteorological historical data sets along with modern tools and techniques of machine learning for better predictions. As research will progress appropriate algorithms or techniques will be used as per need.

IMPLEMENTATION:

For implementation purpose in current stage of research we implemented various machine learning algorithms such as *Linear Regression, Support Vector Model, Bayesian Linear Regression, Decision tree and Random Forest algorithms* on agricultural as well as meteorological historical datasets. For that we used datasets viz. "All-India-Rainfall-Act_Dep_1901_to_2019_0". [2].

For this we installed Anaconda. Anaconda is a distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), that aims to simplify package management and deployment. Where we used Jupyter Notebook**,** which is *a web-based interactive computing platform*. The notebook combines live code, equations, narrative text, visualizations etc. [4]. We also used Pandas Framework**,** which is module of python. Python is an innovative and cognitive

programming platform for the modern generation. [5].

In our previous research paper we have mentioned about the three algorithms and their results viz. *Linear Regression, Support Vector Model, and Bayesian Linear Regressions.*

In current stage of practical implementation we added two more algorithms viz. Decision Tree and Random forest with the agricultural and meteorological data set.

DECISION TREE:

It is the most powerful and popular tool for classification and prediction. A Decision tree is a flowchart-like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node (terminal node) holds a class label. [6]

Decision tree classifiers are significant techniques for prediction by considering a special feature called interpretability. This model breaks data for appropriate decision making process and to answer series of queries to interpret the features. The decision tree model learns from features of training set to infer the class labels of the samples. [7]

The limitation of decision tree structure is over fitting. This issue is raised when algorithm continues to navigate in deeper level to reduce the training error but finally ends up in increased test set error. Ultimately this estimates poor prediction value. It generally happens when it builds numerous branches due to outliers and irregularities in dataset. [8].

RANDOM FOREST:

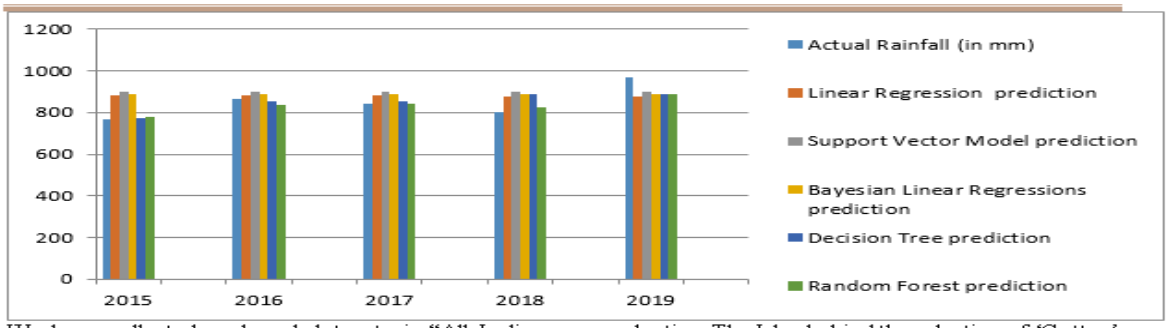
Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML. As the name suggests, "Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset." Instead of relying on one decision tree, the random forest takes the prediction from each tree and based on the majority votes of predictions, and it predicts the final output. [9].

For practical implementation and results these five algorithms viz. *Linear Regression, Support Vector Model, Bayesian Linear Regressions, Decision Tree and Random Forest were used.* Annual Rain fall data from year 1901 to 2019 more than 100 years dataset was used for training of these algorithms and predictions of rain fall of upcoming years was carried out.

Following table shows the collective result of Actual Annual Rainfall for and predicted rainfall by all five machine learning algorithms.

Year	Actual Rainfall (in mm)	*Linear Regression prediction*	*Support Vector Model prediction*	*Bayesian Linear Regressions prediction*	*Decision Tree prediction*	*Random Forest prediction*
2015	765.4	879.89400014	899.78519978	890.07677649	774.8	779.956
2016	863.7	879.70677112	899.7490618	890.07468885	853.7	836.505
2017	843.7	879.51954209	899.78532308	890.07260121	853.7	842.547
2018	802.4	879.33231306	900.50276609	890.07051357	885.9	825.289
2019	969.4	879.14508403	902.13488665	890.06842593	885.9	885.9

Following chart shows the comparative analysis between Actual annual rain fall and predictions made by five algorithms of the annual rainfall.

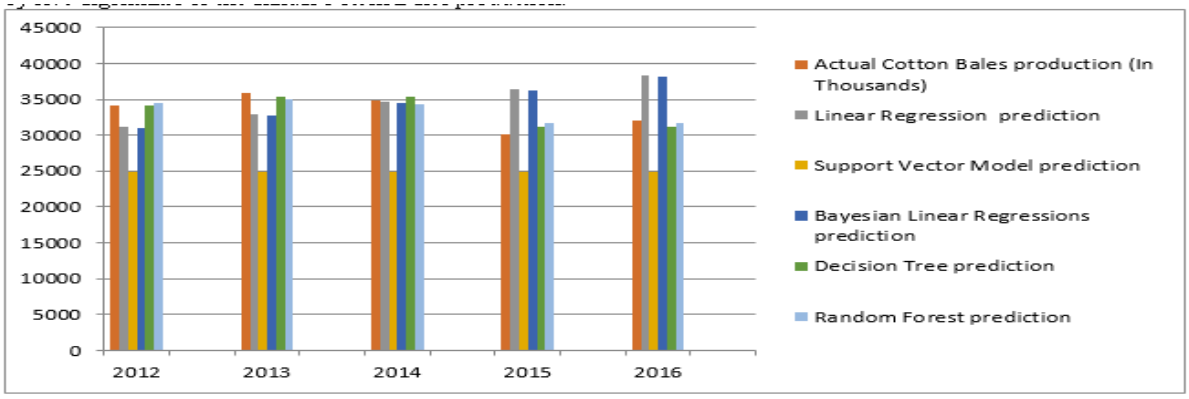


We have collected and used dataset viz "All India level production of principal crops from 2001-02 to 2016-17" [3].The whole dataset was for production of principal crops from 2001-to 2017 having '35' types of crops, from where we worked only on "Cotton" production. The Idea behind the selection of 'Cotton' is because Cotton is the crop which is linked with world market and India is the biggest producer of Cotton.

Following are the results of "Cotton" yield prediction using these algorithms

Year	Actual Cotton Bales production (In Thousands)	Linear Regression prediction	Support Vector Model prediction	Bayesian Linear Regressions prediction	Decision Tree prediction	Random Forest prediction
2012	34220	31095.51911765	24955.14026961	31014.60354966	34140	34438.2
2013	35902	32881.93529412	24955.14051632	32777.90099241	35353.5	35036.9
2014	34805	34668.35147059	24955.14039313	34541.19843517	35353.5	34290.4
2015	30147	36454.76764706	24955.12207749	36304.49587793	31135	31742
2016	32123	38241.18382353	24954.75419805	38067.79332069	31135	31727.8

.Following chart shows the comparative analysis between Actual Cotton Bales production and predictions made by five algorithms of the annual Cotton Bales production.



CONCLUSION:

Concluding on-going research work, it can be say that some other meteorological factors, just as 'Temperature' can also be included to correlate annual rainfall and crop production along with the then market rates for specific crop yield. Currently *Linear Regression, Support Vector Model, Bayesian Linear Regressions, Decision Tree and Random Forest* algorithms were used to predict annual rainfall and 'Cotton' crop production, comparing it with actual available dataset results are quite satisfactory in regard with Decision tree and Random forest algorithm.

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IJCRT
ISSN 2454-7719
International Journal of Computer Research & Technology
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-03

Comparative Study of Cryptography, Steganography and Watermarking Techniques for Information Security

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Abstract:- *Information or data is a very crucial resource to us. Thus securing information becomes more essential. The communication medium through which we send data does not provide data security, so other methods of securing data are required. Information hiding plays a vital role today. It provided methods for encrypting the information to become unreadable for any unintended user. Cryptography, steganography, and watermarking are three popular ways to send information secretly. Information security means protecting data from unauthorized access. It is very challenging to transmit data from the sender to the authorized receiver with full security through insecure media. This paper is an attempt to analyse data-protecting techniques such as steganography, cryptography, and watermarking.*

Keywords — Steganography, Cryptography, Watermarking, Cryptanalysis, Symmetric key cryptography, LSB, DCT, RSA, DWT.

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I. INTRODUCTION

Nowadays, the amount of data exchanged through the internet is increasing. Therefore, data security is recognized as a critical issue when the communication of data is processed over the Internet. Everyone needs their data to be safe during communication [1]. In the past few years due to the fast development in the cyberspace field, it is needed to protect the information so that it is secret and confidential information from intruders. This is achieved through the hiding of data. The Greek word Steganography is a combination of two words "stegos" meaning "cover" and "grafia" meaning "writing" defining it as "covered writing" [2]. Communication over the internet is surely efficient but intruders can steal private information. Many communications such as video chat or electronic mail and even web browsers are Cryptography, Steganography, and Watermarking techniques are widely used to hide the original message for secure communication. Cryptography means the sender converts plaintext to cipher text by using the encryption key and the receiver side requires the receiver to decrypt cipher text to plain text by using a technique known as cryptanalysis [3]. Steganography is a data hiding technique, in which a message is kept secret inside another media whereas in Watermarking special information is secretly inserted in the image not totally secure over the internet for exchanging the information [4]. Sometimes, information may include personal or financial details such as bank-related details which may be intercepted by an intruder so the user requires a third party which do not access and alter the original content.

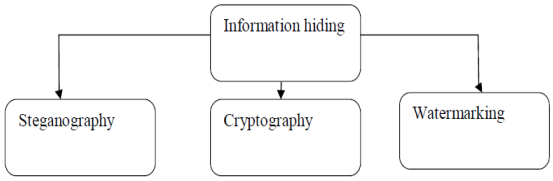

Figure - 1 Information hiding techniques

Need of information hiding:

A few reasons behind information hiding are as follows:

- Personal and private data
- Sensitive data
- Confidential data and trade secrets
- To avoid misuse of data
- Unintentional loss of data, human error, and accidental deletion of data
- Blackmailing purposes
- Cybercrime

II. CRYPTOGRAPHY

It is the art of secret writing between two entities who want to communicate over an insecure channel by converting original messages into a different form to exchange messages between them [3]. Without the exact knowledge of the key unauthorized access cannot be possible. In cryptography, the data is converted from plain text to cipher text [5]. The Sender codifies the data with a key using any suitable scheme and converts the text into cipher text which is a scrambled text. This cipher text is transmitted at the receiver end. The receiver transforms the cipher text message back to plain text. Cryptography schemes include symmetric key cryptography, and asymmetric key cryptography [3].

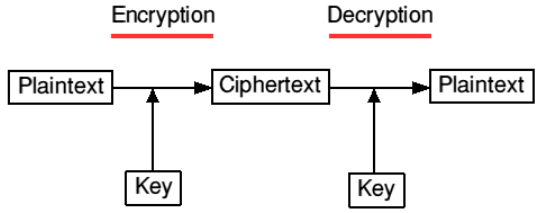

Figure - 2 Basic Cryptography Model

A. Components for Cryptography:

- ***Plain Text:*** *A message in readable form or in original form*
- ***Cipher text:*** *When a plaintext message is encoded using any suitable scheme, the resulting method is called a cipher text.*
- ***Cryptanalysis****: The process of trying to break any cipher text message to obtain the original plaintext message itself is called cryptanalysis.*
- ***Encryption:*** *The process of encoding plain text messages into cipher text messages is called encryption.*
- ***Decryption:*** *The reverse process of converting a cipher text message into a plain text message is called decryption.*

B. Types of Cryptography:

There are two types of cryptography:

1. ***Symmetric Key cryptography:*** - In this cryptography, both sender and receiver use the same key. Both can encrypt and decrypt data using the same key. Before the transmission of information can begin, the key must be distributed [6]. Examples: DES, 3DES, BLOWFISH, AES, etc.

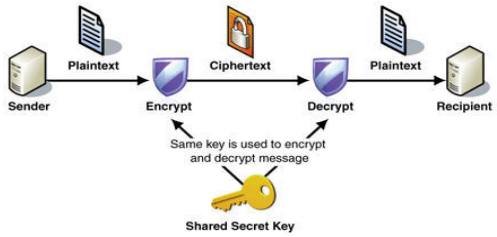

Figure - 3 Symmetric Key Cryptography

- **DES: (Data Encryption Standard):** It was the first encryption standard recommended by NIST (National Institute of Standards and Technology). It is based on an IBM-proposed algorithm called Lucifer. DES became a standard in 1974. Since then, many attacks and methods exploiting the weaknesses of DES have been recorded, making it an insecure block cipher. The algorithm encrypts a 64-bit key. DES has transposition blocks and 16 complex round ciphers. Although the 16 repeating round ciphers are conceptually similar, each uses a different key derived from the original key.
- **Triple DES (3DES):** As an extension of DES, the 3DES (Triple DES) encryption standard was proposed. The encryption method in this standard is the same as the original DES but applied 3 times to increase the encryption level. However it is a known fact that 3DES is slower than other block cipher methods. 3 DES uses 3 keys. For key size, 112 bits.
- **AES: (Advanced Encryption Standard):** It is a new encryption standard recommended by NIST to replace DES. The Rijndael (pronounced rain doll) algorithm was chosen in 1997 after a competition to choose the best encryption standard. The only effective attack is a brute force attack in which the attacker tries to test all character combinations to unlock the encryption. Both AES and DES are block ciphers. AES is a very complex round cipher. AES is designed with 3 key sizes, 128, 192, or 256 bits.
- **Blowfish:** This is one of the most common public domain encryption algorithms provided by Bruce Schneider - one of the world's leading cryptologists, and president of Countermen Systems, a consulting firm specializing in cryptography and computer security. Blowfish is

a variable length key, 64-bit block cipher. The Blowfish algorithm was first introduced in 1993. This algorithm can be optimized in hardware applications although it is mostly used in software applications. Although she suffers from weak key issues, no attack against her is successful.

- **IDEA:** The international data encryption algorithm was developed by Xuejia Lai and James Massey, the block size is 64 and the key size is 128.
- **CAST – 128:** It was developed by Carlisle Adams and Stafford Tavares. It is a faistel cipher with 16 rounds and a block size of 64 bits. The key size is 128 bits.
- **RC5:** was designed by Ron Rivest. It is a family of ciphers with different block sizes, key sizes, and number of rounds.

2. ***Asymmetric Key Cryptography:*** In this cryptography, there are two keys, a private key and a public key. The recipient keeps the private key. The public key is open to the public. When the message is received, the receiver uses private and decrypts the message. In that, a key is transferred to the other side before the exchange of information begins [7]. Example: RSA, Elgamal, Elgamal signature Diffie Hellman key exchange, Digital signature, etc.

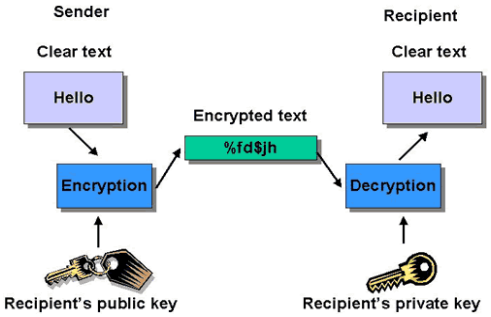

Figure 4 Asymmetric Key Cryptography

- **RSA (Rivest, Shamir, and Adelman):** The most common public key algorithm is RSA. It uses two numbers e and d as public and private keys. The two keys have a special relationship with each other.
- **Diffie-Hellman:** It was originally designed by Key Exchange. In this algorithm, two parties generate a session key to exchange data without remembering or storing the key for future use. They do not need to meet to agree on the key, it can be done over the Internet.

III. STEGANOGRAPHY

Steganography is the study of invisible communication. Steganography means hiding secret messages behind any media files. "Steganography" is a Greek word meaning "hidden writing". Steganography word is classified into two parts: Steganos which means "secret or covered" (where you want to hide the secret messages) and the graphic which means "writing" (text). However, in hiding information the meaning of Steganography is hiding text or secret messages into another media file such as image, text, audio, and video. [8].

Steganography is an ancient art of embedding personal information into other data using specific rules and techniques. As a result, unauthorized users cannot see and identify the embedded information. Steganography manages a secret way of sending information invisibly. Steganography is a valuable technique to hide data behind a carrier file such as image, audio, or video, and transmit that data securely from the sender to the receiver. Steganography is the process of hiding a message, audio, image, or video by embedding it in another image, audio, message, or video. It is employed to protect secret data from malicious attacks [9].

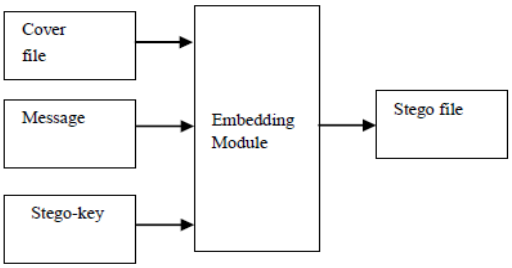

Figure - 5 Basic Steganography Model

A. Components for Steganography

- **Cover-object/File:** The original object where the message has to be embedded.
- **Secret Data/Message:** The data that is to be embedded in a cover object is known as a secret message.
- **Stego object/File:** The cover object, once the message has been hidden or embedded.
- **Stego Key:** The secret code to be shared between Sender and receiver to embed and retrieve the message.
- **Embedding algorithm:** It is the way or the idea that is often used to embed the secret information in the cover message.

B. Types of Steganography

1. **Image Steganography:** For hiding the secret message in carrier image, which is then converted into a stego-image.
2. **Text Steganography:** In this, the message that is to be sent is rooted firstly in a text file by formatting. The format is based on line-shift coding, word-shift coding, feature coding, etc. Reformatting of the text destroys the rooted content hence the technique is not robust.
3. **Audio Steganography:** secret message is embedded into unused audio bits as every file contains some unused bits or unused areas of bits where a secret message can be hidden.

4. **Video Steganography:** Video steganography divides the video into audio and image frames where embedding is performed in the audio file.
5. **Network Steganography:** It involves hiding the information by taking the network protocol such as TCP, UDP, ICMP, IP, etc., as a cover object. In the OSI layer network model there exist covert channels where steganography can be used.

C. Steganography Techniques

There are following some approaches to classifying the Steganography techniques are given below:

1. **Spatial Domain Methods:** In this method, secret data is embedded directly into the pixel intensity. It means some pixel values of the image are changed directly while hiding data.
   Spatial domain techniques are classified into the following categories:
   - **LSB:** This method is most commonly used for hiding data. In this method, embedding is done by replacing the least significant bits of image pixels with bits of secret data. The image obtained after embedding is almost similar to the original image because the change in the LSB of the image pixel does not bring too many differences in the image.
   - **BPCP:** In this segmentation, images are used by measuring their complexity. Complexity is used to determine the noisy block. In this method, noisy blocks of bit plan are replaced by binary patterns mapped from secret data.
   - **PVD:** In this method, two consecutive pixels are selected to embed data.. Payload is determined by checking the difference between two consecutive pixels and it serves as the basis for identifying whether the two pixels belong to an edge area or smooth area.
2. **Spread Spectrum Technique:** This technique uses the concept of spread spectrum. In this method, the secret data is spread over a wide frequency bandwidth. Each frequency band must have a signal-to-noise ratio so small that it is difficult to detect the presence of data. Even if parts of data are removed from several bands, there would be still enough information present in other bands to recover the data. Thus it is difficult to remove the data completely without destroying the cover. It is a very robust technique mostly used in military communication.
3. **Statistical Technique:** In the technique, the message is embedded by changing several properties of the cover. It involves the splitting of the cover into blocks and then embedding one message bit in each block. The cover block is modified only when the size of the message bit is one otherwise no modification is required.
4. **Transform Domain Technique:** In this technique; the secret message is embedded in the transform or frequency domain of the cover. This is a more complex way of hiding a message in an image. Different algorithms and transformations are used on the image to hide a message in it. Transform domain techniques are broadly classified as follows:
   - Discrete Fourier transformation technique (DFT)
   - Discrete cosine transformation technique (DCT)
   - Discrete Wavelet transformation technique (DWT)
   - Lossless or reversible method (DCT)
   - Embedding in coefficient bits
5. **Distortion Techniques:** In this technique, the secret message is stored by distorting the signal. A sequence of modifications is applied to the cover by the encoder. The decoder measures the difference between the original cover and the distorted cover to find the sequence of changes and recover the resulting secret message.
6. **Masking and Filtering:** These techniques hide information by marking an image. Steganography only hides the information as watermarks become a portion of the image. These techniques embed the information in the more significant areas rather than hiding it in the noise level. Watermarking techniques can be applied without fear of image loss due to lossy compression as they are further integrated into the image. This method is used for 24-bit and greyscale images

IV. WATERMARKING

Digital watermarking is the technique of hiding a message related to a digital signal (i.e. an image) within the signal itself. Watermarking is a concept similar to steganography, in which both hide a message inside a digital signal. Watermarking attempts to hide the message associated with the actual content of a digital signal. Watermarking is a process for adding a message (the watermark) to the image [10]. If anybody tries to copy the watermarked image, the watermark is copied along with the image. So watermarking helps to verify the authenticity and identity of the genuine owner of the digital image [11].

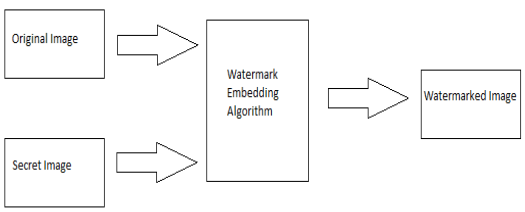

Figure - 6 Basic watermarking Model

D. Types of Watermarking

- **Visible Watermarks** – These watermarks are visible.

- **Invisible Watermarks** – These watermarks are embedded in the media and use steganography techniques. They are not visible to the naked eye.
- **Public Watermarks** – These can be understood and modified by anyone using certain algorithms. These are not secure.
- **Fragile Watermarks** – These watermarks are destroyed by data manipulation. There must be a system that can detect all changes in the data if fragile watermarks are to be used.

V. STEGANOGRAPHY VS WATERMARKING [12][13]

- Steganography involves hiding the intended message in a seemingly innocuous message while cryptography involves encoding the message using an encryption key and sending it as cipher text.
- In steganography, information is just hidden while in watermarking it is hidden and protected.
- Robustness: This criterion is different in both cases. Steganography is mainly concerned with the detection of the hidden message while watermarking concerns potential removal by a pirate.
- Stenographic communications are one- to- one while watermarking techniques are usually one-to-many.
- A steganography/watermarking system is considered insecure already if the detection of steganography/watermarking is possible

VI. STEGANOGRAPHY VS CRYPTOGRAPHY [14][15][16][17]

- Cryptography is the study of hiding information, while steganography is concerned with creating hidden messages so that only the sender and receiver know the message exists.
- In Cryptography, the encrypted message is visible to all whereas in steganography, only the sender and the receiver know the existence of the message.
- Cryptographic methods try to protect the content of a message while steganography hides both the message as well as the content.
- Cryptography uses mathematics and number theory to hide data. There is not much math involved in steganography.
- In steganography, the inclusion of secret data should not affect the quality of the message file. The secret code is visible to an adversary in the case of cryptography.
- One can achieve better security by combining steganography and cryptography.

VII. REVIEW OF RELATED WORK

This literature review describes different Steganography, Cryptography, and Watermarking techniques used for various media.

Reference [18] presented Cryptography and Steganography are well-known and widely used techniques that manipulate information to cipher or hide their existence respectively. Steganography is the art and science of interacting in a way that hides the existence of the communication. The word 'Steganography' is of Greek origin and mostly means concealed writing. Protection of the transmitted data from being prevented or tampered with has led to the development of various stenographic techniques.

The author's paper [19] suggests various cryptography algorithms like RSA, ElGamal, Diffie-Hellman, Knapsack, etc. are proposed with different key lengths by key management methods. The size of encrypted data depends on the key length and key management method; these factors also prove the efficiency of the algorithm. As per the selection of key length for algorithms, the user gets effective results for storing a large volume of data. The execution time also changes as per key length.

In a paper [20] researchers present a detailed study of the traditional Encryption Algorithms such as RSA, DES, 3DES, and AES. The use of the internet and networks is growing rapidly. To provide security to the data and network, different encryption methods are used. In this paper, a survey of the existing works on Encryption techniques has been done. After the analysis, it has come to know that all the encryption methods are useful in their own its way. Out of all AES algorithm is the most efficient regarding speed, time, throughput, and avalanche effect.

In the year 2021, Mohamad et al. [21] discuss the RSA scheme review of asymmetric cryptography techniques. Based on the efforts of researchers over the last decade, it attempts to introduce the application domains of the RSA scheme such as public networks, wireless sensor networks, image encryption, cloud computing, proxy signatures, Internet of Things, and embedded devices. Apart from that, based on the number of studies conducted, the article examines the trends and performance parameters of the RSA scheme, including security, speed, efficiency, computational complexity and space. Finally, this study discusses the techniques and advantages of the proposed scheme. This survey is very unstructured and covers very few RSA schemes. No proper research method was used in this study.

In [22] research paper, researchers present an invisible image watermarking scheme for copyright protection and tamper detection. Here the combination of the Secret key encryption algorithm and LSB technique is used for embedding the watermark. In this process, watermark extraction is done by the same key, and hence, it can be applied for copyright protection of digital media such as images, audio, and video. The proposed method is capable of detecting any modification made in the image pixels.

This technique produces high capacity and minimum computations. Moreover, we can improve this process by embedding the watermark into DCT coefficients.

The authors of [23] propose their steganography technique of data hiding in the least significant bits of pixels. Embedding occurs in two stages. In the first stage, 2 bits of information are embedded in each pixel of the image, and two changed pixels are combined into a pair of intermediate pixels. In the second stage, using a pair of intermediate pixels, two identical separate pairs are obtained to hide 4 more secret bits, due to which it is possible to achieve a large embedment capacity.

Reference [24] presented an algorithm for reversible stenographic embedding information in compressed JPEG images, which differs in an original approach to the selection of DCT coefficients, the change of which leads to less distortion of the cover image during embedding. To ensure reversibility, the message length and coefficients used to embed the message are hidden inside the image along with the message.

A detailed review of research in the field of reversible watermark embedding is presented in [25].

VIII. Comparative Study Of Steganography, Cryptography And Watermarking

Table 1: Comparative Analysis of Steganography, Cryptography and Watermarking

Factors	Steganography	Cryptography	Watermarking
Definition	Steganography is the art of Hiding information behind the Media file.	Cryptography is the art of Achieving security by encoding Message to make them non-readable.	Watermarking is the art of Inserting information into an image secretly.
Techniques	LSB, Spatial, Block	Transposition, substitution,	Spatial domain, Fragile
Carrier	Any digital	Usually text	Usually
Secret key	May be used	Necessary cannot	May be used
Robustne	Yes	Yes	Yes
Type of attack	Steganalysis	Cryptanalysis	Synchronization
Output	Stego file	Cipher text	Watermarked
Fails	When it is	De-ciphered	When it is
Key	Small	Very large	Small
Naked eye Identification	No, cannot be possible because	Yes, can be possible because the original	Yes, as the actual message is hidden
Durability	Steganography basically hides the data	Cryptography, using an encryption algorithm	Watermarking embeds the data covertly

The authors of [26] also consider binary images, but as digital watermarks that need to be embedded in some other images. Data embedding positions are optimally selected using a visual perceptual model, to increase embedding invisibility. With encryption and embedding keys, the digital watermark can be successfully extracted, while the original image will be completely restored.

The authors of [27] propose an algorithm for fragile watermark embedding, which allows localizing changes made to images and restoring distorted fragments. To do this, at the stage of creating a digital watermark, bit sequences are created that will be used later if restoration is required.

The study [28] describes a system for marking medical images in order to verify their authenticity and access control. This system combines a watermarking method based on quantization index modulation and a joint watermarking-decryption method. It allows you to embed a watermark on the side of the sender as evidence of the reliability of the image before sending it in encrypted form. Then, on the receiver side, in the decryption process, another watermark should be built to track access to the image.

IX. Future Work

Currently, methods of cryptography, steganography, and watermarking are actively developing, and many researchers from different countries offer many new algorithms that differ in different quality characteristics. Despite the variety of developed algorithms, in the field of information embedded in digital images, there are still a number of unsolved problems. The overwhelming majority of modern embedding algorithms provide high imperceptibility of embedding, therefore, the attention of researchers working in this field should be aimed at achieving other embedding efficiency indicators: reversibility, robustness, and resistance to steganalysis. The review showed that work in these areas is underway, but there are still a lot of problems that require new original solutions.

X. Conclusion

This paper provides a comparative study of Cryptography, Steganography, and Watermarking techniques that are widely accepted for the transmission of confidential data from one side to the

other side. We can evaluate from the table that since the key length is high in the cryptographic technique it is very difficult to decipher the code. When it comes to naked-eye identification steganography is a better technique but once it is detected the secret message can be easily decoded. The same happens in the case of watermarking. But in the case of cryptography, the naked eye identification can be easily done because during this technique original message is converted into cipher text but due to a large number of secret key combinations it is very difficult to de-cipher it again. Finally, we conclude that cryptography is a better technique as it offers a more secure service but it has some limitation in the case of naked eye identification and it can only be applied in the case of text formats whereas steganography and watermarking technique is applied on various formats. Thus, to solve this problem further enhancement in the cryptography and steganography techniques is very important and both these techniques have to be integrated together for better security results.

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IJCRT
ISSN 2454-7719
International Journal of Computer Research & Technology
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-04

Sound Healing Therapy for Mentally retarded patients using IoT.

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Abstract:- *One of the emerging trends in information technology is the Internet of Things which refers to the network of interconnected devices and different technologies. It facilitates communication between various devices, the cloud and among the devices. We can integrate everyday things with the Internet using the Internet of Things. IoT works effectively with the help of the collection and exchange of real-time data. Using different sensors, the data is collected from various sources and used for analysis by passing it to the cloud. The versatility of IoT makes it an effective option for many businesses, organizations, and industries. With wearable IoT devices, one can monitor patients' health smartly. This paper gives a brief insight into the use of IoT for treatment of the mentally retarded patients with sound healing therapy and explains in detail the process of healing using systematic use of the Internet of Things.*

Index Terms*—Internet of Things, Sound healing therapy, Mental health, Sensors.*

I. INTRODUCTION

One of the most significant and exciting developments in the world of Information Technology is the emergence of the Internet of Things and it is going to contribute remarkably over the next five years. The main contribution of IoT has been observed in designing smart homes, consumer electronics, and healthcare. One of the top wellness trends in the healthcare sector at the moment is sound healing therapy, where music is used to cure many diseases including mental disorders. Using different sound patterns we can improve physical as well as emotional health.

This paper aims to create awareness about the application of the Internet of Things for sound healing. When the concept of IoT was integrated with music, the term Internet of Musical Things was introduced. A musical thing is formally defined as a "computational device capable of acquiring, processing, acting, or exchanging data that serves a musical purpose [1].

We can utilize different musical objects to heal the patient's mental disorder by developing smart instruments using different sensors and wireless connections.

II. INTERNET OF THINGS AND INTERNET OF SOUND THINGS

IoT is made of billions of intelligent and heterogeneous communicating 'things' [2]. When we connect these devices it ultimately increases sustainability, reliability, and efficiency. It uses cost-effective wireless embedded devices that don't demand large infrastructure [3]. The words "Internet" and "Things" mean an integrated worldwide network formed by sensory, communication, networking, and information-processing technologies [2]. The impact of IoT is

been recognized by many leading organizations and industries through which there is a significant enhancement in customer services and decision-making processes.

2.1 Working:

The IoT ecosystem consists of smart devices that are web-enabled and make use of different sensors and processors. These processors can be used to collect, send, and process the data. The data is collected by an IoT gateway. If the data needs to be filtered, then it is sent to an edge device which analyses it locally. To make the data collection process more precise IoT can also use the concept of Artificial Intelligence and machine learning.

2.2 Architecture of IoT

The main concern of IoT is, all the required devices must be connected so that they can possess a complete IoT framework including communication, processing, and networking [4]. The architecture of IoT must be flexible to adopt the extensibility, scalability, and heterogeneous nature of the interconnected devices. The fundamental architecture of IoT includes four layers as described in the diagram.

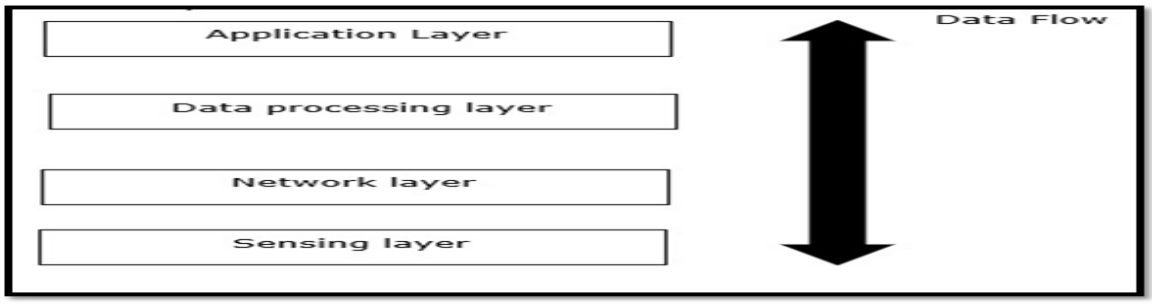

Fig:2.1 Architecture of IoT [5]

2.2.1 Sensing Layer: To build smart systems, this layer represents the use of sensors that are able to sense environmental changes and exchange the data values among the connected devices. The main role of this layer is to collect and process the data and transmit it over the network. [5].

2.2.2 Network Layer: This layer is concerned with the establishment of a strong connection of all the available things for sharing information and communication. It must be capable of mapping things automatically to perform the assigned responsibility collaboratively [4]. It has a data acquisition system that converts the analogous data collected from sensors to digital data.

2.2.3 Data Processing Layer: Depending on the variation and applicability the data is segregated and pre-processed at this layer. This layer prepares the data to be used by the data centers for further processing. Here one can also use the concept of Edge computing which enables the collected data to be processed at the edge rather than sending it to the cloud or data center.

2.2.4 Application Layer: This layer comprises the clouds or data centers where the data is actually managed and used for the specific application. It can be represented as an integration of IoT's social division and industry requirements [6].

III. SOUND HEALING THERAPY

Sound healing is one of the healing techniques that use various vibrations to heal the body mind and spirit. Sound healing uses specific frequencies and harmonics that are said to heal the body. Research says that the root cause of many diseases is unexpressed or blocked emotions. It has been proven that our thoughts and feelings produce energy, which triggers vibrations. Everything vibrates at a different level, including feelings. Emotions that we consider uncomfortable, or unpleasant, vibrate at relatively low levels. Emotions that most people find pleasant and joyful vibrate at higher levels [11]. For healing, sound healing therapy makes the use of different instruments

that vibrate at specific frequencies when struck which can lead to the generation of different

the heart chakra which releases the trapped negative emotions.

IV. PROPOSED SYSTEM

As we know the first layer of the architecture of IoT makes use of different sensors to gather the required data, For the proposed system we can make use of different multimodal sensors like physiological sensors, inertial sensors, and ambient sensors through which we can track heart rate, skin conductance, etc. [7]. These measured factors are useful for analyzing emotions and changes in behavior [10]. Nowadays, many of the latest smart gadgets (smartphones, smartwatches, fitness bands, etc.) are embedded with these sensors.

The data collected from the sensor layer can then be passed to the data processing layer through the network layer, where the disease can be detected and appropriate sound can be generated for healing the patient. The disease detection process consists of comparing the collected data values with threshold values. The threshold values reflect the normal range of the

From the above illustrations we have tried to represent the proposed system, including IoT enabled wearable device like smart watch which will record different factors related to the patients' mental conditions which will be analyzed further and appropriate sound will be generated. Also, with the help of a cloud system we can communicate wit the actual sound healer or medical expert who can analyze the real time patient information. This system will also monitor the impact of different sounds used for patient and help to determine either the next therapy is required or not.

V. CONCLUSIONS

Recent researches identified the impact of sound healing technique on the mental health of many different patients. However, due to the lack of awareness of this therapy

patterns of sound which ultimately can be used for healing the patient. The healing sound opens

measured parameters which in turn indicates the healthy person. So it will be easy to detect the severity of the mental disorder and line of treatment through sound healing therapy.

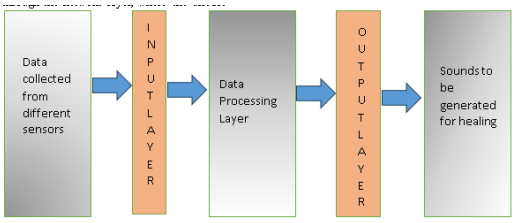

Fig 4.1: Graphical Illustration for the Proposed System [13]

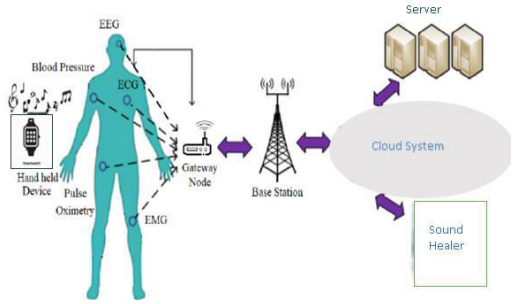

Fig4.2: System Level Illustration [13]

many people don't find any specific solutions to their problems. Also, patient need to attend physically the sessions for sound healing therapy, which may not be affordable and suitable to everyone.

To overcome the above mentioned challenges, this paper proposed an approach which will integrate the concepts of Internet of Things, Internet of Sound Things, and will provide an automated yet systematic way to deliver sound healing therapy. Major component of the proposed system include collection of data from different sensors, and production of appropriate sounds which will heal the mental state of a patient. Furthermore, the sound healers will also be provided to suggest music for the patient, if required.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-05

Wearable Internet of Things (IoT) devices for HealthCare Monitoring

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Abstract *Wearable Internet of Things (IoT) devices are like smart gadgets you can wear, such as smart watches and fitness trackers. They're excellent helpful for keeping track of your health. These gadgets have special detectors that can calculate things such as your heart rate, how much you move, and even how well you sleep. They connect to your phone or computer to show you this information. Doctors can also use them to look after you, even if you're far away. While they're really cool, there are fewa things we need to figure out, like how to keep your details personal and make sure the detectors work just right. In the future, these devices might get even superior and help us stay healthier in smarter ways.*

Keywords: *Wearable IoT devices, health monitoring, smart gadgets, sensors, fitness trackers, smart watches, data tracking, health management, personalized health, remote monitoring, technology and healthcare.*

INTRODUCTION:

In recent years, wearable Internet of Things (IoT) devices have emerged as innovative tools that merge technology with daily life to monitor health and well-being. These devices, which can be worn like regular accessories, have gained popularity due to their ability to collect and transmit real-time data about various aspects of our health. With sensors that measure vital signs, activity levels, and sleeps patterns, these wearable's have the potential to revolutionize the way we manage our health. This paper introduces the concept of wearable IoT devices for health monitoring, exploring their functionalities, applications, benefits, and challenges. As these devices become more integrated into our lives, it is crucial to understand both their capabilities and limitations to harness their potential effectively.

1) What are wearable's?

It's a little device that's far more moveable than a phone, and you can simply carry it on your person as an accessory. It is wearable, rooted in clothing, tattooed on the skin or set in the user's body. Compared with cellular phones, it has many advantages, such as: lightweight and speedy, low power conservation, advanced communication features, design simplification, etc.

It is an arrangement of an internet connection and a microprocessor. so, you constantly obtain real-time messages/notifications through it since it is connected to the Internet and immediately connects to mobiles and individual computers. It enables you to access information from everywhere.

Wearable's are varied and trendy, such as fitness activity trackers, smart watches, Bluetooth headset, smart watches, web-enabled glasses, virtual reality and augmented reality headsets.

The data collected by wearable's can offer insights into diverse aspects of a person's life, including physical activity, sleep patterns, heart rate, and more. This information can be used for personal health monitoring, improving physical performance, enhancing safety, and even enabling new forms of interaction with digital technology.

WEARABLE'S DEVICES:

1) iTBra: developed by Cyrcadia Health. Research has revealed that opaque breasted women can be six times more likely to develop breast cancer. Sixty per cent of younger women and 40 per cent of elder women who have gone through menopause have dense breasts.

It is an intellectual patch using collected data. It provides analysis to become aware of early signs of breast cancer. Cyrcadia's iTBra is a smart wearable bra insert that provide accurate early breast cancer detection. It is worn under garments for just two hours a month, to notice circadian temperature changes in breast tissue. Such changes are connected to the onset of cancer. The data is sent namelessly to Cyrcadia's core lab for analysis through a wearer's mobile device. Results are sent back inside minutes and can be shared with relatives and physicians.

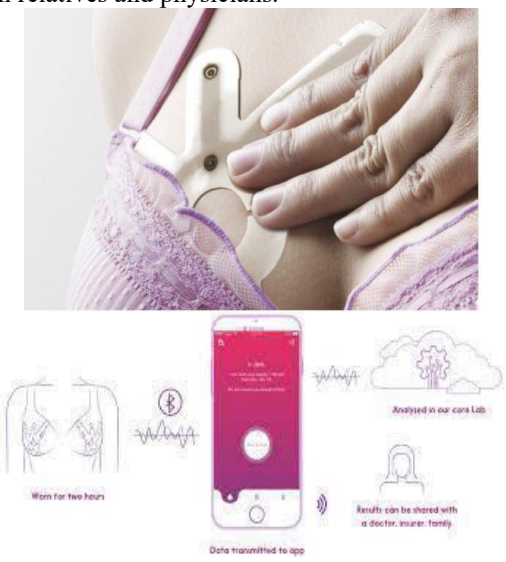


Fig. iTBra

2) AIR Louisville: Wearable devices in Louisville, Kentucky. The devices gather records on air quality, fine dirt, and toxic waste from which to give warnings about dangerous areas.

Fig: AIR Louisville

3) Fitbi: Fitbi devices traces a variety of data related to your every day physical activity. This information varies depending on the gadget, but almost all of them track your every day steps, distance, calories burned, and sleeping activity. Some of the more superior devices can also ensure your heart rate and track your position with GPS, which allows you to view your road, distance, and pace in the cellular phone app after a run.

In adding together to tracking your activity, some of the more superior models can **remind you to move**, give you **call and text notifications** from your Smartphone, and allow you to **manage your melody**. Fitbit has a useful **comparison page** that shows you the features of each gadget; it can be a useful tool to assist figure out which gadget is the best fit for you.

Fig: Fitbi

4**) Smart Watch:** The trendy smart watch is the Apple Watch, which is synced with the iPhone. Android Wear, for example, Moto 360, Samsung Gear, only connect to phones running the Android operating system. A Pebble is a device that can be synced with any mobile operating system.

Smart watches record vital signs like heart rate, SpO2, skin temperature, step count and more. This vital data, when shared with healthcare provider, can help in detect underlying diseases at an early stage. The smart watch records heart rate and when it reports any anomaly, it sends notifications to the worried person. This data provides alerts concerning the patient's risk of an oncoming heart attack or stroke and sends reminders about medical appointments. In such cases, doctors can also accept the patient's data remotely and suggest proper cure instantly.

- **FUTURE OF WEARABLE'S:**

The arrangement of miniaturized microprocessors, high-speed information transfer and mobile network is driving the increase of wearables. In the future, towards the development of focused and practical products.

Wireless charging would be a good solution to develop the battery life of current wearable's. Batteries can be charged from sources like solar energy, body heat and motion into power. When the batteries of today's gadgets can only be used for almost aday.

Fig.

a) Measure data accuracy: Improves the correctness of the gadget. Especially in healthcare applications, the collected information must be of optimal accuracy before the analysis is meaningful.

b) Security and privacy: Data is non-encrypted and is transmitted via Bluetooth or Wi-Fi connections. In the future, information needs to be more protected, especially private information. The adjustment of the security protocol in the D2D network needs to be researched and succeed.

c) Lower visibility: This will make devices look like jewelry, clothing, patches, or straps. Use machine learning in data collection and analysis.

d) Data transmission: Using 5G and other technologies to enhance transmission speed. Moving data storage, processing, and management from the centralized cloud to edge computing enable real-time data collection and processing, enabling quicker and more capable response. Compressive sensing helps to optimize energy utilization and efficient bandwidth. These are the 2 most significant elements in wearable.

e) Localization: Wearable gadgets mostly rely on wireless networks (BLE, Wi-Fi, and UWB) which are vulnerable to Non-Line of-Sight (NLOS), multipath propagation, scattering, diffraction, and reflection leading to information transmission incorrect. In the future, there will be a need for technologies to develop this condition.

PROS OF WEARABLE DEVICES:

a) Convenience: Wearable devices are typically small, light, and easy to wear, making them convenient for continuous health monitoring without interfering with daily activities.

b) Continuous Monitoring: They provide real-time, continuous monitoring of various health metrics such as heart rate, sleep patterns and physical activity, which can help individuals track their health trends over time.

c) Motivation: Wearable's can act as motivational tools, encouraging users to be more active and make healthy lifestyle choices by setting goals and providing feedback and rewards.

d) Early detection: Some wearable's can detect abnormalities in vital signs and alert users early to potential health problems, enabling timely medical intervention.

e) Data Collection: Wearable's collect and store an enormous amount of health-related data, which can be valuable to individuals, health care providers, and researchers to assess and improve health outcomes.

f) Integration: Many wearable devices can sync with smart phones and other digital platforms, allowing users to easily access and analyze their health data and share it with healthcare professionals.

g) Customization: Users can tailor their wearable device to track specific health metrics or goals, such as weight loss, fitness training or stress reduction.

CONS OF WEARABLE DEVICES:

a) Accuracy: Some wearable devices can vary in accuracy, leading to potential inconsistencies in the data they provide, which can be problematic for medical decision making.

b) Cost: High-quality wearable devices with advanced features can be expensive, and some users may find it challenging to justify the cost.

c) Battery Life: Most wearables require regular charging and their battery life can vary. Frequent charging may be inconvenient for some users, especially if they depend on the device for constant monitoring.

d) Privacy Concerns: The collection and storage of personal health data through wearable devices raises privacy concerns. Users should be cautious about how their data is shared and protected.

e) User Engagement: Some users may lose interest in using their wearable's over time, reducing the effectiveness of these devices in promoting long-term behavior change.

f) Limited Functionality: Although wearable's can track a variety of health metrics, they may not be as comprehensive as medical-grade devices used in clinical settings.

g) Skin Sensitivity: Some individuals may experience skin irritation or allergies after wearing certain types of wearable's.

2. BODY SENSOR NETWORKS

- **What are Wireless Sensor Networks?**

Wireless Sensor Networks (WSN) are advancement in energy storage, sensor design, and wireless communication. It helps to examine lots of ecological factors, such as magnetic field, tilt and vibration, light intensity, barometric pressure, humidity, and temperature.

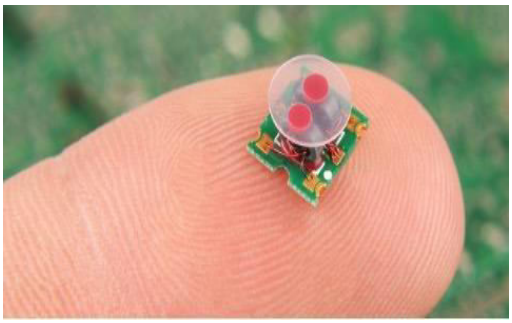


Figure: Smart Dust defense project allows monitoring enemy movements secretly

WSN was evolved based on an open-source called Tiny Microthreading Operating System (TinyOS), which is an power proficient operating system. TinyOS performs controlling power excess, routing decisions, and sensor dimensions. WSN applications are separated into 3 types: monitoring objects, environments, and the interaction of these objects with environments.

- **OVERVIEW BODY SENSOR NETWORKS**

A body sensor network (BSN) is the placement of sensors on the surface of the body as well as embedding them in tissues. It contributes to creating a consistent strategy for universal monitoring by establishing standards.

Figure: An example of Body Sensor Network

The BSN's architecture will include multiple sensors (batteries, wireless transmitters, a small processor) that are attached to the body and connected to hospitals, offices, and homes. The nodes of the BSN collect data from the sensors they are connected to, perform low-level processing of the data, and then wirelessly transmit the information to the Local Processing Unit (LPU) for processing and integration. Finally, the data is sent to a central monitoring server via (3G, GPRS, Bluetooth or wireless LAN).

- **THE FUNCTION OF BODY SENSOR NETWORKS**

Wireless BSN provides a framework for establishing such health monitoring systems and diagnostic tools. This will provide dramatic, important information.

a) Monitoring patients with chronic diseases: Detect early signs of chronic diseases (heart, high blood pressure, diabetes mellitus by ECG) to avoid the risk of stroke. Also to monitor the patient's response and progress to various treatments.

b) Monitoring Hospital Patients: Automated Patient Monitoring from Anywhere. It is very important to monitor and detect problems that occur after surgery. It also provides a streamlined and optimal process for receiving and handling the patient's condition.

c) Monitoring of elderly patients: This helps the elderly to receive adequate and timely medical care. Benefits include reduced mortality, morbidity, and the need for hospitalization.

Some other benefits of BSN also apply to security, military and sports fields.

REAL-LIFE EXAMPLES OF BODY SENSOR NETWORKS

a)Implantable Biosensor Chip:

An implantable biosensor chip developed by the EPFL Integrated Systems Laboratory is implanted on the surface of the skin. Connected to a Smartphone to measure multiple biochemistry indicators simultaneously. It helps in keeping track of cholesterol, glucose and drug concentration.

Figure 10: Biosensor chip

b) European Commission Rich: Devices embedded in clothing, incorporating them on textile platforms for universal surveillance.

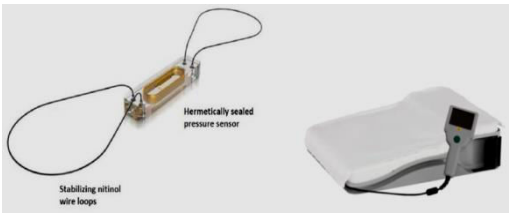
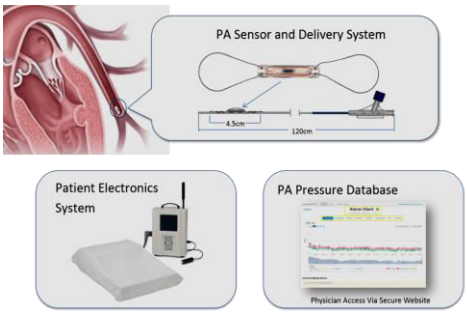


Figure 11: European Commission "Wealthy"

c) CardioMEMS: Developed an implantable pressure sensor that can measure pressure after implantation into an aneurysm sac during endovascular repair.



- **FUTURE OF SENSOR NETWORKS**

a) Data Transfer: Improves data loss to ensure real-time data query capability and QoS.
b) Wireless technology: consumes less power and ensures signal transmission in extreme conditions.
c) Context Awareness: The full awareness of the human body's adaptation to its changing context.
d) Access: Ensures easy sensor change and device biodegradability.
e) Power Demand: Works normally even when the power supply is weak or insufficient.
f) Data Protection: Data security must be ensured to prevent sensitive information from being exposed outside.
g) Event Detection: A mechanism to detect abnormal changes in the body.
h) Dynamics: The equipment interacts more with the environment and ensures the quality of operation when the body is active.
i) Node Size: Needs to be reduced in size or may be hidden and undetected.
j) Node Accuracy: The accuracy of data collection of nodes must be improved, then analysis makes new predictions meaningful.
k) Node Function: Integrates multiple functions into a single sensor.
l) Node Number: Reduces the number of required nodes to use.

- **PROS OF BODY SENSOR NETWORKS:**

a) Continuous monitoring: BSNs provide real-time and continuous monitoring of various physiological parameters, such as heart rate, body temperature and activity level, which can be important for early detection of health problems.
b) Remote monitoring: They enable remote monitoring of individuals' health, allowing healthcare professionals and caregivers to track the condition of patients without having to be physically present.
c) Data accuracy: BSNs are designed to provide accurate data, especially compared to consumer-grade wearable's, making them suitable for clinical and medical research applications.
d) Customization: BSNs can be customized to monitor specific health conditions, making them versatile for a wide range of medical and health applications.
e) Real-time feedback: Users receive real-time feedback on their health metrics, encouraging them to make immediate adjustments to their activities or treatments.
f) Early detection: BSNs can detect anomalies or irregularities in health parameters, helping to identify potential health problems before they become serious.
g) Integration with Healthcare Systems: BSNs can be integrated into healthcare systems and electronic health records (EHRs), streamlining the flow of patient data and improving healthcare coordination.

- **CONS OF BODY SENSOR NETWORKS:**

a) Cost: BSNs can be expensive to develop and implement, making them less accessible to some individuals and health care providers.
b) Privacy Concerns: The collection of sensitive health data by BSNs raises privacy and security concerns. Appropriate security measures and encryption measures are required to protect this data.
c) Comfort and wearability: Some users may find the BSN uncomfortable or intrusive to wear, reducing compliance with the monitoring protocol.
d) Complexity: The complexity of BSN can pose challenges in terms of setup, maintenance and data interpretation, especially for non-technical users.

e) Limited battery life: BSNs often rely on batteries, which have limited capacity. Frequent recharging or battery replacement can be inconvenient for users.
f) Interference: BSNs can interfere with other medical devices or wireless networks, causing potential operational problems or security issues.
g) Data Overload: The constant flow of data generated by BSNs can lead to information overload for healthcare professionals, necessitating the establishment of effective data filtering and analysis processes.
f) Regulatory compliance: BSNs used for medical purposes may need to comply with strict regulatory requirements, which can add complexity to their development and deployment.

CONCLUSION:
Wearable devices and body sensor networks (BSNs) have changed the health care landscape, creating many opportunities and challenges. Ultimately, both approaches play an important role in promoting healthcare and wellness, but their effectiveness depends on careful consideration of their benefits and limitations.

Wearable devices, such as smart watches and fitness trackers, provide convenient and accessible health monitoring tools for the general public. They encourage users to engage in healthy lifestyles, detect certain health problems early, and provide valuable data insights. However, they must face challenges related to data accuracy, privacy, and user engagement, and may be better suited for wellness tracking than clinical diagnostics.

On the other hand, body sensor networks (BSNs) offer a more comprehensive and accurate approach to health monitoring, especially in clinical and research settings. BSNs excel in providing continuous, real-time data, which can be critical for early disease detection and personalized healthcare. However, BSNs are often more expensive, more complex to set up and maintain, and can raise significant privacy issues. They are more specific and may not be accessible or comfortable for all users.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-06

Analysis of Encryption Algorithms Against Text Files

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Abstract- *The goal of this study is to provide a fair comparison of the most popular and in-demand data encryption algorithms. The performance of these algorithms under various conditions is our primary focus, so the comparison that is being presented takes this into account as well as the algorithm's behavior and performance under various data loads. In order to help the reader understand the key differences between the compared algorithms,*

Section 2 will provide a brief overview of cryptography and explain some of the most common terms used in it. It will also provide a brief description of each of the algorithms under comparison.

The outcomes of other contributions will be displayed in Section 3 together with their conclusions.

The used setup environment, settings, and system components will all be covered in Section 4.

To facilitate a better comparison, Section 5 provides examples of the performance evaluation technique and the selected settings.

The simulation findings are thoroughly discussed in Section 6, and Section 7 summarizes the main points and other pertinent factors to bring this work to a close.

Keywords— *Encryption techniques, Internet Security, Computer security, AES, DES, 3DES, Blowfish.*

1. . INTRODUCTION:

The goal of this study is to provide a fair comparison of the most popular and in-demand data encryption algorithms. The performance of these algorithms under various conditions is our primary focus, so the comparison that is being presented takes this into account as well as the algorithm's behavior and performance under various data loads. In order to help the reader understand the key differences between the compared algorithms[1].

2. CRYPTOGRAPHY:OVERVIEW

Cryptography is typically referred to as "the study of secret." Encryption is changing plain text that is "unhidden" into cryptic language that is "hidden" to protect it from data thieves. Another step in this process involves decrypting cryptic text so that it may be understood on the other end.

The straightforward flow of popular encryption techniques is depicted in Fig. 1.

Fig.1 Encryption-Decryption Flow

OBJECTIVES OF CRYPTOGRAPHY:

Every security system must offer a collection of security features that can guarantee the system's secrecy. These activities are commonly referred to as the security system's objectives. The following five major categories fit these objectives:

Authentication: This implies that the sender and recipient identities should be confirmed prior to sending and receiving data using the system.

Secrecy or Confidentiality: It indicates that nobody else is able to read the message's (the date's) content. Only those who have been authenticated may.

Integrity: It is the assurance that the transmitted data's content has not been altered in any way between the sender and receiver. In IPv4 packets, the packet check sum is the fundamental type of integrity.

Non-Repudiation: it is implied that neither the sender nor the recipient can pretend that they didn't send/receive a particular message.

Service Reliability and Availability:

Secure systems frequently experience intrusion attacks, which may have an impact on their usability and level of service to their users. These technologies ought to have a method to give their users the level of service they deserve[2].

Block Ciphers and Stream Ciphers:
The format of the input data that encryption algorithms work on is one of the primary categorization approaches for widely used encryption systems. Block ciphers and Stream ciphers are the two types.

Block Cipher

It is necessary to first define the term "cipher word" before moving on to describe the essential elements of a block cipher. "A cipher is an algorithm for encrypting data (decryption is the opposite)" [Wikipedia-BC].

If data is in the form of blocks, it is encrypted and decrypted using this manner. In its most basic form, ciphering involves breaking up plain text into blocks that are put into the system to create blocks of cipher text.

The most fundamental type of clock cipher is called ECB (Electronic Codebook Mode), which uses direct encryption of data blocks to produce the corresponding ciphered blocks (Fig. 2).

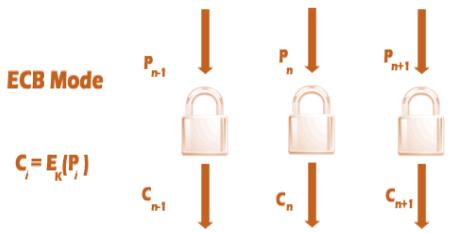


Fig.2 Block Cipher ECB Mode

Stream Ciphers:

Bit by bit operations are performed on a stream of data by stream ciphers. A mixing function and a key stream generator are the two main parts of a stream cipher. While the key stream generator serves as the primary component of the stream cipher encryption approach, the mixing function is typically only an XOR function. The outputted ciphered stream, for instance, will be the same as the original plain text if the key stream generator outputs a string of zeros. The execution of the stream cipher's simple mode is depicted in Figure 3 [3].

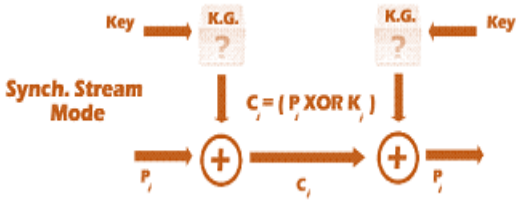


Fig. 3 Stream Cipher (Simple Mode)

MODE OF OPERATIONS:

Block ciphers come in a variety of forms, each of which uses a different method to increase the system's security. ECB (Electronic Codebook Mode), CBC (Chain Block Chaining Mode), and OFB (Output Feedback Mode) are the most used techniques. A chain-like encryption process is created when the ECB mode of CBC employs the cipher block from the previous encryption phase in the current one. Similar to stream cipher, which will be discussed below, OFB operates on plain text in a manner where the encryption key used in each phase is dependent upon the encryption key from the previous stage.

Many other modes, such as CTR (counter), CFB (Cipher Feedback), or 3DES-specific modes, are not covered in this work because the focus will mostly be on ECB and CBC modes.

Symmetric and Asymmetric encryptions : Depending on the kind of security keys used to encrypt/decrypt the secured data, data encryption techniques are primarily divided into two groups: Symmetric and Asymmetric encryption.

Symmetric Encryption:

The sender and the recipient agree on a private (shared) key for this kind of encryption. They then encrypt and decrypt their sent messages using this secret key. The method of symmetric cryptography is depicted in Fig. 4. Prior to encrypting and decrypting

transmitted data, Node A and B must first agree on the encryption method to be utilized. They then decide on the shared secret key that will be used in this connection. Node A begins sending data encrypted with the shared key after the encryption setup is complete, and node B uses the same key to decrypt the encrypted communications.

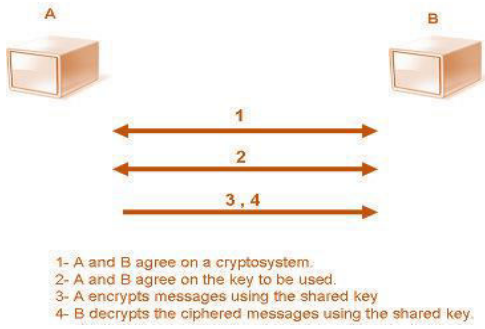


Fig.4 Symmetric Encryption

The fundamental issue with symmetric encryption is figuring out a secure way for the two peers to exchange the secret key. The entire system disintegrates if the key is discovered for any reason. When using a different secret key for each peer-to-peer connection, key management for this sort of encryption becomes complicated, requiring n(n-1)/2 secret keys to be stored and managed for n nodes.

ASYMMETRIC ENCRYPTION:

The second sort of encryption that employs two keys is called asymmetric encryption. To further clarify, only Key2 and Key1 are capable of decrypting and encrypting respectively. Because users frequently employ two keys—a public key that is known to everyone and a private key that is only known to them—it is also known as public key cryptography (PKC). The application of the two keys between nodes A and B is shown in Figure 5 below. Node B delivers its public key to node A after the two have decided on the type of encryption to be applied to the connection. The public key that Node A has obtained is used to encrypt its messages. Node B then employs its private key to decrypt the encrypted communications as soon as they are received.

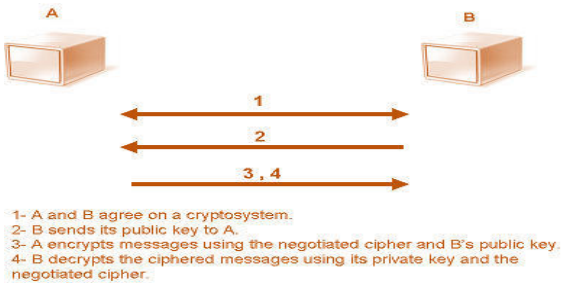


Fig.5 Asymmetric Encryption

The challenge of managing secret keys in symmetric encryption is solved by this capability. However, this particular characteristic of public key encryption renders it mathematically more vulnerable to assaults. Asymmetric encryption methods also demand a lot more computer processing power than symmetric methods, which makes them almost a thousand times slower.

A hybrid strategy is typically utilized to gain the advantages of both approaches. In this method, symmetric encryption is used to transport data between the sender and receiver after asymmetric encryption is used to exchange the secret key[4].

COMPARED ALGORITHMS:

DES: The first encryption standard that NIST (National Institute of Standards and Technology) recommended was DES (Data Encryption Standard). It is based on the Lucifer algorithm from IBM. In 1974, DES was made a standard. Since then, there have been numerous recorded attacks and techniques that take advantage of DES's flaws, making it an unsafe block cipher. 64 Bit key is encrypted by the algorithm. Block transposition and 16 intricate round ciphers are required for DES. Though essentially identical, the 16 iteration round ciphers each employ a unique key that was obtained from the original key.

3DES: The Triple DES (Triple DES) encryption standard was proposed as an improvement to DES. This standard uses a three-fold application of the original DES's encryption algorithm to boost the encryption level. The fact that 3DES is slower than other block cipher techniques is well known.

AES: The new encryption system suggested by NIST to take the place of DES is called AES (Advanced Encryption system). The Rijndael algorithm, which is pronounced "Rain Doll," was chosen in 1997 following a competition to determine the finest encryption standard. The only known attack against it that is effective is a brute force attack, in which the attacker attempts every possible character combination to break the encryption. Block ciphers AES and DES are both.

Blowfish: One of the most well-known cryptologists in the world and the head of Counterpane Systems, a consulting company specialized in cryptography and computer security, Bruce Schneier, supplied one of the most popular public domain encryption methods.

A 64-bit block cipher with variable length keys is called blowfish. In 1993, the Blowfish algorithm was

first presented. Although it is primarily utilized in software applications, this approach can be optimized for hardware applications. Despite having a weak key issue, BlowFish has never been successfully attacked. [BRUCE1996][Nadeem2005].

Here, An overview of the compared encryption techniques is provided. The goal of these introductions to each algorithm is to provide readers just enough background to identify their key distinctions.

RSA: - The RSA algorithm, so named after its creators Rivest, Shamir, and Adleman (RSA), is the most used public key/asymmetric algorithm. It employed e and d as the public and private keys, respectively. The two keys have a unique connection with one another.

Diffie-Hellman: This is asymmetric algorithm & was originally designed by key exchange. In this algorithm, two parties, creates a session key to exchange data without having to remember or store the key for future use. They do not have to meet to agree on the key, it can be done through the internet.

Comparative study of cryptography algorithms:
AES, DES, RSA and DH are shown in below table, which illustrate the comparison of four algorithms using the same text file for an experiment. Time taken by RSA algorithm for both encryption and decryption process is much higher compared to the time taken by AES and DES algorithm.
Encryption algorithm plays the vital role in communication security. After doing the experimental evaluation the performance of existing encryption techniques like AES, DES and RSA algorithms. By using the text files and the experimental result, it was concluded that AES algorithm uses the least encryption, and RSA consumes longest encryption time. We have also observed that Decryption of AES algorithm is better than other algorithms[6].

Algorithm / Factors	AES	DES	RSA	Diffie-Hellman
Keys used in Enc. & Dec.	Same	Same	Different	Different
Algorithm type	Symmetric	Symmetric	Asymmetric	Asymmetric
Key Length	128, 192 & 256 bits	56 bits	1024 bits	Key exchanged
Speed	Fast	Fast	Fast	Slow
Tunabilty	No	No	Yes	Yes
Power Consumption	Low	Low	High	High
Security	Excellent	Inadequate	Lower Secure	Less than RSA
Cost	Cheap	Costly	Costly	Depends on Key
Implementation	Simple	Complex	Complex	Complex

Table – 1 Theoretical Analysis of Encryption Algorithm

Information security relies heavily on encryption algorithms. After performing an experimental examination, the effectiveness of the RSA, DES, and AES algorithms was determined.

Symmetric key algorithms are thought to be good in terms of speed and power consumption while asymmetric key algorithms are thought to be better in terms of tenability, according to a comparative analysis of encryption techniques using these two types of algorithms. The AES algorithm is determined to be superior in terms of cost, security, and implementation for symmetric key encryption. The RSA technique is faster and more secure for asymmetric key encryption[7]**.**

The algorithms for symmetric and asymmetric keys are equally adept at protecting the data conveyed across any type of communication media. The conventional algorithms are discussed in this study.

Because symmetric cryptography uses the same key for both encryption and decryption, there may be security risks. Asymmetric key cryptography, on the other hand, uses two distinct keys to thwart any unethical access to the material. While the other key is accessible in the public key repository, one key is kept secret. Compared to the former, the latter offers greater security [5].

3. Related Work Results

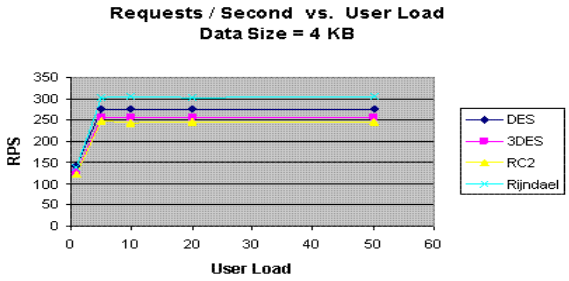
Modern cryptography features like digital signatures, message digests, certificates, encryption, key creation and management, secure random number generation, etc. are implemented using the Java Cryptography Architecture (JCA), a set of APIs. Developers can include security into their applications by using JCA when creating them.

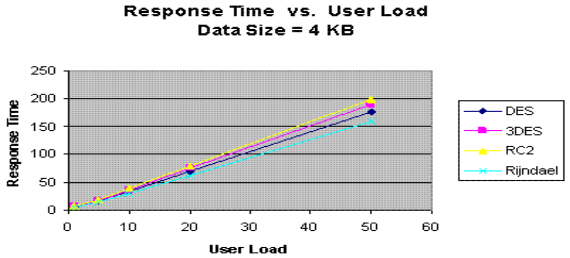
The performance of the widely used secret key algorithms, such as DES, 3DES, AES (Rijndael), and Blowfish, was compared in this work by encrypting input files with different contents and sizes. The algorithms' standard specifications were used to implement them in Java, and they were tested on two distinct hardware platforms to compare how well they performed.

The findings of their trials, which they carried out on two distinct machines—AMD 3500 and AMD 5000 are displayed in Tables 3 and 4 respectively.

Input Size (KB)	DES	3DES	AES	BF
20.53	24	72	39	19
36.02	48	123	74	35
44.83	57	158	94	46
58.70	74	202	125	58
68.45	83	243	143	67
134.10	160	461	285	136
155.23	190	543	324	158
162.46	198	569	355	162
186.89	227	655	378	176
226.95	276	799	460	219
Average Time	134	383	228	108
KB/millisecond	0.83	0.29	0.49	1.01

Table - 3 Comparative execution times (in milli secs) of encryption algorithms in ECB mode on AMD 3500 machine





Input Size (KB)	DES	3DES	AES	BF
20.53	2	7	4	2
36.02	4	13	6	3
44.83	5	17	8	4
58.70	7	23	11	6
68.45	9	26	13	7
134.10	17	51	26	14
155.23	20	60	30	16
162.46	21	62	31	17
186.89	24	72	36	19
226.95	30	87	44	24
Average Time	14	42	21	11
KB/ milli second	7.90	2.54	5.12	9.57

Table - 4 Comparative execution times (in milli secs) of encryption algorithms in ECB mode on AMD 5000 machine

From the results it is easy to observe that Blowfish has an advantage over other algorithms in terms of throughput.

The results showed that Blowfish has a very good performance compared to other algorithms. Also it

showed that AES has a better performance than 3DES and DES. Amazingly it shows also that 3DES has almost 1/3 throughput of DES, or in other words it needs 3 times than DES to process the same amount of data.

Additionally, tests were conducted to compare the effectiveness of the various encryption methods implemented within the java framework. Their outcomes are comparable to those previously displayed (Figure 6).

Fig. 6 Comparison results using Java implementations

The following algorithms were compared: DES, Triple DES (3DES), RC2 and AES (Rijndael). According to the results, AES performed better than other algorithms in terms of both the number of requests processed per millisecond under various user loads and the response time under various user-load scenarios.

4. Simulation Setup

As previously indicated, this simulation mimics the operation of DES, 3DES, and AES (Rijndael) using classes that are available in the JCA.

The implementation makes use of the System-available wrappers for DES, 3DES, and AES. The available packages are *javax.crypto.Cipher*, *javax.crypto.spec.SecretKeySpec*.

The algorithm settings utilized in this experiment are displayed in Table 5. These parameters are used to compare the original results with the results from [Dhawan 2002].

Algorithm	Key Size (Bits)	Block Size (Bits)
DES	64	64
3DES	192	64
Rijndael / AES	256	128
Blowfish	448	64

Table - 5 Algorithms settings

Although 3DES and AES have further settings, these settings are the highest levels of protection they can provide. Greater effort is required to circumvent the encryption of the data when the key length is longer.

Since messages are typically shorter in length, the evaluation test will break up large data blocks into smaller ones in order to evaluate the results while using a block cipher.

Performance Evaluation Methodology

The methodology-related parameters, such as system parameters, experiment factor(s), and experiment beginning settings, are also covered in this section.

System Parameters

8GB of RAM and an AMD RYZEN 5000+ 64-bit processor are used for the research. The simulation program is built using *Jdk20 and Textpad console line programs*. To ensure that the results are reliable and valid for comparing the various methods, the tests will be run a few times.

Experiment Factors:

The parameters that the compared algorithms must be tested in order to determine the performance of the algorithms.

Since each algorithm's security properties and resistance to cryptographic attacks are already well-known and covered. The speed at which the method can encrypt and decrypt data blocks of different sizes has been selected as the factor to gauge performance in this case.

5. Simulation Procedure

By considering different sizes of data blocks (0.5MB to 20MB) the algorithms were evaluated in terms of the time required to encrypt and decrypt the data block. All the implementations were exact to make sure that the results will be relatively fair and accurate.

The Simulation program (console line) accepts input file(input.txt): After a successful execution, the data generated, encrypted, and decrypted is written in separate file. Note that most of the characters cannot appear since they do not have character representation. Another comparison is made after the successful encryption/decryption process to make sure that all the data are processed in the right way by comparing the generated data (the original data blocks) and the decrypted data block generated from the process.

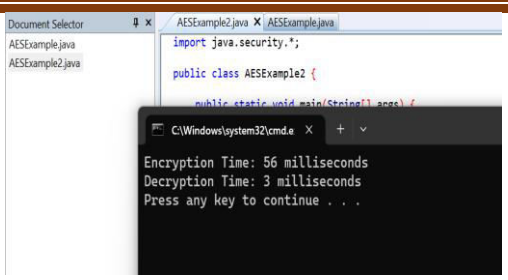


Fig.7 Console output of the simulation program

6. Simulation Results

This section will display the outcomes of the simulation program's use of various data loads. The outcomes demonstrate the effects of varying data loads on each method as well as the effects of the employed Cipher Mode (Encryption Mode).

Performance Results with ECB

The findings of the first set of experiments, which were carried out in ECB mode, are displayed in figure 8 below. The outcomes demonstrate that the Blowfish method outperforms other algorithms in terms of processing speed. Additionally, it demonstrates that AES uses more resources when the size of the data block is relatively large. Since the data block sizes utilized here are significantly bigger than those used in their experiment, the results presented here differ from those obtained by [Dhawan2002].

Another point can be noticed here that 3DES requires always more time than DES because of its triple phase encryption characteristic. Blowfish, although it has a long key (448 bit), outperformed other encryption algorithms. DES and 3DES are known to have worm holes in their security mechanism, Blowfish and AES, on the other hand, do not have any so far.

Since each experiment was carried out numerous times and produced findings that were nearly identical to what was anticipated, these results had nothing to do with the other loads on the computer. The implementation of DES, 3DES, and AES in java is thought to be the best available.

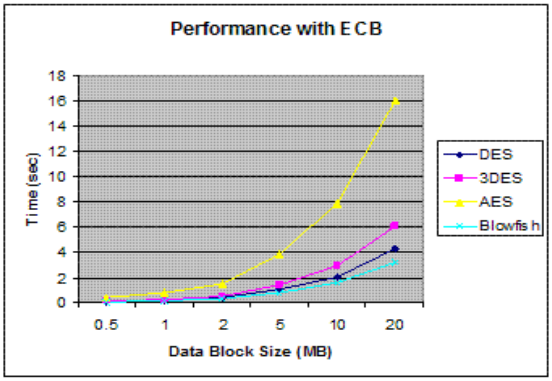


Fig.8 Performance Results with ECB Mode

Performance Results with CBC

Due to its key-chaining nature, CBC requires greater processing time than ECB, as expected. The results shown in Fig. 9 also suggest that the additional time is not substantial for many applications given that CBC offers significantly greater protection than ECB. The results showed that the average difference between ECB and CBC is *0.059896 millisecond*, which is rather little considering that the difference between the two modes is difficult to notice with the unaided eye.

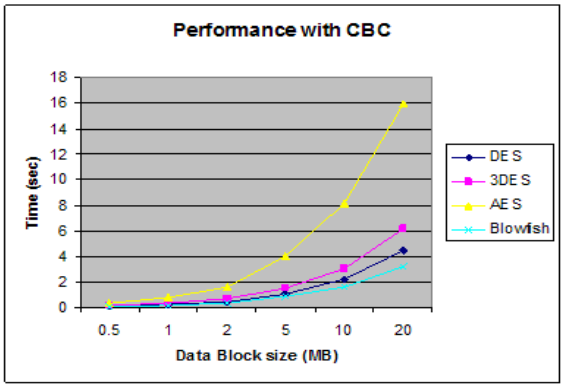


Fig. 9 Performance Results with CBC Mode

The simulation results from running the four comparative encryption algorithms in various Cipher Modes were examined and the results has been displayed. The processing power and performance of the compared algorithms were assessed using various size of loads.

7. CONCLUSION

The results proved that - The simulation results demonstrated that Blowfish performs better than other widely used encryption techniques. Since there are currently no known security vulnerabilities with Blowfish, it is a strong candidate to be used as a standard encryption technique. Since AES required more computing resources than other algorithms, its performance results were subpar. Even though using CBC mode added some processing time, it was generally inconsequential, especially for applications that need to encrypt reasonably big data blocks with more secure encryption. The AES algorithm is the best in security, flexibility and encryption performance strongest. It is most efficient when compared to others.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-07

Approaches to XAI: Circumstances, Obstacles, and Prospects

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Abstract:- *Explainability of artificial intelligence is essential for keeping them responsible as they grow more significant in our everyday lives by directing vital choices in a variety of spheres. Many studies are attempting to tackle the topic from multiple perspectives, and new discoveries are being made. However, knowing these kinds of frameworks remains an endeavour in progress. Explainable AI (XAI) refers to an AI system that has the skills to clarify its choices or forecasts to human beings. The objective of XAI is to enhance the accessibility, credibility, and reliability of AI system. There is an increasing demand for explainable AI (XAI) approaches to boost trust in AI models. In recent years, XAI has been an increasingly prevalent study in the AI sector. Recently, strategies for visualizing, describing, and interpreting XAI models have been developed. In this introductory work, we will assess contemporary strategies for constructing XAI approach ontologies and discuss the challenges related with them, in addition to their particular benefits and drawbacks. The evaluation will also include ideas for XAI study and development.*

Keywords: explainable AI, Interpretable machine Learning, Interpretability, explain ability

. 1. INTRODUCTION:

Machine learning (ML) and artificial intelligence (AI) have proven they have the ability to transform a variety of sectors, government services, and society by performing precisely as humans in a number of situations. Deep learning is frequently described as being cryptic and "black box". The weights (parameters) in such models are extremely many (a lot millions or perhaps a billion), and they are meant to hold the knowledge obtained from training data. These weights are not only many, but it is also quite difficult to determine how they relate to the problem's physical setting. It is extremely troublesome to use opaque, "black box" models in extremely delicate fields like medical and other areas involving the lives of individuals, obligations, finances, and confidentiality. The importance of explanation and openness is being identified as being highly significant since the usages of sophisticated AI and ML, especially DL, are currently spreading swiftly and adopting the electronic medical care, legal, shipping, financing, and military sectors.[1]

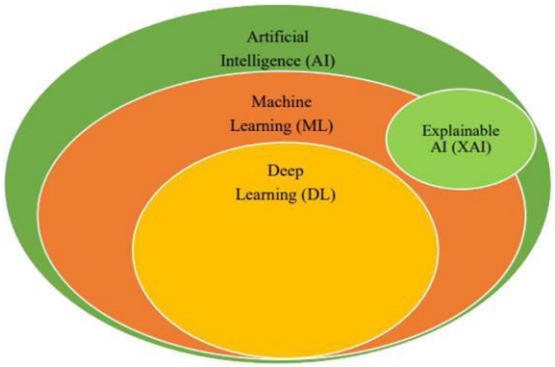

Fig1: AI vs. ML vs. DL vs. XAI., source:[4]

Large data sets that are inclusive/unbiased and of high quality are required to train on for deep learning. Furthermore, classical deep learning takes a long time to train models so that they may fulfil their objective with a proper level of accuracy and significance. The method of deep learning is distinct, yet it is also quite prone to mistakes. Assume the data sets utilised for developing an algorithm are too tiny to be inclusive. When models are trained in this manner, users are shown irrelevant replies (biased predictions derived from a biased training set). The transparency and interpretability of artificial learning algorithms is one of their biggest issues. These models based on artificial neural networks are black box models that extrapolate from and generalise the input information. The DL model cannot tell you why the output was produced when you obtain output data compared to input data. In many ways, this circumstance makes it challenging to use these models in their application domains. For instance, you flagged down a cab and boarded it. The driver is such a driver that when he drives you to your destination, he makes left turns, right turns, and attempts to send you on a strange path than you anticipate, but he is unable to provide you with a sufficient explanation when you ask him why? Would you feel anxious? If it doesn't pose an issue for you, you may pilot a self-driving car yourself. Another illustration would be when you visit a medical professional, the physician requests investigation, and after you have the diagnostics and communicate them to the physician, the physician informs you of your ailment. Despite the fact that he mentions his method of treatment, he makes no attempt at clarifying the origin of your sickness. In this situation, it is still unclear what caused the condition, and you would not be happy with the physician's diagnosis. In deep learning models and artificial neural networks, this is a key open question.[22]

One area at the crossroads of various domains is the explainable artificial intelligence (XAI) method. The part on end-user explanation that incorporates social sciences is one of these categories. This field develops cognitive capabilities in artificial intelligence The correlation between machines and individuals is another place where it can show its explainability because explainable artificial intelligence necessitates very complex user interactions.

This innovative method aims to furnish the individuals with the ability to comprehend the result generated in addition to being trained with the input data and target (class) information at high performance and evaluated with the fresh data input as in the traditional ML-models. As a result, a novel generation of artificial intelligence techniques will be developed that can link input to output in a causal manner.

It will also serve as a system for tracking the user's perception of artificial intelligence's dependability. While a traditional DL-model can respond to "what" or "who" questions, explainable artificial intelligence approaches also use learning models that can respond to "why," "how," "where," and "when" queries.[2]

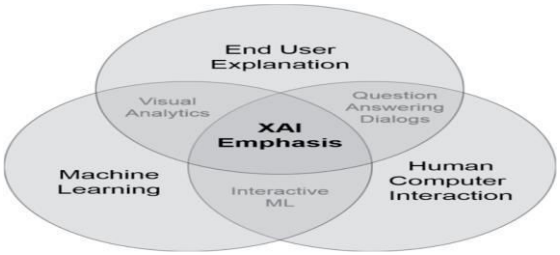

Fig.2 Explainable AI

2. SIMILAR WORK:

Despite the enormous number of studies that have been executed to investigate the explainability and interpretability of AI, an adequate and thorough investigation is still absent. Researchers claim that there are now only a few studies in this field that provide a concise summary of the best methods.

Learning by machine has been advancing from the 1950s, sometimes rapidly and sometimes at a slower pace. Algorithmic learning has emerged as an extremely thoroughly investigated and remarkable domain in recent times, attempting to imitate the real-world approach to decision-making behaviour, and replies. Automated learning studies has yielded promising results, hastening the growth of AI software. According to further investigation, self-learning systems are going to be able to observe themselves, acquire knowledge, arrive at decisions, and conduct actions.

The goal of the Interpretive AI project is to provide computer-human collaboration and machine learning resources in order to make certain of the final user, who relies on judgements, suggestions, or actions generated by artificially intelligent machines.

Despite the fact that the concept of the frameworks for DL extend back to the early 1990s, the corresponding neural network techniques such as

convolutional neural networks (CNN), enhanced reinforcement learning methods, and proactive formed structures have achieved immense popularity. Despite producing effective outcomes, these systems have limitations and are unable to adequately explain what they do and choose to human users.

The mathematical models are currently utilised to assist in choosing who will be given probation, who will be permitted to borrow money, and who will be employed. It is easy to comprehend the logic behind these mathematical frameworks if you have access to them. However, organisations including banks, the military, companies, and others are now focusing on more sophisticated artificial intelligence techniques. These strategies have the potential to render automated decision-making totally incomprehensible. The most typical of these strategies is deep learning, a completely different approach to computer programming. You shouldn't rely only on a "black box" strategy when making decisions, whether they be monetary, medical, or militaristic.

We can cross several boundaries where deploying artificial intelligence in recent years required an action of belief as technology evolves. We humans, of course, cannot always clearly describe how we think, but we have developed a number of strategies to assess and gauge others. Will this be feasible for artificial intelligence (AI) systems that don't think and act like people? We have never created a machine that functions in a way that the creators are unable to comprehend.

How long will it be possible for us to interact with and interact with uncertain or unintelligible smart machine? These searches lead to fresh innovative study on AI algorithms, stopping at businesses like Google, Apple, Microsoft, and several more along the way, featuring an exchange with one of the greatest philosophers of ever.

Despite the staggering number of studies that have been undertaken to investigate the explainability and interpretability of AI, a comprehensive and systematic investigation is still absent. Scholars claim that there are now only a few papers in this field that provide a quick summary of the finest XAI practises.

Citation	findings/ out comes
[1]	Aim: Explainable artificial intelligence: an analytical review. Work: Their study begins with a brief historical background and taxonomy, then formulates the primary explainability difficulties based on the new four explainability principles from the National Institute of Standards. Outcome: recent methodologies connected to the subject are evaluated and critically critiqued. Finally, suggestions for further investigation are made.
[4]	Aim: A systematic review of Explainable Artificial Intelligence models and applications: Recent developments and future trends Work: survey of articles on XAI methods for various applications Outcome: increases the body of published research on XAI by serving as a guide for additional study in the area.
[10]	Aim: A comprehensive analysis of the explainable AI (XAI) models Work: In-depth examination of the XAI frameworks and their effectiveness. Outcome: Identifies new and important XAI research concerns to show off significant, model-specific patterns for better explanation, more openness, and greater precision in prediction.
[17]	Aim: Evaluation of explanations using metrics Work: Literature review Outcome: The work that was suggested discovered several promising future paths for creating AI models that become more transparent.

Table1: Related research on intelligible AI strategies

3. EXPLAINABLE ARTIFICIAL INTELLIGENCE:

The information regarding the processes used to develop the explainability taxonomies, requirements, characteristics, guiding principles, and common approach of explainable AI is described in this part.

3.1 The notion of explainability:

The idea that anything could be explained, which resulted in various descriptions and the growth of particular characteristics and structures. The following list of established categories includes some of them.

Qualities of explainability: This list comprises the standards and traits that academics use attempt to articulate the concept of "explainability";

The structure of an explanation: contains the diverse parts a justification can be built on, such as triggers, context, and implications for the forecast made by a model as well as how they are organised.

The kinds of explanation: includes a number of scholars stated descriptions of their spontaneous tasks, including how much data comprises them and what is excluded.[5]

You can't merely glance into the deep neural network to understand how it functions. The reasoning of a network is contained in the combined behaviour of countless synapses that amass and link up to hundreds or even dozens of layers, mixed together, contains the logic of a network. The electrical charge of a pixel in an image serves as an example of an input that each cell in the first layer receives before doing calculations and sending a new signal as an output. A complicated network's following layer receives this output, and so on until a universal output is created.

As a network can train itself to generate an outcome in particular, back propagation is another process that affects individual nerves' calculations.

It aims to make the incentives for fresh artificial systems to learn clear, pinpoint their advantages and disadvantages, and predict their future behaviour. The finest efficiency and precision standards, as well as superior interpretability and explainability within the framework of cause-and-effect, are needed for the optimal intelligent system.

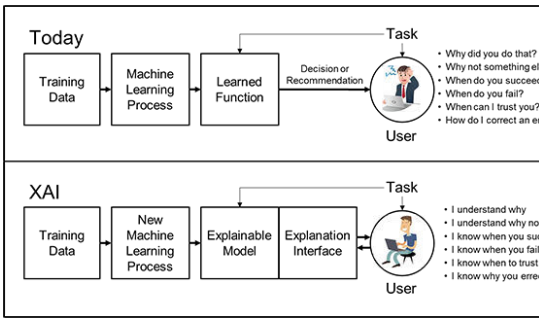

Fig 4: DARPA has put forward an explainable artificial intelligence (XAI) initiative. Source: [6,7]

The explanatory model and the explanation interface are two distinct features that demand prominence in addition to a new algorithmic learning technique. At the basis of the AI methodology is an explanation of the deep neural network-based machine learning approach. It may be preferable to use Deep belief networks, auto encoders, convolutional LSTMs, recurrent (LSTM), and deep reinforcement learning to solve problems. Additionally, a mix of methods that combines a number of deep learning techniques is an option. An adaptive rule-based reasoning system is an explainable model. It is a framework that makes cause-and-effect connections among the information being supplied and moreover, the results of ML process clear. The user's involvement includes the explanation interface. It resembles vocal digital assistants' question-and-answer screens. An encoder unit permits the replies from the explanatory approach, which forms the underlying causal framework of the explainable, and a parser evaluates the user's demands to form the user experience of customers with artificial intelligence.

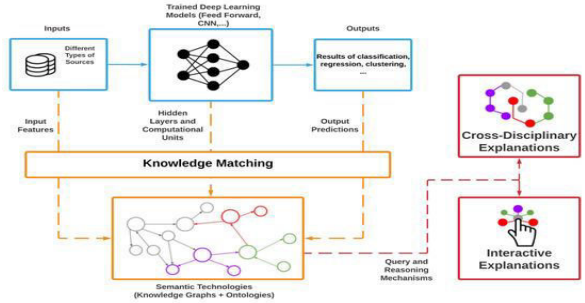

Fig 3: An explainable artificial intelligence (AI) framework that incorporates semantics into deep learning algorithms is shown schematically. Source: [8]

3.2 Approaches for developing ontologies of explainability:

Four main approaches are used for creating the ability to explain taxonomy, which are explained in

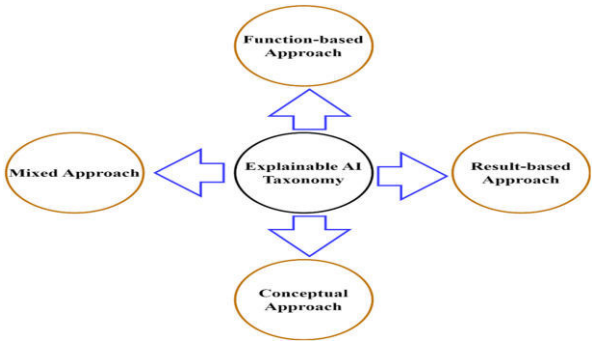

Fig 5: Ways for constructing an explainable ontology.Source:[10]

The hierarchy of categories suggested by Samek and Müller [11] conforms with that method in large part, and we are going to employ it as an example for what follows. In general, functionality refers to how an explainability approach gets details from an ML model. For additional comprehension, consider the following instances. Explainability approaches in the category that deal with local perturbation significantly disturb a model's inputs with the goal to determine the impact of specific aspects that This input's impact on the model's forecast. As a result, the mechanism beneath these approaches. To build the explanation, the category leveraging structure makes use of certain aspects of the ML the ML models they're intended to clarify. approaches that utilise framework, including approaches that explain with local perturbations, frequently result in key attributions. The Result-based Strategy depends on the outcome of an explainability framework, which is an essential element of a model for categorization. Meta-explanation was applied for combining the explanations of both approaches' superior performance over any other methodology employed. Architecture modification is used to reduce intricate frameworks by tweaking the structure of them.

In result-based approach, the main element for its classification is the result of an explainability approach. According to McDermid et al., there are actually three types. Several explainability approaches try to identify the significance of attributes of input for an outcome. As a result, this class has a distinctive significance by studies that follow the results-based approach. Surrogate models are another classification class of the result-based

method. Surrogate model explainability approaches attempt to roughly match (a specific element of) the first model with an easier ante-hoc explainable one. Surrogate models can be generated in a variety of methods, for as by probing the first model via nearby perturbations or by exploiting its framework. As a result, surrogate models can be outcomes of almost any style of operation.

Another outcome that can be explained is by using illustrative example. Instances can be produced or retrieved by exploiting the framework of a model; there's many more methods to do if you have no connection with any of the stated modes of operation.

In Conceptual approach, it divides the categorization of explainability approaches into numerous unique conceptual aspects, a few of which have a hierarchy.

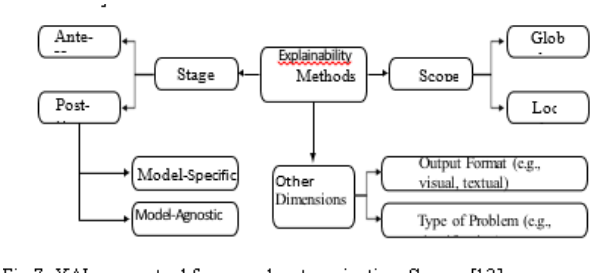

Fig 7: XAI conceptual framework categorization. Source [12]

The hybrid approach has the advantage of incorporating the most basic variations in explainability approaches. As a result, we believe that this technique is most appropriate for persons who are unfamiliar to XAI. This statement is supported even more by the reality that the articles using the mixed approach show a wide range of approaches.[13]

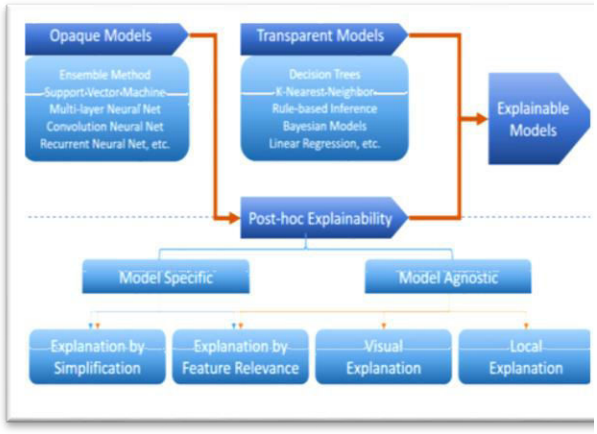

Fig 6: XAI taxonomy of hybrid approach: source [04]

There are several words in the scientific community that refer to the reverse of the "black box" aspect of various AI and ML models, particularly DL. A few phrases are illustrious:

Transparency: A framework is deemed visible if it possesses the ability to be intelligible on its own. In different senses, transparency is the contrary of "black-box" [14]

Interpretability: is described as having the knack to deliver interpretations in human-comprehensible language.[15]

Explainability: is associated with the concept of explanation being a means of communication amongst individuals and machines that use AI. It consists of algorithms that are both precise and accessible to users.[15].

They impart different degrees of AI that are tolerable to individuals. For further evidence, the conceptual framework and vocabulary of XAI are outlined beneath.

Transparent models incorporate algorithms that produce outcomes that are frequently open with one another but this does not imply that the framework is explainable. The opaque model is more accurate than the transparent model.

Agnostic models work simply on the basis of matching model input to model output. Model specific models frequently take use of understanding certain models and attempt to provide a certain type of a variety of models with transparency. The explanations are grouped as follows:

explanations by simplifications,
explanations based on feature importance,
explanations in visuals,
explanation at local scale
interpretability alone is inadequate since it does not address all of the potential issues connected to comprehending "black-box" models. Gaining user confidence and gaining significant insights into the causes, reasons, and judgements behind "black-box" tactics requires explainability rather than simple interpretability. Although it goes without saying that models that can be understood are interpretable, this is not always the case.

3.3 XAI methodologies:

Some Explainable AI approaches are addressed further below. Shapely Additive Explanations (SHAP), Local Interpretable Model-agnostic Explanations (LIME), Partial Dependence Plots (PDP), and Anchors are the methodologies used.

PDP plots (Partial Dependence Plots): indicate how the estimate of an AI model fluctuates as a result of one or two distinct variables in the forecasting, i.e. the predictors' residual influence. As a result, they enable evaluation of the interaction among the two types of

variables. PDPs visually depict the average variation of the prediction on an arc.

LIME (Local Interpretable Model-agnostic Explanations) is a local method for testing how a model's predictions change as the input data is changed.

SHAP (Shapley Additive explanations) is an approximate explanation approach based on Shapley's Value Theorem, which was put forward in 1952 to allocate game value among participants. SHAP is used to describe the significance of every factor in a particular forecast (which is expressed as the mean change in the model's prediction when its value fluctuates). SHAP, in particular, calculates the significance of every factor in an individual prediction using a combination of baselines, local importance functions, and Shapley's Value Theorem.

Anchors is a strategy for explaining individual (local) forecasts of black box classification models by identifying decision rules known as "anchors" who describe what will happen.

Grad CAM has applications in medical imaging, and it is also relevant to CNN models that do not have fully connected layers.

Layer-wise relevance propagation builds heatmaps according to essential locations, using the relevance score to bring out the areas of importance required for prediction.

White box models are built on algorithms that are designed to be interpretable. Such models are classified depending to the specific method employed, and the variables that have to be optimised are typically restricted in order to obtain improved interpretation. This leads to a better understanding of the information and more accurate findings, which contributes to improved decision making, particularly in industries where interpretability is crucial.

3.4 Need of explainable AI:

Since explanation leads to the generation of discoveries in the methodology of modelling as well as the explanation of the outcomes, resulting in to greater comprehension of that expression. As a result, it is beneficial to develop the modelling to offer an improved domain, and XAI explains the response to the query "why" that is possible to deliver in the conventional framework that lends trust to AI utilising XAI employed to decrease the influence of network skew. [18]

There are four reasons: Explain in order to defend, explain in order to regulate, explain in order to enhance, and explain in order to figure out.[4]

Design of Transparent Models: Explainable AI is required to comprehend model outcomes. Clients require explanations offered by the explainable model to fully know the framework.

Model Evaluation and Debugging: The framework violates legal as well as ethical norms due to shortcomings in the data used to train it.[17]

Explainable Knowledge Discovery: AI can aid in the extraction of obscure details from predictive model output. Fresh conclusions of data may be obtained with the aid of interpretations.

Better performance: Explainable AI improved model accuracy by meeting ethical and legal criteria, offering credible justifications for greater comprehension of model decisions, eliminating bias, and creating resilient and dependable models.[17]

3.5 Standards of explainable AI:

The standards suggested by NIST held a session with the AI researchers and suggested 4 Explainable AI tenets: "Explanation, Meaningful, Accuracy, and Knowledge Limits" are them at all times.[19]

Explanation: A framework offers or contains supporting information or reasons for actions and/or outcomes.

Meaningful: A framework provides explanations that its intended consumer(s) can understand.

Explanation Accuracy: An explanation precisely captures the system's internal deal with and/or the intent behind producing the output.

Knowledge Limits: A framework can only operate in the conditions for which it was designed and when sufficient confidence in its outcomes is present.**3.6 Styles and purposes of explanations:**

Styles is the justification for asking for a response or the query that the rationale is meant to address. Purposes refers to the manner in which a statement is made.

Three distinct groups of styles emerge: level of detail, machine-human interaction, and format all play a role in the information's presentation.

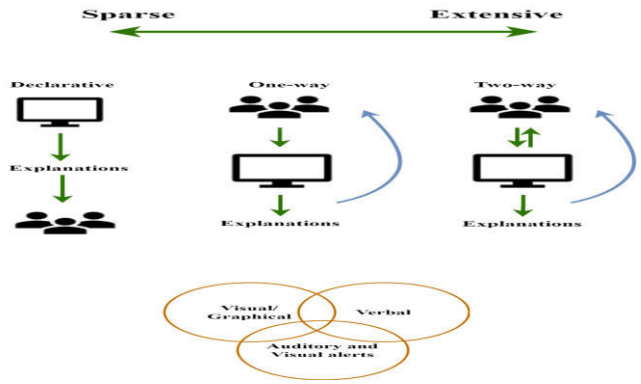

Fig 8: Styles of explanations: source [4][19]

There is a variety in the level of detail, from minimal to substantial. Sparse data means knowledge that is a nutshell confined, or, at an extreme level, deficient in depth. Declarative explanations, one-way interaction, and two-way interaction are the three categories to define the level of human-machine interaction. Verbal, audio, and visual alarms are all included in the explanation's format.[19]

4.0 CHALLENGES OF EXPLAINABLE AI:

Explainable Artificial Intelligence concept addresses related scholarly issues:

- solutions to develop models that's simpler to comprehend: The recurrence of the results, the model development and execution process, the precision of the predicted outcomes, the rationale of the order of the probable predictions, the discrepancies in the input data, in addition to the fairness and accuracy of the explanation, are some of the factors that still limit the model's explainability.
- ways to create interfaces for explanations:
  The only local and global explanations that are currently possible using XAI approaches are those that apply to a particular observation or set of data. Therefore, methods for providing reliable explanations for the findings of groups or subsets of data, or for moderate explanations, must be developed. Additionally, without a comprehensive investigation,
  Although weighted averages of Shapley values allow SHAP to obtain explanations for subsets, the specifics of these explanations will depend on the level of detail in the fraction data.
  The results produced by various comprehension methodologies at various levels may at first seem incompatible.
  The question that remains challenge is the requirement to describe more sophisticated models, such as specific varieties of neural networks with deep roots.

5.0 DISCUSSION:

The objective of XAI is to retain a high degree of learning performance while explaining the internal workings of models. Although Explainability Artificial Intelligence is an emerging field of study, It is just now being recognised as being an essential prerequisite enabling the implementation of AI techniques in everyday situations. XAI is offering a perspective regarding how to integrate intelligent machines and cognitive ability in order to make it easier and increase the acceptance of AI systems by humans.[1]

We have examined a number of contemporary ways for creating explainability method ontologies.[21] We have noted, among other things, that the discrepancies and irregularities between different taxonomies may prevent us from seamlessly obtaining a clear image of the XAI field. But such a detailed picture is essential for XAI to reach its full ability.

Deep Learning is receiving more emphasis due to its precision value, which it learned with additional information; however, it is regarded as an opaque model because we are unaware of the model's output or the process by which it was arrived at. We are working on "Explainable artificial intelligence" to make the model's output and it’s processing more understandable.

There are a few domains where advanced ML and AI algorithms don't seem to gain from traditional approaches because of this field's relative youth. It consequently is recommended to look for non-conventional means of rationale. The papers evaluated have been picked carefully depending on their relevance to XAI and their subject matter. To provide interested scholars with a summary of current trends, more emphasis is placed on recent studies.[10] Given the increase of study ideas in the area, a fresh and complete structure ought to be created to address the codification of XAI with the term’s "explanation" and "interpretation".

6.0: CONCLUSION:

This paper offers an overview of multiple Explainable AI articles that have been published, which helps readers grasp utilising XAI. In this study, we attempt to explain how the four commonly used approaches—functioning-based, result-based, conceptual approach, and mixed approach-were used to construct the XAI taxonomy. We also discuss challenges, the concept of explainability, methodology, the need for XAI, the standards of explainable AI, the styles and purposes of explanation. Investigators will find it valuable to be aware of the latest XAI advancements. This will motivate scholars to create novel XAI methodologies for more sensitive domains.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-08

Entity Linking and Named Entity Recognition for Text Summarization and Knowledge Graph Construction

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Abstract:- *The mythological documents are representing the ancient epic of India. Thus, processing of such documents to create a graphical view with appropriate linkage with context is important. For representing the graphical view, Knowledge Graph (KG) shall be used. KG construction process is using Natural Language Processing concepts stating the entities, attributes and relationship is derived in connected manner. KG organizes linked entities and defining relationships along with facilitating understanding for the concept represented in the document. The text summarization is essential as it presents a brief summary of input document. The challenge associated with Knowledge Graph construction and text summarization is related to ambiguity in extracting the Name Entity. The proposed model applies NER, dependency parser and ranking matrix representing context similarity identified with feature extraction and scoring. These extracted entities and features will be used to generate summary which in turn as acts as input for Knowledge Graph.*

Keywords: *Natural Language Processing (NLP), Named Entity Recognition (NER), Named Entity Linking (NEL), Text Summarization, Knowledge Graph (KG)*

. 1. INTRODUCTION

With plenty of information in an unstructured format rise a need to expressed such text using the Natural Language (NL). This form of text is not easily processable by computers. To make such text available to computers for computation purpose require Natural Language Processing (NLP) and information extraction techniques [1].

The first crucial thing to considered while preparing a Knowledge Graph is identification of the entities stated in the text. These entities can be either named entities that refer to individuals or any abstract concepts. As the entities are represented as nodes in KGs and relations as edges, KGs are considered as an appropriate way of representing NL text in computer-processable form.

For preparing KGs, extracting named entities from texts, or Named Entity Extraction (NEE) is important task. NEE is a task that involves recognizing the mention of the Named Entity in the text (NER), disambiguating its possible references (NED), and Entity Linking the named entity to an object in a knowledge base (NEL). The study is based on historic documents and the historical documents may contain cases where the name of places is in a language different to the main text one [2]. These particularities have then a significant impact on NLP and IR applications over historical documents [3]. Although Named Entity Recognition (NER) and Entity Linking (EL) systems have been developed to process modern data collections in general, NER and EL systems for processing historical documents are less common [4]. The objective of the study is to resolve the challenge faced during Named Entity Recognition (NER) and classification when applied to historical documents.

With valid recognition and linking of entities to its context leads to appropriate identification of classes, attributes and relationship are defined. With appropriate classification of context sensitive historical document, a Knowledge Graph can be constructed. The Knowledge Graph is to provide meaning to the data and remove any semantic ambiguity. Also, it helps to provide a visualization of

concept. The primary use of knowledge graphs is found in search process and to increase Human Computer Interaction with suitable visualizations in the form of Graph. The Knowledge Graph shall be used to educate the Indian citizens about the historical documents.

The knowledge Graph for historical document of other countries (Greek, China etc.) and another domain document is constructed. However, their arises a need for Knowledge Graph construction for Indian historical document focusing to Ramayan.

The secondary objective is to utilize Knowledge Graph (KG) to educate society about ancient Indian historical document of India that is Ramayan.

2. LITERATURE REVIEW

The main goal of the Named Entity Recognition (NER) task is to spot named entities within a provided text. This pivotal step has a direct impact on the disambiguation process. In other words, if an entity is mistakenly identified, it becomes less likely to be accurately connected or associated with the correct information [1]. Named Entities are the set of linguistic and application-related criteria which, eventually, compose a heterogeneous set of units [2]. The historical documents may contain duplicated and ambiguous information about named entities due to the heterogeneity and the mix of temporal references [3]. A disambiguation process is thus essential to distinguish named entities to be further utilized by search systems. The methods have been used for NER including Hidden Markov models, Conditional Random fields, Feature engineering approaches using Support Vector Machines, Max Entropy classifiers for finally classifying outputs and more recently neural network-based approaches [4].

2.1 Knowledge base and Knowledge Graph Representation

A knowledge base is a collection of facts and information about a specific domain, such as geography, medicine, or sports [4]. A knowledge graph is a structured representation of information that can store extracted data. It consists of nodes, edges, and properties, with nodes representing entities and edges representing the relationships between them. The smallest unit of a knowledge graph represents semantic data as triples, which consists of a subject, a predicate, and an object (i.e., as ordered sets of terms). Knowledge graphs are dynamic and the facts related to an entity are added or removed over time [7]. They allow for the representation of complex connections between entities and characteristics, leading to more effective data retrieval, reasoning, and inference. Knowledge graphs contain the entities & their relationship or in simpler terms: subject, relation, and object. The subject and object are entities that are involved in a relationship defined by the predicate.

In the knowledge graph, the nodes are the holder of the entity information where the edges are the links between the nodes which are holding the information about the relationship between the nodes.

Further, other relationships and entities can be added. When there is large number of entities available with the situation, constructing Knowledge Graph manually is not feasible. So, this task is assigned to machines. For the machine, it is a challenge to understand the natural language which can be done by Natural Language Processing (NLP) algorithms like POS tagging, Named Entity Recognition (NER), sentence segmentation. The historical documents may contain duplicated and ambiguous information about named entities due to the heterogeneity and the mix of temporal references. A disambiguation process is thus essential to distinguish named entities to be further utilized by search systems.

2.2 Steps of Knowledge Graph Construction

Step1 Sentence Segmentation

Step2 Entities Extraction

Step 3 Entity Relation Extraction:

Step4 Build a Knowledge Graph [17]

2.3 Applications of Knowledge Graph

- Semantic search
- Question Answering [18]
- Recommendation systems [19]
- Fraud detection and security
- Telecommunication system

2.5 Text Summarization

The process of constructing a concise, cohesive, and fluent summary of a lengthier text document, which includes highlighting the text's important points, is known as text summarization [8].

Text summarization involves the use of algorithms and techniques to analyse and extract the most important information from a given text [9]. Text Summarization offers new choices to the similarity function for the Text Rank algorithm. This algorithmic accommodates toward automatic summarization of texts. The fundamental idea performed by a graph based ranking model [2].

1.6 Challenges

2.6.1 Challenges with study of Knowledge Graph

1. Research related to knowledge graph refinement:
   - o Ontology learning mainly deals with learning a concept level description of a domain, such as a hierarchy (e.g., Cities are Places)
2. Approaches for Completion of Knowledge Graphs
   - o Methods for Completing Type Assertions
   - o Methods for Predicting Relations
3. Approaches for Error Detection in Knowledge Graphs
   - oMethods for Finding Erroneous Type Assertions
   - o Methods for Finding Erroneous Relations
   - o Methods for Finding Erroneous Literal Values
4. Knowledge extraction
   - o Entity linking and disambiguation
   - *o*Fact extraction and verification

One of major challenge is Entity Disambiguation and managing identity

Many entities extracted automatically have very similar surface forms, such as people with the same or similar names, or movies, songs, and books with the same or similar titles. Two products with similar names may refer to different listings. Without correct linking and disambiguation, entities will be incorrectly associated with the wrong facts and result in incorrect inference downstream.

2.6.2 Challenges with historical documents in Named Entity Recognition

Recognizing named entities in historical documents and constructing a knowledge graph from them presents several challenges:

While recognizing named entities in historical documents is critical before constructing Knowledge Graph [10].

1. Outdated language and spelling variations

Historical documents often contain archaic language and spelling variations that may not align with modern language models used for Named Entity Recognition (NER). The models may struggle to identify entities correctly due to the differences in language usage.

2. Lack of sufficient training data

Historical texts may have limited annotated data available for training NER models. Annotating historical documents can be time-consuming and challenging, leading to insufficient data for training accurate NER systems.

3. Contextual Ambiguity

Historical texts might lack contextual clues that help disambiguate named entities. The meaning of certain names or terms could have changed over time, leading to ambiguity in their identification and linking to specific entities in the knowledge graph.

4. Scarcity of Reference Knowledge Bases

Building knowledge graphs requires linking named entities to external knowledge bases. However, historical entities may not be well-represented in existing knowledge bases, making it difficult to create accurate connections.

5. Fragmented and Incomplete Information

Historical documents might be fragmented or have missing parts, making it challenging to gather comprehensive information about named entities and their relationships for constructing a knowledge graph [29].

6. Named Entity Variation over Time

The names of people, places, or organizations can change over time due to cultural shifts, political changes, or other historical events. Handling such variations poses a challenge for NER and knowledge graph construction.

7. Low-resource Languages

Historical documents can be written in low-resource languages for which pre-trained NER models and language resources may not be available. This can hinder the accurate recognition of named entities [30]. Addressing these challenges requires adapting NER models to historical language characteristics, curating specialized historical training data, developing techniques to handle contextual ambiguity, leveraging domain-specific knowledge bases.

3. PROPOSED PLAN

As the text documents representing “Ramayan Kandas” is inputted, the text passes through NLP pipeline. This process continues with appropriate data pre-processing phase, then after processing text results in suitably correct identification of entities, attributes & relationship amongst entities. Then after appropriate extractive text summarization is applied where context specific sentences are fetched. These identified sentences maps with triple generation representing the subject, predicate, object (s,p,o) pairs. These triples will used as critical input in knowledge Graph (KG) construction.

CONCLUSION

The mythological documents are essential resources for cultural and historical heritage of India. So, enriching semantically such documents, with aspects such as Named Entity Recognition and Entity Linking, can improve their analysis for establishing relations between semantically related entities based on the context. Also, it can be used to improve the coverage and relevance of entities within knowledge bases. Another perspective would be to apply a text summarization in an extractive manner to establish a feature set revealing ranking score for extracted features in matrix form. These features can be used to generate summary. The document summary helps to construct Knowledge Graph.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-09

Block Chain In Agriculture

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Abstract:- *The majority of people around the world need agriculture for survival. Improvements in agricultural productivity and quality, adequate marketing infrastructure and support, and efficient food management are all essential for agricultural growth . Food safety is an essential issue that concerns both producers and consumers. Transparency in the supply chain helps improve the processes involved in production. Traceability is also important as it allows us to determine the origin of the product with data such as producer, harvest and production dates etc. To meet the increasing demand, the agricultural system needs to be extensively improved. To solve agricultural problems, advanced technologies are being developed. Blockchain is the most recent addition to this technology. Cryptographic hashes are the basis of blockchain technology. This guarantees that the user's transactions and identity will never be affected. If a fake transaction occurs, the decentralized mining system will prevent it from entering the encrypted chain. The supply chain logistics industry is one of the most visible implementations of blockchain technology.*

Keywords: *Blockchain Technology, Trust, Transparency, Security, Traceability.*

✓ . Introduction:

In this particular section, we review the work related to blockchain in agricultural supply chains found in the literature. Blockchain has gained a lot of popularity in the banking and finance industry, but it is steadily growing in the agricultural sector. In [10], the authors proposed an agricultural food supply chain traceability model based on risk analysis and critical control points in collaboration with blockchain and IoT. An application of product tracking from case producer to consumer is implemented by Hyper-Ledger and presented in Ethereum [11]. Furthermore, the authors presented a traceability solution for the food value chain. The authors discuss how to apply blockchain technology in the agricultural food supply chain and raise issues of trust, security and integrity in [12]. In [13], the authors reviewed the agricultural-ICT concept in blockchain and presented a revised model of ICT in agricultural blockchain. To increase efficiency in smart contracts and DLT, an approach is presented in [14]. Furthermore, the authors highlighted the challenges and obstacles in the adoption of blockchain technology in the agricultural sector. In [15], researchers presented an efficient blockchain agricultural food-management supply chain with smart contracts. Potential risks and challenges in adopting blockchain in the food supply chain are discussed in [16]. In [17], researchers presented an approach to measure grain quality using blockchain smart contracts. The authors in [18] explore how blockchain-based systems promote value transfer in small-scale agricultural farms. To increase transparency and automate the process of blockchain in agriculture, the authors in [19] presented an advanced proto-type. The authors studied the challenges of blockchain implementation in the dairy industry in [20]; Furthermore, they call for blockchain-based traceability.

✓ Challenges:

1. There is no way to change or update data in the blockchain if, at any point, someone makes a mistake. Immutability of blockchain is a major

advantage. However, unlike traditional database systems, blockchains are difficult to modify or manipulate.

2. A verified transaction cannot be altered by security schemes.
3. Using smart contracts, the system can be controlled and the steps can be automated.
4. The blockchain environment will require some money during its initial setup.
5. Hacking of IoT devices is possible.
6. Acquisition of data requires IoT devices. Damage to devices may affect data collection.

✓ **Traditional and Centralized Supply Chain:**

As shown in Figure 1, the traditional structure of a supply chain is Using this method a central database containing data related to all processes is created. An administrator manages the database. Several limitations apply to this approach. This system uses a server to manage the database. So, if that server fails, the entire system will be down. A dishonest administrator can change the data without the stakeholder's knowledge. Those changes are unacceptable for trackback. Thus, this centralized approach is also opaque and traceable. Among the major challenges of traditional supply chain ecosystems are product traceability, stakeholder transparency and trust in collaborative systems. In the traditional approach, there are too many intermediaries, leading to trust issues and performance issues. Various supply chain organizations include farmers, distributors, retailers, etc. Consequently, any outbreak involving food products would be extremely difficult to detect. Functional impact, social impact and economic impact of emerging technologies in supply chain ecosystems must be examined. Furthermore, the traditional supply chain ecosystem is highly centralized. This creates trust issues when multiple organizations collaborate. Centralized processes make it easier to handle data without the knowledge of other stakeholders. Any carelessness in the food supply chain can endanger people's lives or health. This is a major concern in terms of traceability. Trust issues in supply chains can cause significant losses for companies. Companies do their best to build trust among customers. Providing access to data while protecting it from being changed by others should solve these problems. By using emerging technologies in the supply chain, we can solve these problems. With blockchain technology, supply chain performance can be improved and problems can be eliminated. Moreover, it has some features that are useful for solving supply chain problems beyond the use of distributed ledger technology. As a result of its immutability and distributed nature, it provides a secure and reliable record that cannot be altered or altered. Food supply chain ecosystems can be improved through transparency and the use of emerging technologies.

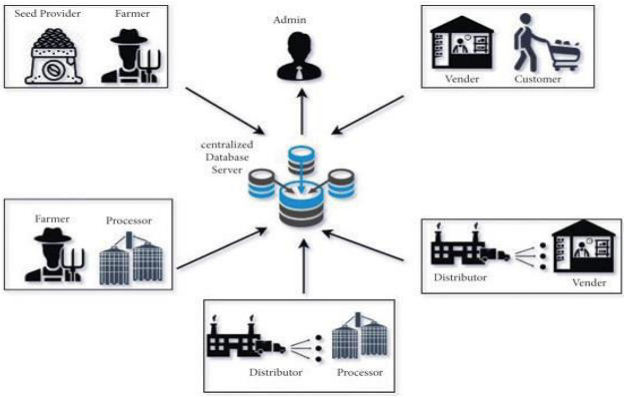

Fig 1: Centralized food supply chain.

✓ **Blockchain in the Agri-Food Supply Chain**

Many constraints plague agriculture and food (agri-food) supply chains, including lack of traceability, poor visibility and inefficiencies. These challenges have a direct and significant impact on management efforts to ensure agri-food product compliance, enhance food safety and quality, reduce food waste, and reduce supply chain operation costs. Advancement of traditional supply chain becomes imperative in case of unexpected increase in product demand. Furthermore, customer satisfaction can be improved with the help of supply chain management. Supply chain includes operations such as product flow, information and product journey history. Figure 1 shows a traditional food supply chain consisting of producers, suppliers, manufacturers, distributors and retailers working in a chain to deliver products from producer to consumer. Traditional supply chains based on centralized systems lead to data loss, data tampering and security risks due to lack of traceability, transparency. **Traditional supply chain has the following disadvantages:**

1. Lack of traceability and transparency.
2. No details of the origin of the product.
3. Food safety is not assured at any stage.
4. No transactions are recorded throughout the supply chain.

The problems mentioned above can be solved by blockchain technology; On distributed networks, it acts as a public ledger and overcomes information maintenance issues such as verification and

authentication. Blockchain technology provides security, maintains tamper proof records, avoids any third party middle man in the transaction, helps reduce the overall cost of transaction and improves product quality. Adoption of cryptographic method here increases user confidence, resulting in increased demand for the product. Cryptocurrency-related encryption methods help authenticate and verify users and new blocks; That is why each block in the blockchain network contains transaction details. A chain consists of a ledger from the beginning to the creation of a new originating block. Each block has a reference to the previous block because of the hash value. A peer-to-peer network helps in the verification of new transactions and users. Among emerging technologies, blockchain technology is likely to significantly impact many areas of collaboration. Using distributed ledger technology, organizations can communicate without an intermediary in a peer-to-peer network. Due to its numerous features, it promotes trust and transparency in a collaborative environment.

✓ **The Process Of Blockchain Impact In Agriculture:**

Consumer-to-provider solutions provide a functional structure as well as a database with a public ledger that contains digital data about objects, individuals, and events that can be viewed or verified by a large number of people in the blockchain. By using blockchain technology in supply chain management, we can overcome problems like:

1. Overall management of the system.
2. System Errors.
3. Production delays.
4. Transparency.
5. Traceability.
6. Improving communication between all components of the supply chain.
7. Enhancing trust between customers and suppliers.

The supply chain needs to evolve to meet the changing and growing demands of consumers. Also, we can generalize the use of blockchain in the food supply chain to create a better marketing environment. Food product data, such as its harvest date and price, is uploaded by the supplier and then an RFID chip is embedded in the product as shown in Figure 2 [4]. These tags contain an antenna and a microchip. A special printer is used to print the identification information on the tag. The information on the tag can be used for a variety of purposes. When RFID scanners scan a product, the information in the tag is read, which may include information necessary to protect the item and manage the supply chain, such as the following:

1. Factors of production.
2. Product ID Number.
3. Location history.
4. Order Status.
5. Serial number of individual product.

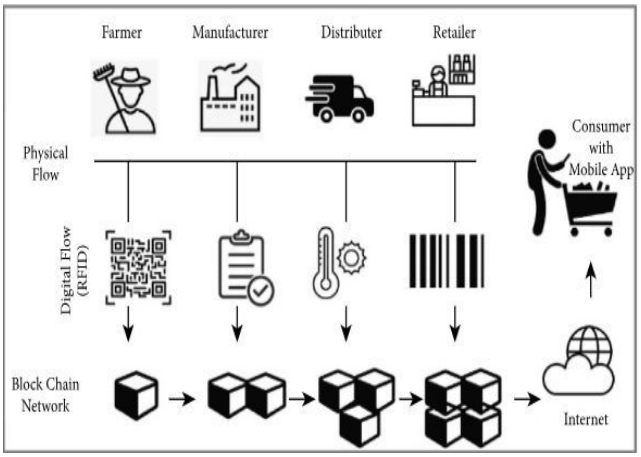

Fig 2: Traditional food supply chain.

Figure 2 illustrates how an RFID receiver can be used to update and transmit this information, and the data is not limited to including serial numbers and IDs. As goods move through warehouses and vehicles, the information provided by RFID will be automatically linked to systems that track shipping and stock positions. By incorporating RFID into these systems, it is possible to verify the quality of the correct items and products. Product information can be tracked throughout the shipping process and in storage with collaboration or IoT to increase accountability and accuracy. Supply chain networks that fully utilize RFID can track the location of goods, allowing theft and other illegal activities to be quickly detected and punished. After tagging by the supplier, the manufacturer collects product information and adds a QR code to the package. The product then goes to the distributor, who is automatically notified of the food's arrival. Then, based on fully accessible data on customers such as delivery dates and other user information, the distributor selects the appropriate 3PL (Third Party Logistics). The origin and destination of the food items are then communicated to the 3PL. It flexibly optimizes network flow. Now the product transferred to the retailer uses machine intelligence to predict sales and also provides customers with a mobile application. The product is now ready for sale. Product information remains consistent throughout the chain. The store provides complete transparency on delivery time. Every company now scans RFID at every step of the

production process and updates the blocks information in the cloud using a mobile app. The app or website is used for verification, authentication and transactions among other things. Communication platform is provided through website and mobile app. When the genesis block is created, the information is saved in it, and the very first transaction is made and the blockchain technology starts working. Consumers can access product data such as origin, aging, duration and expiration by scanning a QR code using the app.

- ✓ **A Blockchain-Based Proposed Model for Agricultural Supply Chains Using Smart Contracts:**

The proposed model includes block chain smart contracts to coordinate food traceability in agricultural supply chains. The implementation of this model improves the traditional blockchain-based supply chain. This model has 4 levels. In the first layer, the manufacturer agent manages all the operations that fall within their domain, such as purchasing materials and selling products. The next level deals with the processor agents who process the products such as sorting, packaging and processing. In the transport layer, all functions related to transportation throughout supply chains are managed by transportation agents. In the next level, the retailer agent buys the product from the processor agent and sells it further to the consumer. All components of the entire supply chain are interconnected in a decentralized blockchain with smart contracts. And every transaction in the entire system can be traced through the blockchain network. Everyone in the entire supply chain can trace the product as shown in Figure 3.

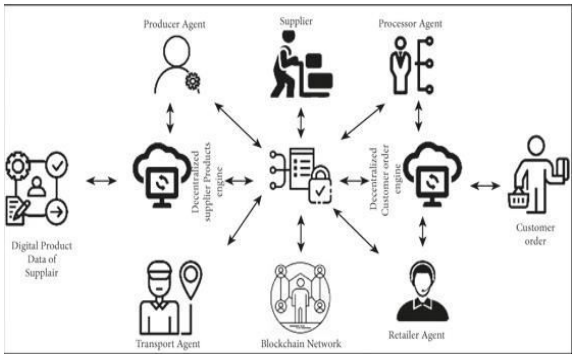

Fig 3: Decentralized smart contract-based supply chain.

The customer can check the origin and process of the product. This new supply chain model enables the agricultural industry to grow exponentially. The use of blockchain enables consumers to trace all products from origin to distribution. The main advantage of this model is the confidence of the end customer which will greatly increase the sales. Figure 4 shows the sequence diagram for the proposed model.

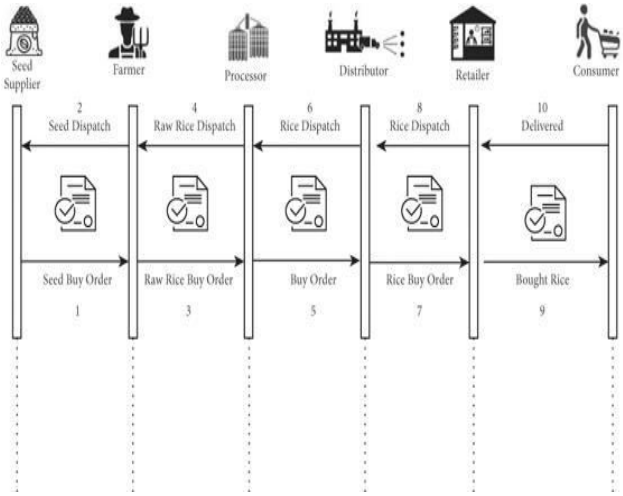

Fig 4: Sequence diagram of food supply chain.

Outcomes of the Proposed Model:

After extensive literature survey and experiments by numerous researchers, we proposed our conceptual model which consists of manual/factors used in current agri-food supply chain processes and another which will be a blockchain-based model. We have created a detailed

Table 1 that illustrates the potential implications of a blockchain-based system and how this system can ensure transparency, traceability, security and immutability throughout the agri-food supply chain process.

Table 1

Outcomes of the proposed blockchain-based agri-food supply chain system.

Attributes	BC-based proposed system	Traditional method
Irreversibility	The transactio information cannot b changed even b the administrato	The information can be easily manipulated by the administrator
Unanimity	A shareholder agreement is considered	Consensus is not available
Origin	Transaction history is available	No history, no record of information
Structure	Completely decentralized	Centralized
Trust	Building trust in a collaborative environment	Centralized approaches impose trust problems
Storage	Distributed storage	Centralized

Conclusion and Future Work:

Researchers are striving to develop systems that can innovate in the current situation. Blockchain technology is one of the developing and emerging technologies these days as this technology is disrupting every sector and can revolutionize the agriculture sector by improving the supply chain and ensuring data integrity, security and traceability. It has the potential to improve the country's economy by reducing corruption and improving producer and consumer satisfaction. Blockchain establishes an efficient and transparent system by removing intermediaries in supply chain management. In this paper, we present an advanced blockchain approach to augment traditional supply chains. To efficiently manage the entire supply chain, we use multi-agent systems with smart contracts as they eliminate middlemen, allowing the circular economy market to grow. Our methodology is automated. Using blockchain technology, we provide strong security features to agricultural systems. Product origin can be verified, product shipment can be monitored and proof of all transactions can be saved with this model. Another innovation of this study is the agent that verifies that both parties are following the terms and conditions of the smart contract. A fine or penalty is imposed if the agent finds that the participant has not met the conditions. This makes our model more reliable and efficient compared to other models; It can also track and validate orders. In addition, we have developed a smart contract using the Ethereum blockchain to validate our model. Researchers can test such proof-of-concepts as well as models using Hyper Ledger Fabric Composer or multi-chain tools designed to work only with permissioned blockchains where all entities are known. The article addresses two main research questions. We first examine some of the most pressing problems with traditional supply chain ecosystems, and then we explore how blockchain technology can be used to solve these problems. Our second question requires an analysis of the benefits of integrating blockchain technology with the supply chain. In conjunction with Ethereum's blockchain and proof of authority consensus algorithm, the Interplanetary File System is used. Due to the immutable nature of block chain technology, it can increase trust, transparency and security in the supply chain. This model can be adapted to different types of supply chains in different domains.

1

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023

Paper ID: CS- 10

Segmentation of DhammaLipi character using Histogram Projection Method

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Abstract:- *Segmentation is very important phase in Optical Character Recognition. Segmentation in OCR is nothing but breaking the whole image into lines then character to recognize them. In this paper we segment lines ,words, characters in DhammaLipi using Histogram Projection Method. Implementation is done using Matlab. This technique is very efficient and easy to understand. One section of this paper summarize Horizontal Histogram Projection method to segment line in an image. The second section contain Vertical Histogram Projection technique to segment character and words from the line.*

Keywords: *Histogram Projection Method, Segmentation*

INTRODUCTION :

Segmentation is the most important and challenging step in Optical Character Recognition(OCR) because properly segmented character is accurately recognize. Segmentation in OCR is nothing but separation of lines ,words ,characters from the scanned document. This is the third step in character recognition. Before that we have to capture the image using digital device like camera or scanner. Due to the atmospheric condition or defect in digital devices image become blur. The blur image contain noise .So first and important step for accurate character recognition is preprocessing the image for improving its quality.Their are various noise removing filters bare present in digital image processing like lowpass filter, Highpass filter ,median filter, max filter , min filter [6] etc. We can apply one filter or series of filters on one image depending on the noise. By applying such filters we can remove noise from image and our image become clear for further processing. Then we convert the image in more simple form like grayscale and binary format. Binary format image is more simple for processing because it contain only two intensity values 0's and 1's . Next step in ocr is segmentation. In segmentation first we have segmented lines from image and store it into another file. Then we have performed word segmentation and store words In in another files. And last find the character segmentation and also store it in another file for further processing.

In this paper we have applied horizontal histogram Projection method for line segmentation and vertical histogram projection method for word and character segmentation[1][3].

LINE SEGMENTATION:

Line segmentation using the histogram projection method in MATLAB involves analyzing the vertical histogram of an image to find regions with gaps or spaces between lines of text. These gaps indicate potential locations for line segmentation[1][2]. Here are the steps to perform line segmentation using histogram projection in MATLAB[6].

1. Load or create the image you want to segment into lines. You can use the **imread** function to load an image from a file or create one using MATLAB's image manipulation functions.

2. Convert the image to grayscale if it's a color image, as histogram projection is typically done on grayscale images.

3. Calculate the vertical histogram by summing up the pixel values along each column of the grayscale image.

4. Analyze the vertical histogram to identify peaks and valleys that represent spaces between lines of text.

5. Set a threshold to distinguish between peaks (lines) and valleys (gaps).

6. Perform line segmentation based on the identified peaks and valleys[4].

We performed these steps on the following Lumbini Rummindei inscription written in Dhmmalipi.

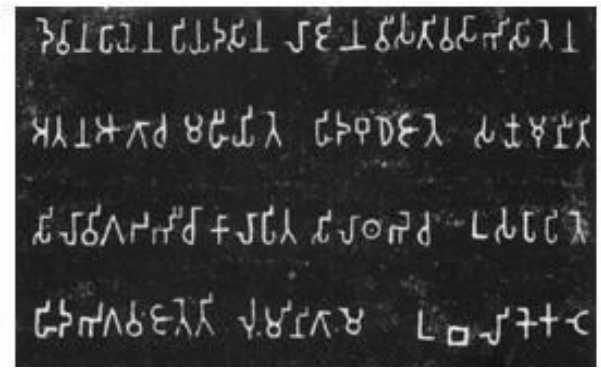

Fig 1..Lumbini Rummindei Inscription

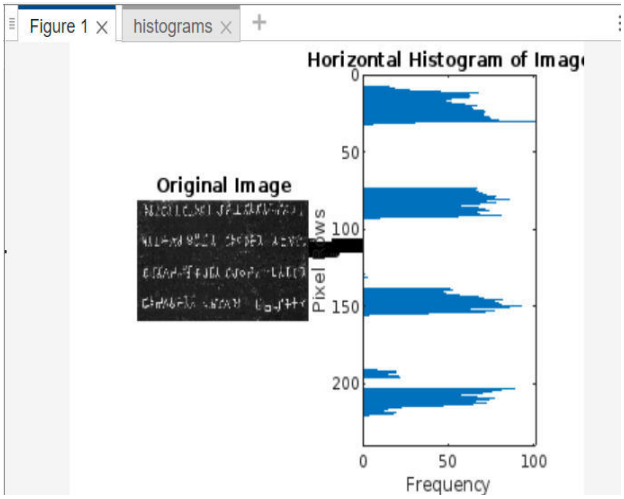

Fig.2 Horizontal Histogram of binary image.

Segmented lines:

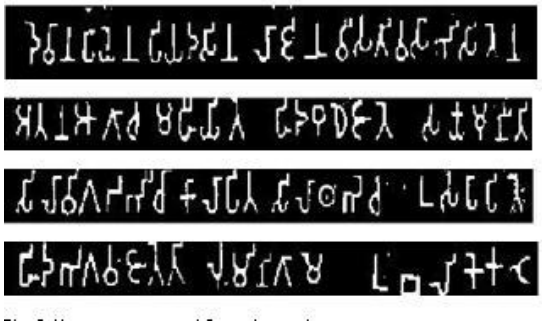

Fig.3 lines segmented from input image.

Word segmentation

1. We load the image(segmented in line segmentation), convert it to grayscale (if necessary), and then binarize it to create a binary image using a threshold (you can adjust this threshold).[3]

2. We compute the vertical histogram projection by summing the pixel values along each column[6].

3. We identify word boundaries based on a threshold value (adjust as needed). The threshold determines where the histogram values are high enough to indicate the presence of a word.

4. We find the starting and ending indices of each word based on the detected word boundaries.

5. We initialize a cell array to store individual word images.

6. We loop through each word, crop it from the binary image, and store it in the cell array.

7. Optionally, we save each word to a separate file and display them for visualization.

Resulting images:

Fig. Input Line segmented in line segmentation.

Fig. Segmented Words
Character Segmentation:

Character segmentation is done on the segmented word. For character segmentation we performed similar steps as word segmentation except we found the boundary of the character than word using vertical histogram.

The resulting images are:

Fig. Segmented characters.

CONCLUSION.

Histogram Projection Method is very simple to understand. Line segmentation accurately segment all lines. Character segmentation segment one extra beginning character (spaces)in a line. We have implemented primary work for segmentation of lines, words and characters of Dhammalipi. Sometimes it becomes crucial to identify word boundaries of handwritten Dhammalipi shilalekh.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-11

Deep Learning and Natural Language Processing Applications

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Abstract:- *The golden age of AI is currently ongoing. Machine learning is used in the majority of AI applications, and it presently offers the best track of developing a strong AI. On the other hand, deep learning, which is a subset of machine learning, is reaching at the peak of its development as it gains popularity and excels in a variety of application scenarios. AI is capable of understanding and generating human language, thanks to deep learning and natural language processing. In a time when technology is changing our life style, the combination of Natural Language Processing (NLP) and Deep Learning is at the top of revolution. This powerful combination bridging the gap between human communication and machine understanding, resulting in a world where our technology understands our language and reacts accordingly. This paper presents the various applications of deep learning in NLP.*

.Keywords - *Applications, Artificial Intelligence, Machine Learning, Deep Learning Processing, Natural Language Processing*

I. INTRODUCTION

Machine learning and deep learning are two well-known and powerful disciplines of artificial intelligence which have various applications in the fields of science, technology, engineering, and mathematics (STEM).

A. Machine Learning

Machine learning is a general phrase which refers to the computer's skill to learn from data and carry out tasks without being explicitly programmed. Machine learning algorithms can examine big and complicated datasets, discover patterns and trends, and use this information to make predictions and come to decisions.

Machine learning approaches can be classified into three categories supervised learning. unsupervised learning and semi supervised learning. In Supervised learning the algorithm is trained using given labelled data, which means that the desired output or outcome is known. Unsupervised learning occurs when the algorithm is trained on unlabelled data, which requires the programme to independently identify the structure and features of the data. Semi supervised is the combination of supervised and unsupervised learning.

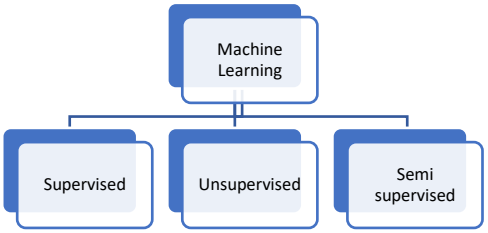

Fig.-1 Machine Learning Approaches

B. *Deep Learning*

Artificial neural networks that learn from data are used in deep learning, which is a subset of machine learning. Different layers of linked nodes are used to make up artificial neural networks, which imitate the look and feel of biological neurons. The structure and operation of real neurons are imitated in artificial neural networks, which are made up of layers of interconnected nodes. Layers of connected nodes in artificial neural networks resemble the form and operation of organic neurons. Depending on its inputs and weights, each node can process and transfer information.

Deep learning is named as deep because it can create a deep and sophisticated network with numerous layers of nodes that can learn from high dimensional and unstructured input. Deep Learning (DL) is a dynamic area of AI that has emerged as particularly promising for handling complicated problems. DL represents a growing and significant research in the field of A.I. It has the ability of carrying out tasks including speech recognition, computer vision, natural language processing, and image recognition.

C. *Differences between Machine Learning and Deep Learning*

Deep learning and machine learning share some characteristics, yet they also differ significantly. One distinction is the requirement for high-quality data. Smaller and simpler datasets can be used for machine learning, but in order to extract useful information from the data, more pre-processing and feature engineering may be required. Deep learning can handle more large and complicated datasets, but it may require more computing time and resources to train the network. The models' interpretability and openness are another distinction. Machine learning models are easier to analyze and explain, allowing you to know how they make decisions and the elements that affect them. Deep learning models are frequently more opaque and "black boxes," which means that it may be difficult to trace how they arrive at their outputs and what hidden properties they learn.

D. *Natural Language Processing*

A branch of artificial intelligence (AI) called natural language processing (NLP) employs machine learning (ML) and deep learning (DL) methods. Natural language processing (NLP) techniques are applied to the processing and analysis of natural language data in order to extract knowledge and produce valuable information.

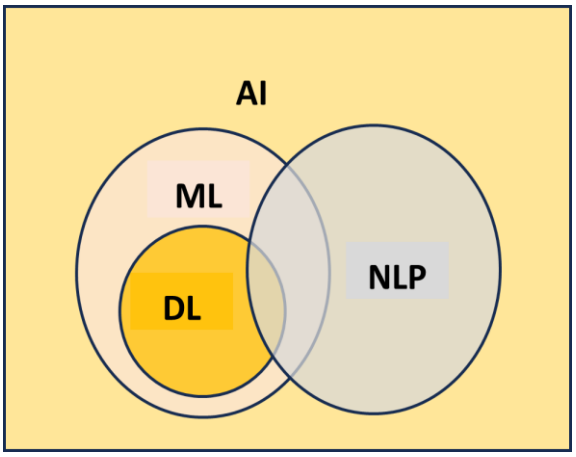

Fig.-2 Correlation between Artificial Intelligence, Machine Learning, Deep Learning and Natural Language Processing

NLP is the study of how computers interact with human (natural) languages is known as natural language processing (NLP). NLP is a branch of artificial intelligence and computer science. Its aim is to make machine capable to recognize, interpret and produce human language in order to communicate with people. With the use of natural language processing (NLP), computers can process massive amounts of natural language data and extract the necessary information to use in a variety of applications, including machine translation, question-answering, text summarization, Customer service chatbots, sentiment analysis algorithms for social media, and other many innovations are all made possible by using NLP.

These applications have been further expanded by integrating deep learning with NLP, allowing for modified marketing policies, enhanced sentiment analysis, and real-time language translation. Deep Learning, a subset of machine learning, enhances this, through the use of neural networks that closely resemble human brains. Deep learning in NLP enables machines to produce human-like responses, develop novel content, and even anticipate our requirements.

E. *NLP and Deep Learning: How They Relate*

Deep Learning (DL) is a dynamic area of AI that has emerged as particularly promising for handling complicated problems. DL represents a growing and significant research in the field of A.I. In the domain

of Natural Language Processing (NLP), deep learning is a cutting-edge strategy that has changed the industry. Deep learning models may successfully capture and represent complex patterns in data by utilizing neural networks with numerous layers, enabling a more sophisticated understanding and creation of human language. One of the important benefits of deep learning in NLP is its ability for feature learning. Deep learning algorithms can automatically find the representations required for feature detection or classification from raw data instead of depending on manual feature engineering, where linguists or domain specific experts manually construct features for processing language data. This saves time and efforts and facilitates more accurate and adaptable language processing. Contextual knowledge is a strength of deep learning models. For correct language comprehension, it is essential to know the context of the words used in a sentence. Deep learning models can examine the adjacent words and phrases and understand that a word's meaning can vary depending on the context. The accuracy and precision of language analysis and generation are improved by this contextual understanding.

Deep learning is essential to NLP because DL makes it possible to model complicated patterns, makes it easier to grasp context, and provides scalable performance. It offers considerable advantages in language processing jobs due to its capability to learn directly from data and capture high-level representations. This has led to breakthroughs in fields like sentiment analysis, machine translation and question-answering systems.

II. NLP APPLICATIONS USING DEEP LEARNING

Here we take some common Deep learning applications in NLP. Natural language processing (NLP) has seen a significant increase in the use of a range of deep learning models to enhance, expedite, and automate its features. These models and techniques are also providing better ways to transform unstructured text into useful information and insights.

A. Tokenization And Text Classification

Sentences are divided into words through the process of tokenization. Document tokenization is simple in English-language as gaps between words and paragraphs are clearly mentioned in English documents. However, the majority of other languages, pose unique difficulties. For instance, logographic languages with no spaces between words or even sentences, such as Cantonese, Mandarin, and Japanese Kanji, might be difficult to learn [1]. DL models are able to categorise and forecast a document's theme. For example, recurrent neural networks (RNN) and deep convolutional neural networks (CNN) can automatically categorise the tone and sentiment of the original text using word embeddings that determine the vector value of words. The majority of social media sites use CNN and RNN-based analysis tools to detect and flag spam content on their platforms.

We can apply text classification in various applications such as web searching readability assessment and language identification.

Text classification is used to predict a class label of predetermined classes. Classification of a document's topic or theme is the aim of text categorization. Some examples of text classification are

1) Sentiment analysis

Sentiment analysis is a well-known application of text classification, where the emotional tone of the source text represents the labels for the classes—such as "positive" or "negative". Emotion recognition from text is a critical task in natural language processing, which has huge implications for a variety of fields, including artificial intelligence, human-computer interaction, and others. Human reactions to the events are accompanied by physiological thought known as emotions. Analysis of these emotions without consideration for voice and facial expressions is crucial and necessitates a supervisory technique for accurate emotion interpretation. Despite these obstacles, it's important to recognize human emotions as they increasingly express themselves through rude words on social media platforms like Facebook, Twitter, etc. In [02] researcher propose a sentimental classification of gathered tweet. They applied deep learning techniques to classify sentiments of tweets into positive, negative emotions. enthusiasm, fun, happiness, love, neutral, relief, surprise are the classes used for positive emotions whereas anger, boredom, emptiness, hate, sadness, worry are the classes used for negative emotions. For their experiment they have used RNN (Recurrent Neural Networks) and LSTM (Long short-term memory) methods on three different datasets. An extensive analysis shows that the system improves emotion prediction on the LSTM model with 88.47% accuracy for positive or negative classification and 89.13% and 91.3% accuracy for positive and negative subclass, respectively.

2) Spam Email filtering

Spam Email filtering determines whether or not email text is spam. Email is one of the most well-known and effective ways to share data or messages on Internet. The occurrence of spam emails has also significantly increased due to the importance and widespread use of emails. Spam emails are unwanted emails with a variety of contents, including offers, advertisement, harmful links, malware, trojans, etc. Spammers send junk mail with the purpose to accomplish email fraud, so it's critical to separate spam email from valid communications. The goal of the research in [03] is to develop models for detecting email spam using machine learning and deep learning methods so that spam and valid emails can be separated with high accuracy. In this study author constructed Deep learning models using LSTM and BERT and the Enron email dataset has been used to identify and categorize new email spam. The text of the email was analyzed, and data preprocessing was done, using an NLP approach. The outcomes are compared with the earlier email spam detection models. With BERT, BiLSTM, and LSTM, the suggested deep learning approach achieved the highest accuracy of 99.14%, 98.34%, and 97.15% respectively.

Research in [4] were carried out utilizing several kinds of neural networks and machine learning methods. However, despite all of their efforts, the random forest classifier managed to achieve the greatest accuracy of 94.2%. Comparing deep learning techniques to conventional machine learning algorithms, it is found that deep learning perform with superior accuracy. In this study, a deep recurrent neural network was employed to identify spam emails. After analysing of several configurations for this method, the best setup that produced the highest accuracy was based on employing Tanh as the activation function with a dropout rate of 0.1 and a total of 100 epochs. The hybrid gated recurrent unit recurrent neural network's best accuracy (98.7%) was surpassed by the suggested method's high accuracy of 99.7%.

3) Language Identification

Text classification can also be used for language identification, which classifies the language of the original text. In [5], the automatic language identification (LID) problem is tackled using deep neural networks (DNNs). In response to their recent success in acoustic modelling author modify DNNs to the challenge of determining the language of a given spoken utterance using short-term acoustic data. On the Google 5M LID corpus and NIST LRE 2009 datasets, the suggested method is compared against cutting-edge i-vector based acoustic systems. Results demonstrate how DNNs can be very useful for LID, particularly when a lot of training data is available. Over the baseline system, they discovered relative improvements in C avg of up to 70%.

In [6] researcher evaluate a previously proposed convolutional neural network and convolutional recurrent neural network-based spoken language detection technique. To ensure equal class distribution and effective memory consumption, they enhance the method by changing the training technique. Using a modified set of languages, they successfully reproduce earlier experimental findings. Their research demonstrates that convolutional neural networks and convolutional recurrent neural networks are both capable of learning language-specific patterns from representations of speech recordings' mel spectrograms.

4) Genre Identification

Identifying the genre of a fictional story through genre classification is another application of text classification. Instead of expressing language as a flat sequence or an unordered collection of words or characters, recent developments in NLP are discovering ways to emphasize the hierarchical aspect of text. For a human reader to build a comprehension of a document, they must be able to understand various levels of abstraction and meaning. In [7], authors discuss the challenge of creating genre identification methods that can operate on exceedingly big and complicated literary materials. The task is to categorize a full-length book that is a part of a corpus of literature, where works often have well over 200,000 words, and where genre is an ethereal, conceptual term. In this study the Gutenberg Dataset for Genre Identification is used. Author also shows that how current deep learning models for this task compare to conventional approaches. They presented that employing an ensemble of chapters method can considerably enhance outcomes in deep learning methods. The compositionality of subtexts that make up a bigger work and contribute to the overall genre serves as the motivation behind the ensemble of chapters technique.

B. Image Captioning

One of the most famous applications of image processing with combination of NLP is Generating Captions for Images. It's difficult to automatically use natural sentences to describe an image's content. The image's caption should describe the objects in the image as well as describe how they relate to one another and their characteristics (visual recognition model). A language model is also

necessary since semantic knowledge must be expressed in natural language.

The ideal image captions can be created by aligning the visual and semantic components. Due to the growth of deep learning, the integration of computer vision and natural language processing has received a lot of attention. Image captioning is the field in which one or more sentences are used to teach a computer how to understand the visual information contained in an image. Deep learning-based research from recent years has improved the accuracy of image captioning. In addition to the ability to recognize the item and the scene, high level image semantics also needs the ability to analyse the state, the properties, and the relationship between these things. Even though image captioning is a challenging and hard task, many academics have made substantial advancements in image captioning. In [8] author described three main methods of deep neural network used for image captioning. These are CNN-CNN based CNN-RNN based and Reinforcement-based framework. They describe the evaluation metrics and list the main advantages of image captioning. They also present difficulties encountered in image captioning. As computer vision and NLP (Natural Language Processing) are often used in artificial intelligence (AI) for automatically producing an image's contents, the regenerative neuronal model which is dependent on machine translation and computer vision is developed in [9]. This model is used to produce natural-sentences that ultimately describe the image. Both a convolutional neural network (CNN) and a recurrent neural network (RNN) are used in this model. The CNN is used to extract features from images whereas the RNN is used to generate sentences. When an input image is supplied to the model, it is trained in such a manner that it will produce captions which almost exactly describe the given image. They performed various experiments using several datasets to test the model's precision, smoothness, and linguistic proficiency. Their experiments demonstrate that the model often provides correct descriptions of an input image. Image captioning is used to create explanations that provide context for the images. In general, image captioning is extremely helpful in a variety of applications, such as the analysis of enormous quantities of unlabelled photos and the discovery of hidden patterns for machine learning applications. Deep Learning Models can be used for this image captioning. Deep learning and Natural Language Processing advancements have made it simpler than ever to create descriptions for the provided photos. In [10], a deep learning model for image captioning is proposed. They trained their model using data from the Flickr 8k dataset. Convolution Neural Network (ResNet) is used as the encoder to access the image features whereas Recurrent Neural Network (Long Short Term Memory) is utilized as the decoder to generate the captions for the images using the built-in vocabulary and image features. The researcher found that this ResNet-LSTM model is more accurate than the CNN-RNN and VGG Models. When they run this model using the Graphic Processing Unit, it performs well. This deep learning model for picture captioning is incredibly helpful for evaluating vast volumes of unstructured and unlabelled data to identify patterns in the images that will be used to steer self-driving cars and create software that will help the blind.

C. Speech Recognition

A growing number of tasks requiring complex vocabulary voice recognition and separation are being performed by neural networks, and DL is being progressively used to construct and train these networks. These theories and techniques are really applied in signal processing, phonetics, and word recognition, the three main components of speech recognition.

D. Machine Translation (MT)

Another well-known application of NLP is Machine Translation (MT). It is the study of using computers to translate languages without the involvement of humans, and it is a key task in the field of natural language processing. Deep learning methods for neural machine translation are a relatively new development. Long short-term memory (LSTM), recursive auto-encoder (RAE), feed-forward neural network (FNN), and RNNs are all used to train the computer to accurately translate sentences from one language to another. In order to translate sentences without employing a large rule database, suitable DNN solutions are employed for procedures like rules reordering, word alignment, language modelling and join translation prediction. The study of machine translation has been underway for decades. The elimination of the language barrier is the primary goal of machine translation. Earlier research in this field started by directly replacing the source language word with the target language word.

Later, as computer and communication technology developed, data-driven models such as statistical and neural machine translation techniques became more dominant. In [11] researcher applied a deep learning method based on neural networks to the translation of English into Urdu. Around 30923 sentences from parallel corpora are used. The corpus includes news, commonly used language in daily life, and sentences from an English-Urdu parallel corpus. There are

540924 Urdu tokens and 542810 English tokens in the corpus, and the proposed system is trained and tested using 70:30 distribution. The number of automatic evaluation metrics are used to evaluate the effectiveness of the proposed method and the model output is also compared with the output from Google Translator. The average BLEU score for the proposed model is 45.83. In [12] researchers discuss Deep Neural Networks (DNN) and the idea of deep learning in the context of machine translation, a form of natural language processing. DNN is now a key component of machine learning techniques. One of the best techniques for machine learning is the recursive recurrent neural network (R2NN). It consists of a recursive neural network (like the Recursive auto encoder) combined with a recurrent neural network. The training of the recurrent neural network for reordering from source to target language using semi-supervised learning techniques is described in this research. To create word vectors for the source language, a Word2vec tool is necessary, and an Auto Encoder supports in the reconstruction of vectors for the target language as a tree structure. The output of word2vec is crucial for the input vectors' word alignment. The RNN structure is extremely complex and to train the big data set on word2vec takes a long time. Consequently, strong hardware support (GPU) is needed. GPU enhances system performance by reducing training time.

For a long time, it was believed that computer translation systems could never match the accuracy of human translation. In [13] author offer CUBBITT, a deep-learning system that questions this assumption. CUBBITT considerably surpassed professional-agency English-to-Czech news translation in terms of maintaining text meaning (translation adequacy) in a context-aware blind review by human judges. Although CUBBITT is found to be significantly more fluent than earlier state-of-the-art systems, human translation is still rated as being more fluent. Furthermore, in a Translation Turing test, the majority of participants have trouble differentiating between CUBBITT and human translations. In some cases, this effort is more adequate than human translation and even comes close to it. This implies that deep learning might be able to take the role of people in situations where preserving the meaning is the main goal.

E. Question Answering (QA)

Like other applications Question Answering (QA) is also a popular application of NLP. Question-and-answer systems attempt to respond to a request that is posed as a question i.e., the goal of question-answering systems is to respond to questions. Therefore, these systems provide answers to a variety of questions that are posed in natural languages, including definition questions, biographical questions, and queries involving many languages. One of the most well-known difficulties that researchers in the DL field have to deal with is developing a completely effective question-answering system. Although deep learning algorithms have made some growth in text and image classification in the past, they were unable to handle problems that required logical thinking, such as question answering problems. However recently these deep learning models are enhancing the performance and correctness of these QA system. Recurrent neural network models, for instance, succeed where conventional methods fall short in providing accurate answers to questions with a length of several paragraphs. More crucially, the DL model is trained in a method that eliminates the requirement for linguistic expertise while building the system, such as when developing a semantic parser.

Question Answering (QA) systems are used in information retrieval to automatically respond to questions posed by humans in natural language with the proper answers using either a pre-structured database or a collection of natural language texts. Instead of searching through all papers like a search engine would, it just displays the information that was requested. Due to the growing amount of information in daily life, even a simple query requiring the exact fragment of information demands extensive and expensive resources. In [14] researchers propose a closed domain QA System for handling documents connected to education act sections to extract more exact answers using NLP approaches, in addition this study also explores several methodologies and implementation details of question answering systems for general language.

F. Question Generation

Making the most of the information is becoming more and more important due to its recent rapid increase. One of the potential ways to obtain this much information is through question-and-answer systems. The Question Answering System cannot recognize questions that cannot be answered and questions that are irrelevant since it lacks human common sense and reasoning ability. These questions are answered by making erroneous and inaccurate approximation. In [15], author propose a Question Similarity technique to improve this restriction. A Question Similarity Score is calculated after a question is compared to possible questions that could be generated from the given paragraph before being submitted to a question-answering system. The Question Similarity technique efficiently finds the questions that cannot be answered and are irrelevant. In order to recognize questions that are irrelevant or

unanswerable, the suggested Question Similarity method utilizes human-style reasoning. This approach can completely stop irrelevant and unanswerable queries from being submitted to the question-answering system. Question answering systems perform better when they only focus on queries that can be answered. Additionally, they provide an application of QAS that, for given a passage, generates question-answer pairs that are applicable in a variety of domains.

G. Document Summarization

Automatic summary is a well-known technique for reducing a document to its key points. It works by producing a condensed version of the text while maintaining important information. Nowadays, the huge amount of data is available, so the importance of document summarization is growing. The two types of text summarization are extractive and abstractive. Extractive summarization techniques reduce the amount of work required by selecting only the relevant sentences from the original text. Although there are many different approaches, extractive approaches are particularly appealing to academics with an interest in Natural Language Processing (NLP). The implications of sentences are determined using linguistic and statistical traits. In [16], researchers investigate extractive and abstract summarization techniques. This research also examines the techniques, which results in a summary that is less repetitious and more focused. It has "gold-standard" human-generated summaries. The outcomes demonstrated that the performance of the suggested system in producing summaries nearly matched that of the human annotators.

We have travelled through various applications of NLP using Deep Learning. People are interested in this field because of these applications. Although it seems to be attracting industries, researchers are still having difficulty handling the exponentially rising amount of data. These difficulties include overfitting problems in neural networks, the reduction of hyper-parameters, a scarcity of highly configured processors, and processing in hidden layers [18]. In our future work we will try to explore these difficulties.

become simple for DL specialists to create effective text summarization models thanks to recent developments in sequence-to-sequence. models. Extractive and abstractive document summarization can be accomplished by paying close attention to the sequence-to-sequence paradigm. In sequence-to-sequence paradigm, the encoder RNN examines the source text to create a series of hidden states for the encoder. The previous word of the summary is then fed into the decoder RNN. This input is used to update the context vector, which is the hidden state of the decoder. The output is then produced by the context vector and the hidden state of the decoder. This sequence-to-sequence paradigm, offers an effective mechanism for abstractive summarization, which allows the decoder to produce words in any order it chooses. In [17], author investigate the field of extractive automatic text summarization using deep learning approach and apply it to a low-resource language, Konkani. The proposed method obtains a vector representation of sentences using fastText pre-trained word embeddings from Facebook. After that, the feature vectors are used to automatically generate summaries using the deep multi-layer perceptron approach as a supervised binary classification problem. Using pre-trained fastText word embeddings lowered training time and removed the need of huge training set. Recall-oriented understudy for gisting evaluation (ROUGE) toolset was used to compare the system-generated summaries to the

III. CONCLUSION

Deep learning techniques and neural networks are quickly replacing statistical language modelling in the field of language modelling. This is because advanced performance on challenging NLP tasks has been made possible by DL models and approaches. So far, text classification, Speech Recognition, machine translation, question answering, summarization, and natural language inference seem to be NLP tasks that can be successfully completed using deep learning models. We are hopeful that deep neural networks will gain more popularity and can be used in more NLP applications in the future. From this paper researcher can better understand the increasing importance of Deep Learning models and techniques in NLP applications.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-12

Assessing the Efficacy of the Destination-Sequenced Distance-Vector Routing (DSDV) Protocol in a VANET Environment for Highway Scenarios

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Abstract—*From over the past few years, vehicle ad hoc networks (VANETs) have seen increased use in intelligent transportation systems. VANET's architecture includes essential components like autonomy, dispersed networking, and dynamically changing topology. The capabilities of VANET and its applications for enhancing traffic safety have attracted a great deal of commercial and academic interest, particularly in research on potential improvements to transportation networks. Such a quickly changing vehicular environment is suited for some proactive protocols, such as DSDV. This study examines how the DSDV protocol performs under two various mobility models and also this study reveals the nature of DSDV protocol in different scenarios.*

Keywords —*DSDV, OMNeT++, Routing Protocols, Simulation, SUMO, VANET.*

INTRODUCTION

Traffic congestion and accidents have emerged as important global concerns as a result of the growing number of vehicles on the road. According to the World Health Organization, road traffic accidents are one of the top ten global causes of death, claiming more than one and a quarter million lives and causing fifty million nonfatal injuries annually. If no preventive measures are taken, these numbers are predicted to rise. Congested traffic, meanwhile, hinders economic development by reducing transit efficiency.

Given the foregoing, governments, academic institutions, and automakers were becoming increasingly interested in vehicular ad hoc networks in order for them to develop into the core of the ongoing development of the intelligent transportation system.

Vehicle Ad hoc Networks (VANETs), a division of Mobile Ad hoc Networks (MANETs). In VANETs, mobile nodes are vehicles with cutting-edge equipment on board that travel on constrained routes (such as roads and lanes) to communicate with each other and exchange messages via Vehicle-to-Vehicle (V2V) communication as well as between vehicles and fixed roadside infrastructure via Vehicle-to-Infrastructure (V2I) communication.

In VANETs, vehicles can communicate over distances of 100 to 1000 meters. As a result, two communication units are included in the architecture of these networks: Onboard units (OBUs) are installed inside of moving cars, whilst roadside units (RSUs) are fixed nodes positioned close to a street intersection or traffic signal. RSUs act as an access point, whereas vehicles act as a router, source, or destination to spread messages.

In order to support the implementation of novel traffic services ranging from commercial applications, traffic management, entertainment, and safety, VANETs are made up of a wireless network of cars that may communicate with one another.

Numerous routing protocols have been proposed in order to increase the effectiveness and dependability of routing in VANET. These protocols aim to reduce packet loss while increasing throughput. Routing protocols in VANET are a complex and difficult undertaking due to the significant mobility of nodes, which makes the network topology dynamic and frequently causes link disconnections. The network characteristics in this case have a significant impact on the choice of routing protocol. A single routing protocol cannot satisfy the requirements of all network types as a result.

DESTINATION-SEQUENCED DISTANCE VECTOR (DSDV) ROUTING PROTOCOL

The routing table is used by DSDV to determine the shortest path to the destination. The routing table for each node includes the following information about each node in the network:

- Destinations Address
- Next hop route Address
- Sequence number generated by destination, which used to guarantees a loop-free path

Figure 1 shows the network structure, and Table 1 provides details on node A's routing table and how it controls the routes between neighbours.

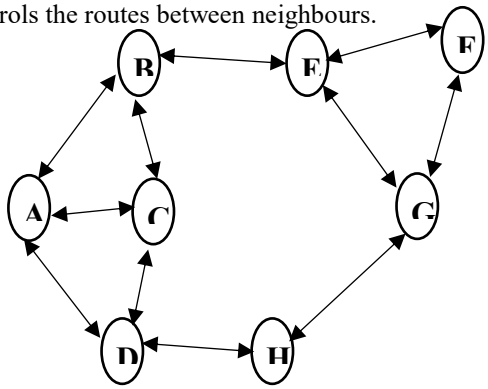


Figure 1. Network Topology

Table 1. Routing Table Information of Node A

Source	Destination	Next Hop	Hop Count	Sequence Number
A	B	B	1	B000
A	C	C	1	C100
A	D	D	1	D200
A	E	B	2	E300
A	F	B	3	F400
A	G	D	3	G500
A	H	D	2	H600

Each node keeps this table updated by occasionally sharing all tables with every other node in the network. Figure 2 shows a real-world OMNET++ application. By sending hello messages to each other, nodes find each other.

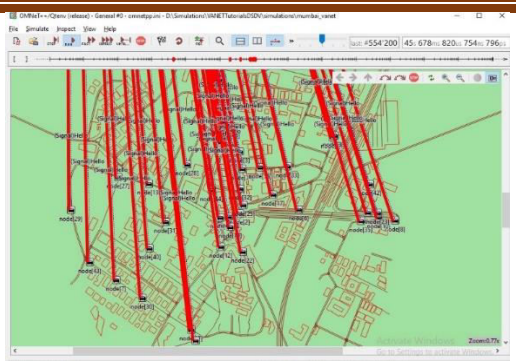


Figure 2. Hello messages exchange in DSDV

As shown in Figure 3, the procedure is repeated for each node until the network topology is produced. After that, the source can readily get to the destination.

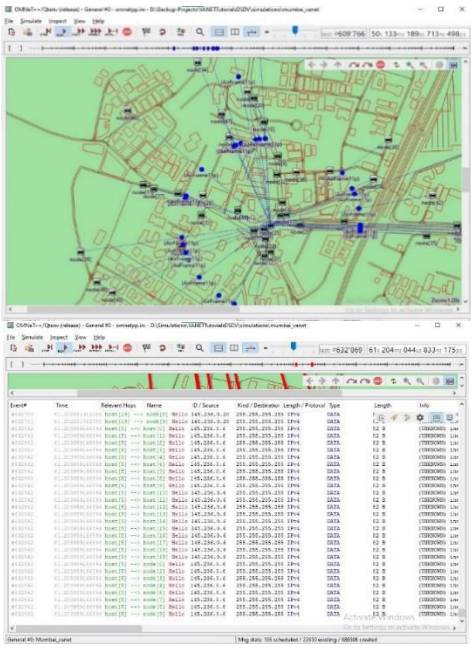


Figure 3. Network topology completed and routing tables built after sending hello messages

Loop Free Prevention

Loop free occurs when connections between two nodes fail, such as the connection between nodes C and E in Figure 4. Node C wants to inform other nodes that a link is broken after realizing it. However, Node A updates the table to Node C more quickly than Node C. Node C transmits its update table to A after determining that there is a link to E from A with a hop count of 2. The two nodes in this case will cycle endlessly and fail to recognize the network link that is broken.

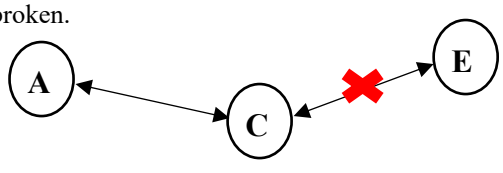


Figure 4. The infinite loop problem

METHODOLOGY

This study employs the experimental research methodology. In this instance, the behavior of the DSDV was examined in two distinct real-world VANET environments, namely Mumbai and Mohali, using two different simulation tools, SUMO and OMNeT++. In order to create various scenarios, both the Manhattan model and the Random Waypoint mobility models were used.

The simulation visualization for the Mumbai Road and Mohali Road Networks developed in SUMO 1.8.0 is displayed in Figures 4, 5, 6, and 7.

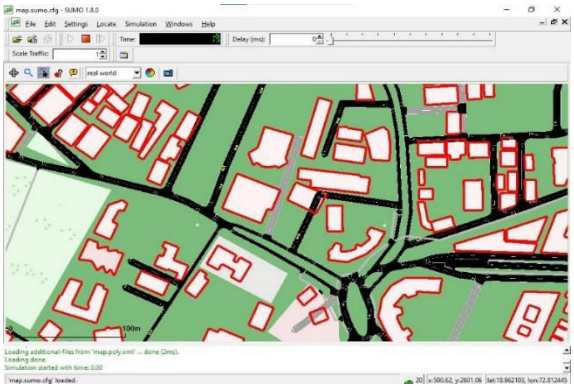


Figure 4. Mumbai Road Implementation in SUMO 1.8.0 (RWP mobility model)

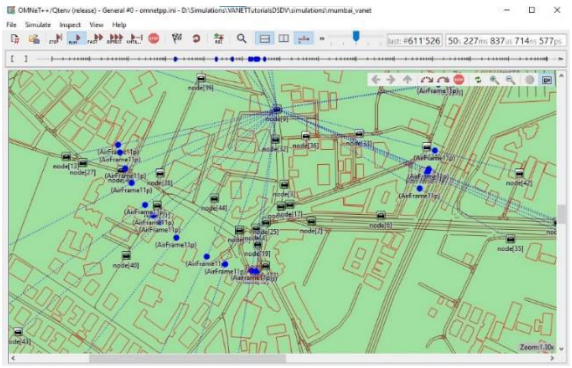


Figure 5. Simulation view in OMNeT++ 5.6.2 of Mumbai Road Network created in SUMO 1.8.0

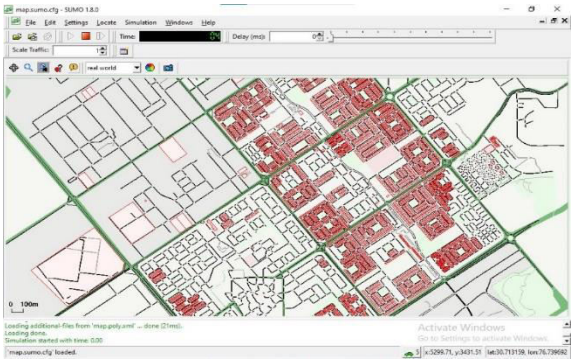


Figure 3. Mohali Road Implementation in SUMO 1.8.0 (Manhattan mobility model)

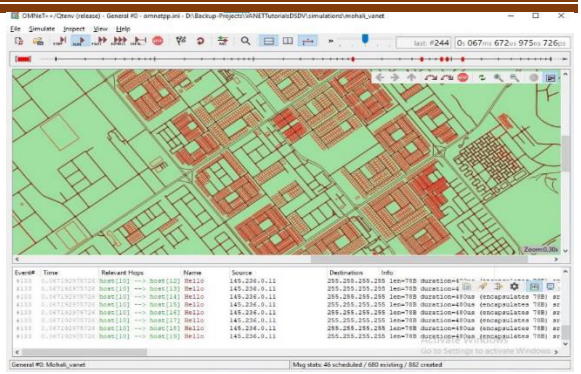


Figure 4. Simulation view in OMNeT++ 5.6.2 of Mohali Road Network created in SUMO 1.8.0

SIMULATION EXPERIMENT

Here city scenario is taken with maximum 300 vehicles. The proactive routing protocol DSDV is used. Both Random Way Point and Manhattan mobility model are used for the experiment. The impact of accident on the performance of network is checked using the accident event. Also the transmission range is varied to check the performance.

Parameter	Value
Map	Mumbai (August Kranti Ground Area), Mohali (Mohali Tahsil office Area)
Protocol	DSDV
Number of Nodes	10, 20, 30, 40, 50, 100, 150, 200, 250, 300
Simulation Time	2500 seconds
Traffic Type	CBR
Routing protocol	AODV
Transmission Range	2600 m
Mobility Model	Random Waypoint, Manhattan
Simulation area	10000 m*10000 m
Node Speed	max 22.22 m/s (80 km/hr)
Delay Time	00 sec
Interface Type	Queue
Mac Protocol	IEEE 802.11p and IEEE 1609.4 DSRC/WAVE
Packet Size	512 MB
Queue length	50
Radio Propagation Model	Two-Ray Interference model
Obstacle Model	simple obstacle shadowing model
Accident count	0, 1

Table 2.1. DSDV performance in Mumbai Road Map while varying accident event

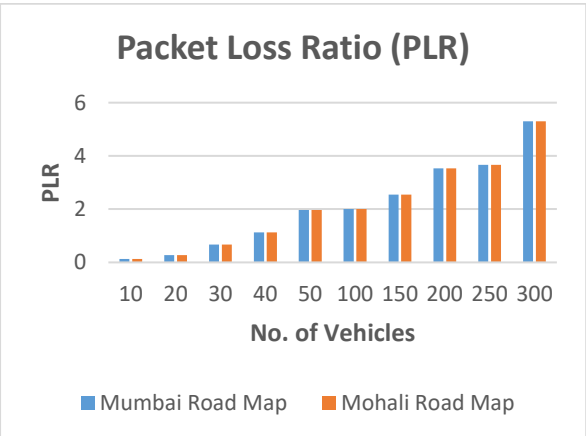
No. of Nodes	Without Accident				With Accident			
	Packet Loss Ratio (PLR)	Packet Delivery Ratio (PDR)	Average End to End Delay (ms)	Average Throughput	Packet Loss Ratio (PLR)	Packet Delivery Ratio (PDR)	Average End to End Delay (ms)	Average Throughput
10	0.125	1.000	26.000	0.003	0.375	4.000	32.625	0.008
20	0.278	4.000	25.000	0.008	0.667	4.667	27.000	0.008
30	0.667	4.667	21.000	0.015	0.944	7.389	26.500	0.008
40	1.125	8.600	14.875	0.005	1.500	8.500	11.857	0.008
50	1.967	9.727	12.667	0.003	2.571	9.571	11.143	0.004
100	2	10.283	12.200	0.001	3.371	11.314	10.778	0.003
150	2.545	10.667	8.367	0.006	4.526	12.211	8.895	0.003
200	3.533	16.375	7.267	0.010	3.714	15.014	5.457	0.003
250	3.667	16.400	6.879	0.008	5.733	17.167	3.967	0.002
300	5.3	18.333	2.389	0.005	5.757	17.714	3.814	0.002

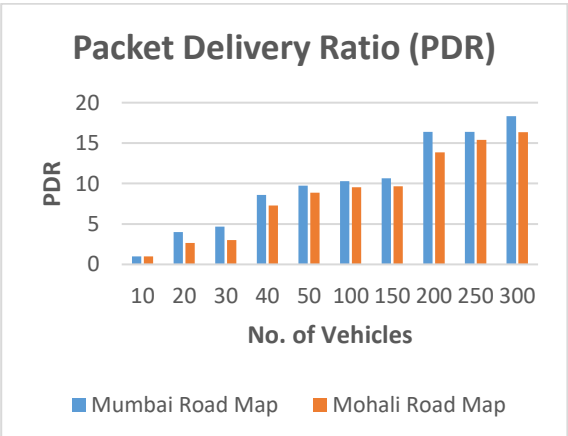
Table 2.2. DSDV performance in Mohali Road Map while varying accident event

No. of Nodes	Without Accident				With Accident			
	Packet Loss Ratio (PLR)	Packet Delivery Ratio (PDR)	Average End to End Delay (ms)	Average Through put	Packet Loss Ratio (PLR)	Packet Delivery Ratio (PDR)	Average End to End Delay (ms)	Average Throughput
10	0.125	1	24	0.003	0.250	3.500	30.375	0.011
20	0.278	2.667	22.667	0.009	0.333	4.667	21.500	0.010
30	0.667	3	16	0.016	0.833	6.278	20.333	0.010
40	1.125	7.267	12.75	0.006	1.000	7.500	10.429	0.009
50	1.967	8.879	11.333	0.003	2.143	8.143	9.667	0.004
100	2	9.55	10.7	0.001	2.771	10.743	8.368	0.004
150	2.545	9.667	7.733	0.007	3.429	11.158	8.286	0.004
200	3.533	13.875	6.267	0.013	4.421	14.714	4.886	0.003
250	3.667	15.4	5.97	0.009	5.400	14.857	3.633	0.003
300	5.3	16.333	2.111	0.006	5.671	16.833	3.529	0.003

Results can be discussed using the graphs generated (shown in Chart 1 and Chart 2) using the readings obtained from experiments (Table 2.1 and 2.2)

RESULTS AND ANALYSIS





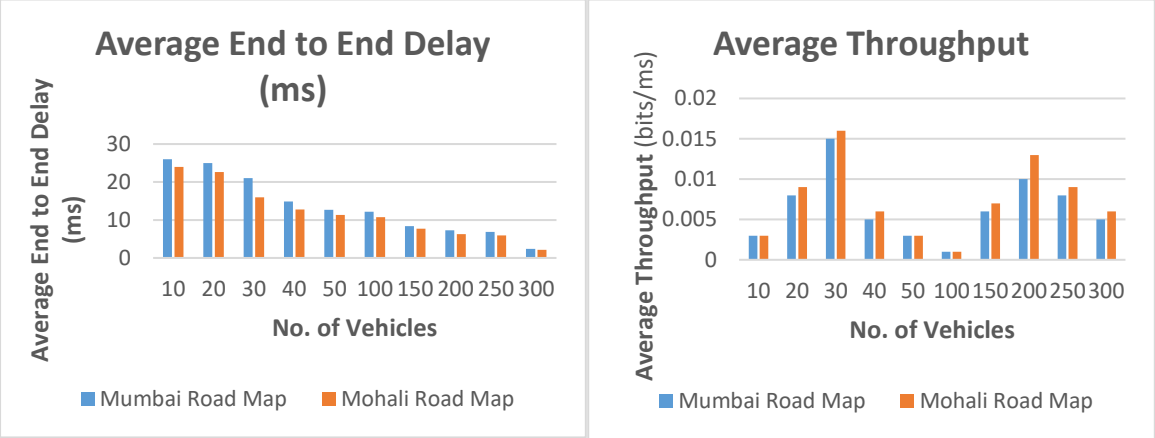
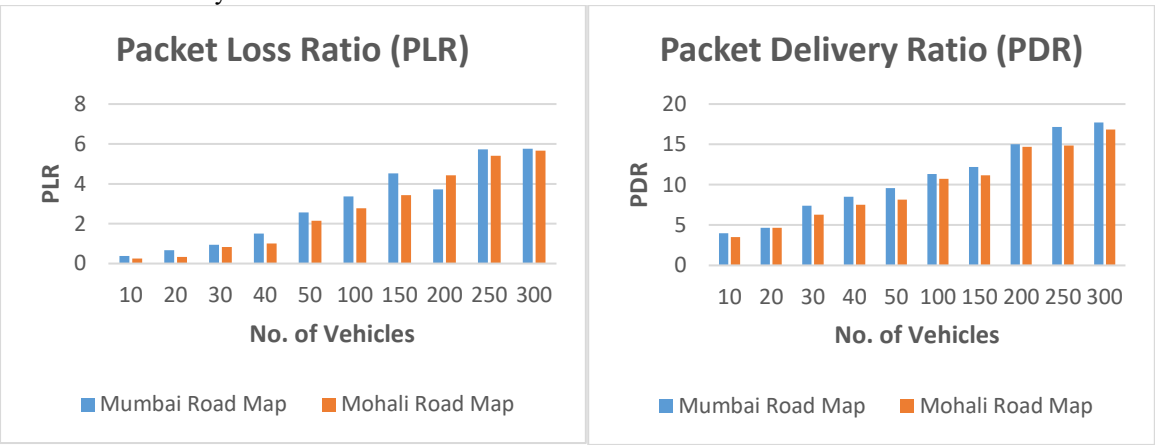


Chart 1. Graphs for Packet Loss Ratio (PLR), Packet Delivery Ratio (PDR), Average End to End delay and Average Throughput without accident event.

Chart 1 show that the packet loss ratio (PLR) and packet delivery ratio (PDR) increases with increasing number of vehicles without accident event. Whereas, the end to end delay decrease as number of vehicles increase. Average throughput is better when the number of vehicles is up to 200, after it degrades the performance in case of average throughput without accident event.



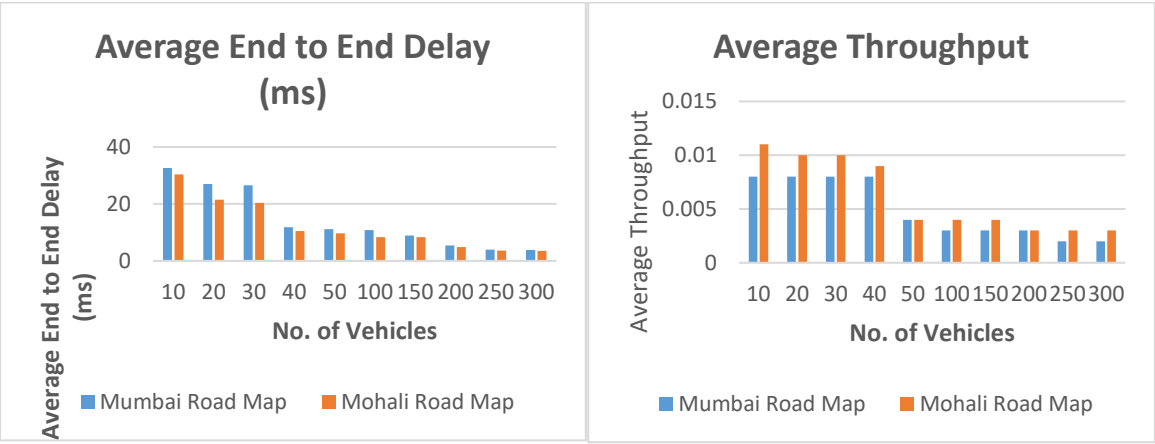


Chart 2. Graphs for Packet Loss Ratio (PLR), Packet Delivery Ratio (PDR), Average End to End delay and Average Throughput with accident event.

As depicted in Chart 2, the packet loss ratio (PLR) and packet delivery ratio (PDR) increase as the number of vehicles involved in accident events rises. Conversely, the average end-to-end delay and average throughput decrease as the vehicle count grows. Furthermore, when comparing Mumbai VANET to Mohali VANET,

we observe that the PLR, PDR, and average end-to-end delay are higher in Mumbai VANET. In contrast, the average throughput is greater in Mumbai VANET compared to Mohali VANET.

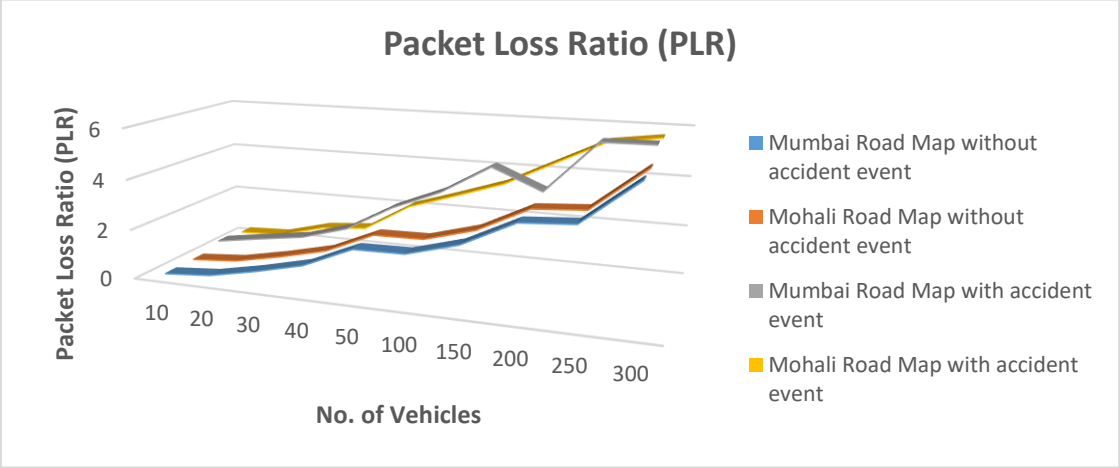


Chart 3. Comparison Graph for Packet Loss Ratio (PLR) in all scenarios.

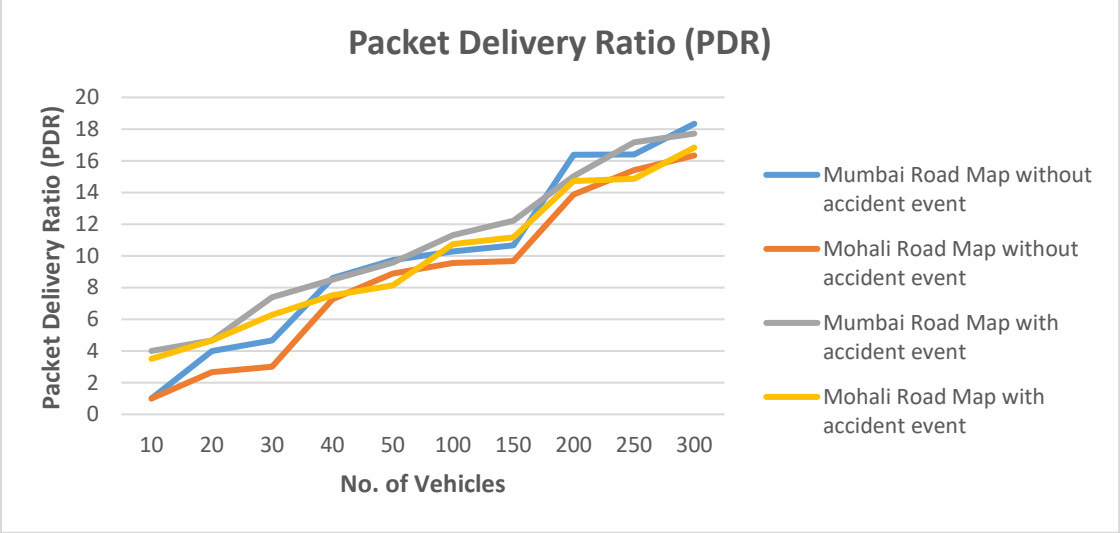


Chart 4. Comparison Graph for Packet Delivery Ratio (PDR) in all scenarios.

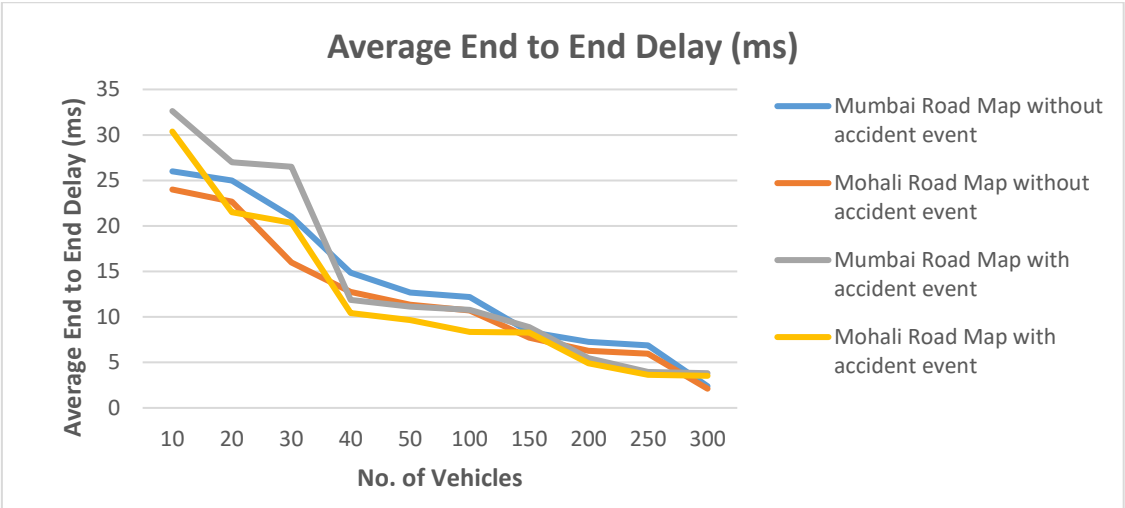


Chart 5. Comparison Graph for Average End to End Delay in all scenarios.

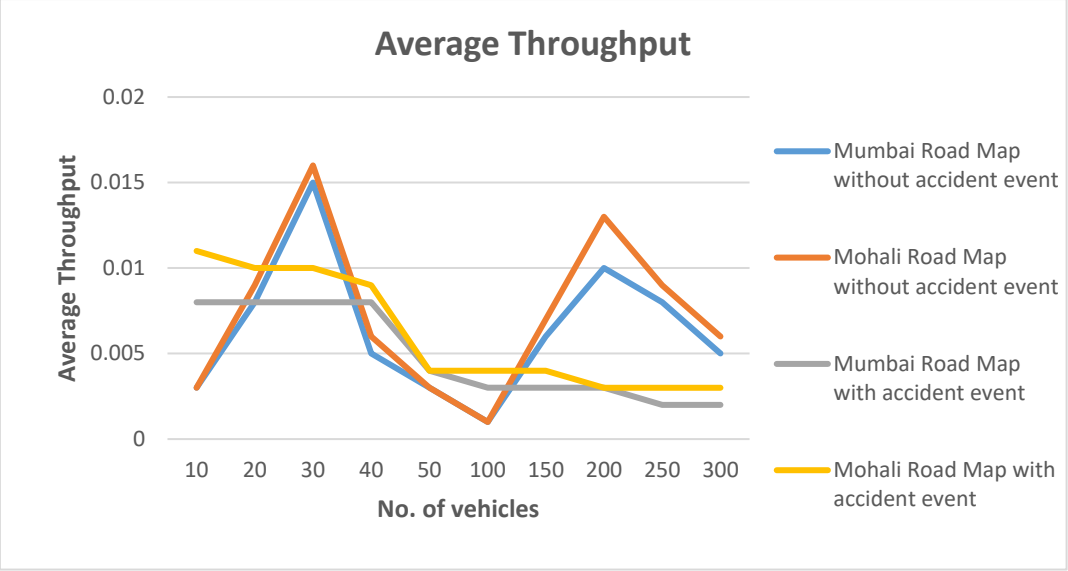


Chart 6. Comparison Graph for Average Throughput in all scenarios.

DISCUSSION

Packet loss ratios (PLR) are same in both mobility models and their values increases as no. of vehicles increases. Packet delivery ratios (PDR) increases as no of vehicles increases and their values are better in Mumbai Road Map network (RWP mobility model) than that of in Mohali Road Map network (Manhattan Grid Mobility). Average end to end delay and average throughput decrease as no. of vehicles grows. Average throughput has larger value than that of in case of Mohali Road Map network.

When we compare all the scenarios results, it can be said that packet loss ratio (PLR) and average end to end delay have minimum value in Mohali road map network without accident event. Packet delivery ratio (PDR) is better in Mumbai road map network without accident event. Mohali road map network without accident event gives the highest value of average throughput.

CONCLUSION

In this paper, for the simulation experiment, four different road scenarios were taken into account namely: Mumbai Road Map (RWP) without accident event, Mumbai Road Map (RWP) with accident event, Mohali Road Map (Manhattan Grid) without accident event and Mohali Road Map (Manhattan Grid) with accident event.

The packet loss ratio (PLR) has minimum value in RWP mobility model without accident event. When the accident event is taken in account, the RWP model has average minimum value than that of in case of Manhattan Grid model.

The packet delivery ratio (PDR) is greater in case of RWP model with accident event than rest of three scenarios.

The average end to end delay is considerably larger in RWP model with accident event scenario as compared to other three scenarios.

The value of average throughput is larger in case of Manhattan Grid mobility model without accident event than rest of other scenarios.

The experimental results and discussion shows that DSDV protocol gives the better performance in terms of average throughput for the limited no. of vehicles (for the area 10KM X 10KM up to 100 vehicles). The DSDV protocol is useful when there is need to decrease the value of the end to end delay.

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IJCRT
ISSN 2454-7719
International Journal of Computer Research & Technology
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-13

Image processing techniques for satellite image analysis for historical map classification - a review

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Abstract:- *Historical map classification has become an important application in today's scenario of ever-changing boundaries. Historical map changes include boundary changes cities/states, vegetation areas, water bodies, etc. Detecting changes in these areas is mostly during satellite images. Thus, extensive knowledge of satellite image processing is essential in historical map classification applications. A detailed analysis of the benefits and This article discusses the shortcomings of many satellite imaging methods. Although several calculation methods are available, different methods work differently on different satellites image processing applications. The wrong choice of methods leads to worse results in certain ways application This work introduces satellite imaging methods and appropriate methods with these applications. In this work, several comparative analyzes are also made, which show applicability of multiple methods. This work will help support the selection of innovative solutions various problems related to satellite image processing applications.*

Keywords:-

Remote sensing, change detection, feature extraction, segmentation, and classification are some related keywords.

1] INTRODUCTION

Combining historical map classification and satellite images is a new attempt to detect The ever-changing land/water features of the Earth. Satellite images taken over a period of time Used to detect an increase/decrease in area in a given area. This information In addition, they are used to produce accurate maps for all practical applications. Processing of satellite images is one of the most important calculation methods that can be applied in the military, agriculture, prevention of natural disasters, identification of natural resources, etc. However, a satellite image processing is very difficult due to the large dimensions of satellite images.

Remote sensing images contain a large amount of information, and if the image quality is not good or if the image analysis does not use the optimal feature set, the effect of a remote sensing application using the technology may not be fully realized. Visual interpretation of remote sensing images uses various interpretation elements such as shape, tone, hue, texture, etc. Manual understanding is limited to analyzing one image at a time due to the complexity of interpreting multiple images. the explanation of the guide is subjective and the visual classification time depends mainly on the quality of the image

The remote sensing method is considered a compatible tool in many applications because the images can cover a large area. The usefulness of satellite images for remote sensing applications depends on the accuracy of the technology. A good idea how good image processing techniques can help you decide which application is the best choice. As technology advances, there is a demand for near-real-time monitoring and visual working images used by emergency services and the public as natural disasters become more frequent. . Recent developments in Earth observation satellites are accelerating their use in such applications. Therefore, methods are developed for the effective use of available information so that the best possible questions with revenue potential are available to save services and decision makers in a timely manner.

Several methods have already been studied for efficient processing of satellite images. However, There are many ways to improve the performance of a traditional system.The methods also have advantages and disadvantages which helps develop new solutions to the current challenges of the satellite industry graphics. The paper reminder is organized as follows - Part 2 paints a different picture remote sensing processing techniques, Section 3 explains various performance evaluation metrics image processing, Section 4 provides a brief overview of the research and Section 5 concludes. Several methods have already been studied for efficient processing of satellite images. However, there are many ways to improve the performance of a traditional system. A detailed understanding of traditional methods is very necessary to develop new automation systems for processing satellite images. This work presents a comprehensive overview of this topic from different perspectives/applications of satellite image processing. The methods also have advantages and disadvantages, which helps to develop new solutions to the current challenges of satellite graphics. The presentation reminder is organized as follows - Section 2 paints various remote sensing image processing techniques, Section 3 explains various image processing performance evaluation metrics, Section 4 provides a brief overview of the study, and Section 5 presents the conclusions.

2] IMAGE PROCESSING IN REMOTE SENSING

There are many methods and algorithms for processing satellite images. Satellite

Image processing methods covered are enhancement, feature extraction, segmentation, fusion,

change detection, compression, classification and feature detection shown in Fig

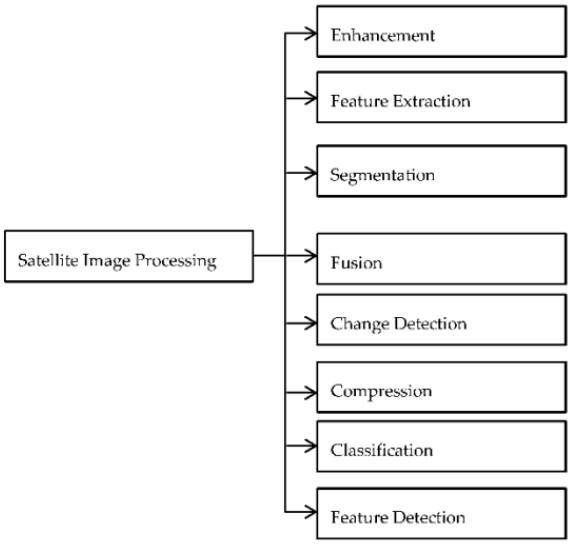

Figure 1. Image processing framework.

3] PERFORMANCE ANALYSIS

Quantitative and qualitative evaluation are available to analyze different performance methods. Different outcome measures are calculated and compared with existing evaluation methods performance improvement. Some calculated parameters are explained in detail which includes Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Feature Similarity Index (FSIM) and structural similarity(parallel) index (SSIM). PSNR finds the final image quality. Equation (1) calculates the PSNR as follows:

PSNR finds the final image quality. Equation (1) calculates the PSNR as follows:

$PSNR=\log_{10}(255*255/MSF)$,
(1)

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}[I(i,j) - I'(i,j)]^2,$$

(2)

where I(i,j) is the original image and I 0 (i,j) represent the threshold image. PSNR and MSE are mostly used to analyze the quality of the compressed and reconstructed image. SSIM measures structure

similarity between the source and final image, while FSIM measures similarity source and final image. There are two properties that can be seen in FSIM. These are phase matching and the magnitude of the gradient. Phase compatibility (PC) is a dimensionless quantity that is important local texture map and is the main feature of FSIM. A computer is a contrast invariant without a contrast information about the human visual system. Gradient Magnitude (GM) is another important feature of FSIM. Computer and GM complement each other by describing the local quality of an image. It was calculated using equation (3) as

$$FSIM = \frac{\sum_{x \in X} S_L(x) PC_m(x)}{\sum_{x \in X} PC_m(x)} \quad (3)$$

where x represents the entire image, SL(x) represents the similarity between the two images, and PCm is phase compatibility map. SSIM is calculated using equation (4):

$$SSIM = \frac{(2\mu_x\mu_y + C_1)(2\sigma_{xy} + C_2)}{(\mu_x^2 + \mu_y^2 + C_1)(\sigma_x^2 + \sigma_y^2 + C_2)}, \quad (4)$$

where μx and μy represents the sample means of x and y, respectively; σx and σy give the sample variances of x and y, respectively; and σxy describes the sample correlation coefficient between x and y and x and y are local windows in the input images. SSIM and FSIM values vary between 0 and 1 with a value 1 representing best similarity. These values can analyze the extend by which the image has recovered after the image is distorted. Following are the performance measures for classification problem with number of correct and incorrect predictions tabulated in terms of count values divided for each classes. A matrix based representation called the confusion matrix is developed and it can be used to analyze the performance of the classifier. Confusion matrix gives the performance of classifier with respect to a test data. It is awhere μx and μy represents the sample means of x and y, respectively; σx and σy give the sample variances of x and y, respectively; and σxy describes the sample correlation coefficient between x and y and x and y are local windows in the input images. SSIM and FSIM values vary between 0 and 1 with a value 1 representing best similarity. These values can analyze the extend by which the image has recovered after the image is distorted. Following are the performance measures for classification problem with number of correct and incorrect predictions tabulated in terms of count values divided for each classes. A matrix based representation called the confusion matrix is developed and it can be used to analyze the performance of the classifier. Confusion matrix gives the performance of classifier with respect to a test data. It is a

an array indexed by the actual class of the object in one dimension and by the class in the other were classified [86]. This provides a correlation between the observed and predicted values of the classification. With this matrix, it is possible to find out if categories and predictions have been entered incorrectly are correct or not [87]. When arranged in a matrix format, the correct predictions are given on the home page on the diagonal, while incorrect predictions are off the diagonal. This makes control easier where predictions are wrong. The four main error metrics calculated by the matrix are true Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN). The real positive is when the sample is correctly classified as positive, TN is when the sample is correctly classified as negative, FP or false positive is when a sample is misclassified as positive and FN or false negative when a sample is misclassified as negative [88]. Consider an example of a confusion matrix to the multiclass categorization trouble. Here the watershed land cover changes Data obtained with Landsat 7 ETM images from 2007 and 2018 are presented in reference [89]. The matrix is developed for a land cover change detection problem with six different land cover classes namely forest, body of water, countryside, meadow, open land and city. Assume that we need to estimate the number of pixels correctly and incorrectly classified in each category. In the classification of 1470 pixels, the water body is correctly classified for 60 pixels, the forest is correctly classified For 20 pixels, farmland is correctly classified for 20 pixels, grassland is correctly classified 290 pixels, urban area is correctly classified with 90 pixels and bad areas are correctly classified 750 pixels. The remaining pixels are misclassified and account for the classification errors related to land cover classification accuracy. For water bodies, the TP includes cases if a body of water is correctly classified as a body of water, TN includes cases where all other categories are correct classified,

FP covers cases where all other classes are misclassified as bodies of water and FN covers in cases where the water body is incorrectly classified into other categories

Table 7. Confusion matrix example.

	Actual Class						
	Water	**Forest**	**Agriculture**	**Grass**	**Urban**	**Bareland**	**Total**
Water	60	0	0	0	0	0	60
Forest	0	20	0	0	0	0	20
Agriculture	0	0	20	0	0	0	20
Grass	30	0	10	290	10	0	340
Urban	0	0	0	0	90	0	90
Bareland	10	20	60	50	50	750	940
Total	100	40	90	340	150	750	1470

The total accuracy is obtained by dividing the total number of correct pixels (diagonal elements). in the matrix) with the total number of pixels in the confusion matrix. Compare the two classified data The observed results and frequencies in the confusion matrix are assumed to be multinomially distributed with the completely random nature of the confusion matrix elements [90]. Availability of the actual data reference, the randomness within fails. If reference information is found in a column and this information is considered true, elements belonging to certain types may be correct are classified or mixed with other types and are in the same column but never different columns A multinomial coincidence is not possible at all. For that, quality control A column set (QCCS) was developed. The main advantage is that it allows you to declare quality requirements for each class and test whether they are satisfied [91]. There is also precision, recall, precision and F-measure derived from the confusion matrix [92]. Accuracy is measured as the ratio correctly predicted observations as a whole. This is an effective parameter mainly when the data set is symmetric. remember is the number of positive class predictions of all positive examples in the database.

In an unbalanced classification problem with only two classes, recall is a ratio of the number from true positives to total true positives and false negatives. In an unbalanced classification A multi-class problem, the recall is calculated as the ratio of true positive sums for all classes to the sum of true positives and false negatives for all classes. Its value varies between 0 and 1 the best value is considered to be 1. Accuracy is a measure of the number of positive class predictions that actually belong positive class. For a two-class unbalanced classification problem, accuracy is a ratio true positives and true positives and false positives. For the unbalanced A multi-class classification problem, the accuracy is calculated as the true sum ratio positives in all classes to the sum of true and false positives in all classes. In the year unbalanced classification, the distribution of information between known classes is biased. It's very predictive modeling is difficult because most machine learning methods are developed together assuming an equal number of data in each class. Thus, an unbalanced classification is a problem if there is an uneven distribution of classes in the educational data. Many real-life classification problems Spam and fraud detection involves unbalanced distribution. Equations 5 and 6 represent Recall and correctness, respectively.

$$\text{Recall} = \frac{TP}{TP + FN},$$

(5)

$$\text{Precision} = \frac{TP}{TP + FP},$$

(6)

where TP or true positive is when the sample is correctly classified as positive, FP or false positive is if the sample is classified as false positive and FN or false negative is if the sample is incorrectly classified as -ve. F-measure is a parameter that determines the resolution of an image. Equation (7) calculates the F-measure as follows:

$$F\_measure = \frac{2.\text{Precision}.\text{Recall}}{\text{Precision} + \text{Recall}}.$$

(7)

High performance value and accuracy ensure a high F-Measure. Precision, recall and F measure are mainly suitable for pattern recognition and classification. The importance of the confusion matrix is that it can show the mistakes made classifier The ROC or Receiver Operating Characteristic curve is a chart describing the rating presentation Area under the curve (AUC) is a measure of the two-dimensional area under the ROC curve ROC is plotted between true positive rate (TPR) and false positive rate (FPR). TPR is a relationship of positive samples considered true positive, w.r.t. all positive samples. FPR is the ratio of negative samples to negative samples misclassified as positive. Areas of AUC ranges from 0 to 1, and closer to 1, the better the

classification performance. Similar to ROC curve is a precision-recall curve centered on minority class performance. It can analyzing a single classifier, but comparing classifiers is difficult. Precision-Recall AUC can also be is calculated and is useful for unbalanced classification.

4] DISCUSSION

Remote sensing data includes spatial, spectral and temporal resolution. Spectral statistics It is widely used in remote sensing image classification. The most important aspect of ground accuracy object is the spatial resolution. Temporal resolution helps create land cover maps for the environment planning, land change detection, urban planning etc. Image enhancement improves image quality and information content before further processing is fulfilled. Some of the more commonly used techniques include contrast enhancement, spatial filtering and etc. Linear contrast enhancement is best used for Gaussian remote sensing images or quasi-Gaussian histograms, where all brightness values are typically in one band histogram area. But the situation appears mainly in scenes with large land and water bodies Non-linear contrast enhancements can be applied to low-contrast images, from which in the histogram debugging is a visible technique. Non-fusion-based enhancement provides little spatial information but computationally complex. To overcome the limitations of high complexity, fusion is based enhancement is used.

Pixel-based feature extraction methods are used to extract low-level features that do not takes into account information about spatial relationships. Low-level features are extracted directly from raw, noisy pixels, and edge detection is the most commonly used algorithm. Object-oriented approaches are used to obtain high-level features that represent shapes in images viewed independently of lighting, translation, orientation and scale. High level features are extracted depending on low-level feature information. Advanced function decompression is mainly used for automatic object detection and extraction. Depending on the condition resolution of the source image, different segmentation algorithms are used. Low to medium high-resolution images, clustering algorithms are a better choice, but for high-resolution images multi-resolution segmentation gives better results. Image of high spatial resolution, detailed geometry features are easy to identify, while multispectral images contain richer spectral information. Image properties can be improved when both high spatial and spectral properties are of interest resolution can be integrated into a single image. Thus, the detailed properties of such an integrated image is easy to detect and useful for many applications such as urban and environmental studies.

When detecting changes, it is difficult to find an appropriate method to search for changes what happened Several factors influence the selection of an appropriate technique for change detection such as physical properties of objects changing over time, misregistration of images, effect of cloud/fog and so on and it is quite difficult to find one method in nature the problem is to determine the most appropriate Techniques such as image extraction and image the relationship can only be used when changing and non-changing information is needed. As a detailed matrix is needed, classification change detection is a good choice. Image categorization techniques, either pixel-based or object-based, are used to convert an image into a thematic map. Creation digital surface and terrain models (DSM/DTM) from satellite imagery have become commonplace method for analyzing the structure and development of vegetation and geomorphological landforms.

Recently, image processing using quantum computing is also called quantum image processing (QIP) and applying machine learning through quantum computing or quantum learning (QL). provided a new perspective for large-scale image processing. QIP uses quantum properties encode images to improve certain features such as image, storage and time efficiency circulation Thus, quantum algorithms are widely extended to improve digital or traditional algorithms image processing applications and tasks.

5] CONCLUSIONS

This study provides a detailed overview of image processing techniques for satellite image analysis was presented This work tries to give an idea about the importance of image processing techniques in remote monitor application. Roadmap of various image processing research activities steps are explained for remote monitoring applications. From birth technology and constant availability of satellite images, the topic is image processing in remote sensing growing interest. The survey explores and highlights various image processing techniques compensation and limits of these method. In addition,

different techniques applications are discussed and performance indicators are explained. Low satellite contrast images, wrong choice of image segmentation threshold, wrong interpretation of image pixels part of change detection are some image processing challenges. Complexity of satellites image still presents difficulties in real classification applications and can be solved by participation computationally intelligent paradigms such as machine learning. In the current scenario, machine learning is an emerging field of research that enables effective data-driven decision making and learning and act sharply. The quality of the input image and the complexity of the image features are some factors that influence the decision of which image processing technique to use. There are studies is currently extended to hybridized image processing techniques to improve image robustness existing techniques. Future work may be extended to apply the techniques described in different practical aspects of remote sensing and extending the implementation of quantum algorithms for remote use identification applications.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS- 14

India's First Autonomous Anti-Drone System: Indrajaal

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Abstract *In India over the past ten years, the usage of drones or unmanned aerial vehicles (UAVs) for both military and non-military reasons has expanded. In order to counter the dangers that UAVs offer, counterdrone technologies are also being developed. How successful are these anti-drone defenses? This brief examines this issue and makes recommendations for India to lessen the growing drone threat. This brief's objective is to demonstrate that any assessment of the effectiveness of anti-drone systems must take into account contemporary technologies like artificial intelligence (AI), cognitive GPS avoidance, and hardware sandboxing.*

Keywords— *counterdrone, anti-drone, system, drone*

.

INTRODUCTION

The nation's first autonomous drone defense dome, known as Indrajaal, has been planned and created by Grene Robotics. According to the company, an Indrajaal unit can automatically defend a 1000–2000 sq km region from threats like UAVs, incoming missiles, loitering bombs, and Low-RCS targets.

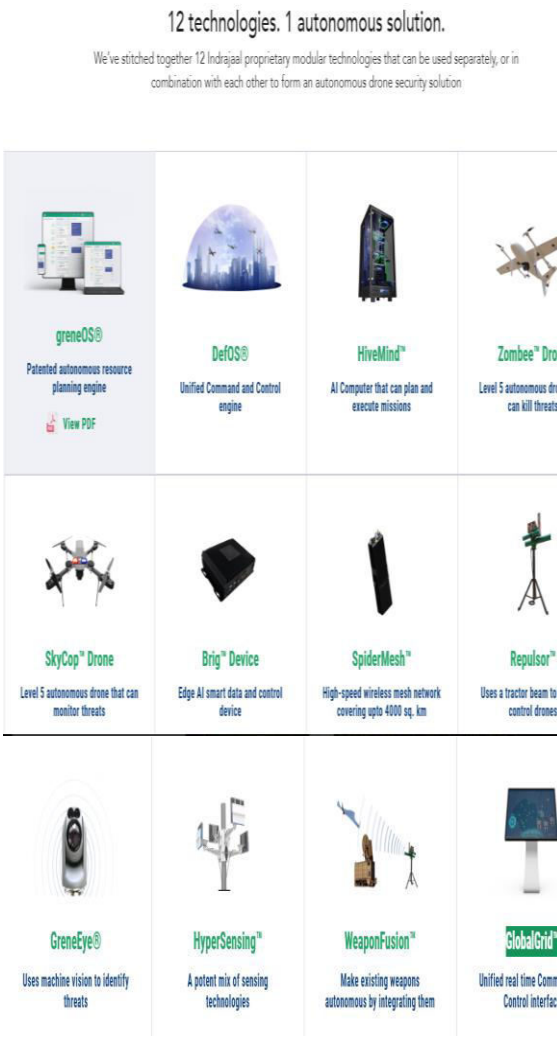
According to the company, manual weaponry and point-based defense systems are ineffective against modern warfare, which is driven by AI and robotics, hence the development of Indrajaal was crucial. Rogue forces have frequently and for the first time in India embraced cutting-edge technologies like UAVs, Smart Swarms, etc. According to a press release from Grene Robotics, on June 27th, Jammu Air Base was assaulted by such technology that dropped explosives adjacent to the Mi-17 hangar.

Additionally, huge defense bases, NCR, linear infrastructures, international boundaries, and other sensitive regions will not be able to be protected from threats like the PLA, which is already experimenting with cutting-edge weaponry, using point defense anti-UAV systems.

Working

Indrajaal's design principles are based on delivering such autonomy to the Defence Forces using a combination of 9–10 cutting-edge technologies powered by Artificial Intelligence, Cybersecurity, and Robotics that is capable of recognizing, evaluating, determining, substitute, and evolving autonomously in real-time. Autonomous Defense/Weapon Systems are the third revolution in warfare. Indrajaal is capable of fending off all such threats, whether they involve one or more UAVs, Low-RCS, loitering munitions, or any other combination of these. situational awareness in real time Mobile, Distributed, and Decentralized The ability to integrate with all current weaponry and infrastructure is a meshed, intelligent network. Integrated construction of a honeycombed cell structure using nine to ten different technologies **12technologies. For**

1 autonomous solution.



365 days a year persistent, independent, and monitoring

Indrajaal's main characteristics are:

- situational awareness in real time
- Mobile, Distributed, and Decentralized
- Mesh networks that are integrated and intelligent
- being able to combine with the whole arsenal and infrastructure of modern weaponry
- Integrated construction of a honeycombed cell structure using nine to ten different technologies
- 365 days a year persistent, independent, and monitoring

1) greneOS®

By building a digital twin of the organization and connecting all of its resources to it in real time, the cutting-edge platform greneOS® enables the platform to analyze data and make informed decisions about resource allocation, optimization, and utilization.

The platform's capacity to manage resources autonomously enables businesses to streamline processes, cut costs, and boost overall effectiveness. By using greneOS®, businesses can be confident that their resources are being handled as effectively and efficiently as possible, freeing up time and money to concentrate on other important parts of their operations.

2) DefOS®

A system called DefOS® is intended to integrate various disjointed command and control platforms. Unified Command and Control (UC2) is the name given to this kind of platform. The UC2 platform offers tools for data integration, analysis, and visualization, as well as a common dashboard or interface that enables users to monitor and manage numerous systems. Additionally, it is flexible and scalable, supporting a variety of applications and configurations.

3) HiveMind™

Modern supercomputer HiveMindTM acts as the command center for controlling and coordinating

numerous drones in real-time. It is a potent defense and security tool for drones, making it perfect for military, law enforcement, and other security-related applications.

4) Zombee™ Drone

A specialized drone called the ZombeeTM Drone is made to act like honeybees and defend its hive. A fly-and-die drone is the ZombeeTM Drone. It chases after hostile drones, collides with them, and destroys them.

5) SkyCop™ Drone

The SkyCopTM drone is an advanced unmanned aerial vehicle created expressly to improve airspace safety by identifying and reducing threats caused by unlicensed drones.

6) Brig™ Device

This cutting-edge tool acts as a "police force of the sky," capable of watching, recording, and stopping drones that might be dangerous to the airspace.

For effective and safe data processing and analysis on the edge, the BrigadierTM Edge Processor is a potent AI device. The BrigadierTM is called after the prestigious brigadier rank, which stands for power, leadership, and knowledge in the military.

7) SpiderMesh™

The way SpiderMeshTM functions is by building a mesh network—a collection of wireless nodes that can communicate with one another. Each node serves as a data relay, making it possible for messages to be sent between nodes even if they are not directly connected. This indicates that a large area can be covered by the network without the use of cables or other physical connections.Data transmission in parallel is one of SpiderMeshTM technology's primary benefits. This enables speedier communication and boosts overall network efficiency by permitting the simultaneous sending of many messages.

Additionally, the mesh network architecture offers redundancy, guaranteeing that data can still be transferred across alternative paths if one node fails or loses connection.

8) Repulsor™

Electromagnetic waves are used by the RepulsorTM technology, a form of defense mechanism, to obstruct or jam the signals of approaching drone threats. This method works by sending out a strong radio signal that hinders the drone's navigational capabilities and causes it to malfunction.

9) GreneEye®

GreneEye® is a cutting-edge technology that uses machine learning and machine vision algorithms to recognize and track drones and other interesting things. Real-time drone detection and tracking is made possible by this technology, which is particularly helpful when unlicensed drones represent a security risk.

10) HyperSensing™

A state-of-the-art detection system called HyperSensingTM technology was created to find drones in vast areas up to 100 square kilometers. To identify a variety of drones in practically any environment, it blends active RF technology like radar with passive RF technologies like ESM (Electronic Support Measures) and acoustic detection technologies.

11) WeaponFusion™

A state-of-the-art system called WeaponFusionTM technology combines various air space defense weapons into a seamless, intelligent network. The system may maximize these weapons' performance and react to threats with unmatched efficiency by linking them and enabling communication and coordination amongst them.

12) GlobalGrid™

A commander can easily comprehend the organization's present position and resources using the GlobalGridTM system, and they can be followed in real-time as they travel and engage in activities. Users may quickly zoom in and out, move between different areas of interest, and access crucial data

like sensor readings and intelligence reports thanks to the system's extremely dynamic interface.

Additionally, the GlobalGridTM system gives commanders additional control capabilities that enable them to effectively manage their resources and quickly adapt to changing circumstances. The system provides a wide range of tools and functions, including the capacity to deploy and guide teams, command and operate weapons systems, watch over the movements of vehicles, and evaluate sensor data all in real-time.

Features of Indrajaal Anti Drone System

- Let's now discuss the characteristics of the Indrajaal drone defense dome. The following details the many characteristics of this drone defense dome system:
- The 1000–2000 square kilometer protection zone for the Indrajaal drone defense system.
- Additionally, the Indrajal drone defense system is constantly aware of its surroundings.
- A drone equipped with the Indrajal drone defense system has a weapons infrastructure built in.
- Together, the Indrajal drone defense system's more than ten technologies include a 24-hour tracking and monitoring system.
- The drone's construction is in the form of a honeycomb.
- An integrated network system is part of the Indrajal drone defense system.

Autonomous defence weapon system

The third revolution in warfare is the autonomous defense weapon system. The foundation of India's Indrajaals ideas is giving the armed forces autonomy. It would be accomplished by combining 9–10 technologies that are powered by robotics, cybersecurity, and artificial intelligence. It would then be able to identify, choose, evaluate, and change independently in real time. Future Prognostications:

Better than any 300 point defense anti-UAV system, the Indrajaal can offer seamless connectivity.

For the purpose of scaling up and putting the defense shield into use, Gene Robotics has provided simulated models to defense personnel.

"Indrajaal is capable of identifying, assessing, deciding, acting, and evolving autonomously in real-time, round-the-clock," stated executive director Gopi Reddy. Whether the danger

CONCLUSION

To sum up, each mechanism should be upgraded in terms of range and precision to track the drones with sophisticated stealth features, taking existing detecting technology performance and drone capabilities into consideration. Additionally, sensor fusion technology st improve cost effectiveness while making up for the shortcomings in each approach. Designers of anti-drone systems should create their own layouts for the detecting systems and then map those to the equipment that best satisfies their needs. The collaboration of designers and programmers may result in technical developments for the drone detecting system.

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International Journal of Computer Research & Technology
IJCRT
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-15

Patient Chief Complaints Keyterm Extraction using Text Pre-processing Techniques

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Abstract *— Significant improvements in natural language processing technologies have been made over the past decade. The study is currently being conducted to extract relevant keyterms from the patient chief complaints in Marathi. We obtained our data from a solitary, nonprofit, private hospitals from rural area of India's North Maharashtra Region. Data with respect to 3600 patient visits, between the years of 2020 and 2021 is collected from the hospitals.The efforts resulted in a collection of total 4000 text-free chief complaints .This article presents the study that focuses on the text pre-processing techniques developed in effective manner for extraction of relevant keyterms from the phrases according in the main complaints of the patients.This article presents the methodology and the results regarding this experimental works.*

Keywords — *NLP techniques, Extraction, Marathi , Pre-processing, keyterms*

INTRODUCTION

Text pre-processing is an essential and fundamental stage in Natural Language Processing before developing any model. In order to clear up ambiguity and inconsistencies from a raw text corpus that has been gathered from one or more sources, pre-processing is required [1]. In order to access precise and dependable data, a user must devise the most effective technique available. Even after cleaning, more text pre-processing is required to rearrange the data so that it may be immediately entered into the model. If text pre-processing is not done properly, the data will be as useful as useless, and the NLP model produced will only be as bad as useless. Many well-known languages have been the subject of research in the field of text processing. However, regional language text is now very necessary. In Maharashtra, where the Marathi language is somewhat less focused, this has been taken into account when analyzing the work for regional languages.This study was created to extract pertinent keyphrases from phrases in accordance with the patients' main concerns and it relies on text pre-processing approaches. The article that follows covers the methodology, findings, and literature review.

Literature Survey

S.P. Paramesh [2] asserts that the description data for IT tickets needs to be cleaned up in order to improve outcomes. To omit terms from the text, the author used POS tagging, stemming, and the list of common English stopwords. Porter's stemmer has reduced the word to its most basic form. Phone numbers and email addresses are also removed from the dataset using pattern matching regex methods to produce better results.Shreedhara K.S. eliminated noisy data in order to. Effective text preparation has been emphasized by [4]. Stopwords are removed together with date, time, and numeric data using regular expressions, which are

helpful for pattern matching. The author has used random oversampling and undersampling techniques to balance the uneven data. From feature extraction to feature selection, Judith D. Trippe [6] demonstrated how text pretreatment significantly affects all processes in the final stages of natural language processing. The author makes use of stemming, filtering, and tokenization.Ranjan Satapathy has published two models for the microtext language that is most frequently used on social media sites like twitter [8]. A few examples of contractions that are normalized using the lexical and phonetic models include "Btw," "wrt," "lol," and "2morrow." The author concludes that sentiment analysis in these contractions can be accurately detected utilizing the aforementioned models plus a polarity classifier to determine the intent as being positive or negative.N. Vasunthira Devi[5] discussed the restrictions and applicability of NLP approaches used in healthcare and education. In order to help students develop their talents, educational institutions can benefit from eloquent grammar and corpora. The inability to access medical records, on the other hand, is a challenge for healthcare systems.By training classification models on two separate datasets, one that had been preprocessed and the other that hadn't, Feras Al-Hawari and Hala Barham [3] compared the prediction accuracy of the models. The experiment showed that with preprocessed and cleaned description data, each of the four classification models had an accuracy improvement of around 20 to 30 percent. [7]Virat V. Giri, Dr. U.P. Kulkarni, and Dr. M.M. Math Readers can quickly and easily comprehend the content of original papers using the succinct summary provided by the summarization method without having to read each individual document. [9] Automatic text summarizing is a technique for reducing the length of the original text while keeping all of its information and meaning. [10] This essay is divided into three sections: a preliminary typology of summaries in general; a description of the SUMMARIST automatic multilingual text summarization system currently being developed at ISI; and a discussion of three approaches for evaluating summaries. Marathi text is automatically pre-processed for summarization in [11]. Sonali B. Kulkarni, Vaishali M. Kumbhakarna, and Apurva D. Dhawale Abstract: It is possible to condense a lengthy text into a shorter version using a process called text summarizing without losing any of the text's original meaning. Text summarization is often done on regional and common foreign languages, although there has been little work done on the Marathi language. Users are finding it tough to read newspaper articles with extraction of its various perspectives with sorting as the volume of e-contents on the web is dramatically growing. To summarize news that will be useful to students taking competitive tests, we are concentrating on educational, political, and sports news.[12] Text summary is a process that reduces the original lengthy text to a shorter version while preserving its general sense. Usually, the popular foreign and regional languages are used for text summaries, but the Marathi language has seen very little progress in this area. Users find it tough to read newspaper articles with the extraction of its various views with sorting as the volume of e-contents on the web is dramatically growing. We are concentrating on summarizing educational, political, and sporting news in order to assist students taking competitive exams.

For the majority of the frequently used natural languages, a number of automated text pre-processing methods are accessible.These text pre-processing techniques often only support English and other international languages. For Indian languages an automatic text pre-processing techniques are less .Various text pre-processing techniques by using NLP for Indian languages are discussed below:

Materials and Methods

This article includes a study that focuses on text pre-processing methods created in an efficient way for extracting pertinent keyphrases from phrases in accordance with the primary complaints of the patient.

1. Data Collection

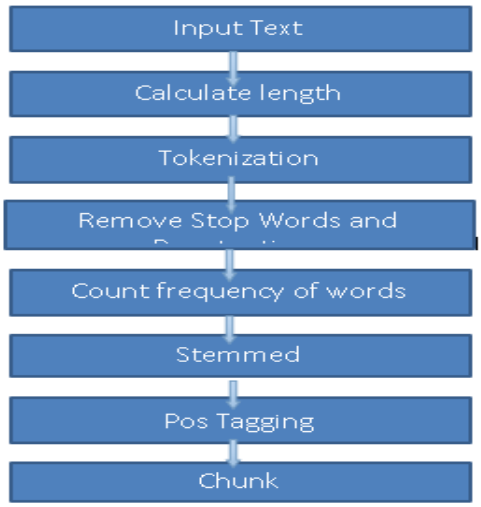
- **Setting** A single, private, and nonprofit hospital in rural (Dhule Dist.), North Maharashtra Region, India.
- **Participants** From 2020 to 2021, 3600 patient visits produced 4000 total text free chief complaints in Marathi language used for the validation dataset.
- In this article, we take a sample of 150 complaints out of 4000 total complaints in .csv.
- In this article, we make use of a patient symptoms database, which is 82.5 KB in size.

2. Pre-processing of Marathi Patient Chief Complaints

- In light of this, efforts to promote regional languages in Maharashtra, where the Marathi language is rather less prominent, have been

investigated. According to the research on this subject, there isn't a strong tool or method that efficiently describes Marathi material. Therefore, it must focus on Marathi text extraction. The text passes through pre-processing, one of the key steps for a successful output.

- Linguists classify Marathi as an Indo-Aryan language. The majority of this language's speakers are from Maharashtra. Marathi has a rich morphology, making it particularly challenging to extract the right keyphrases from a text.
- The following **fig.1. shows the pre-processing technique for Marathi patient chief complaint.**



Here we are installing Python Libraries **inltk** with version 3.4.5 which work with NLP & information extraction for our system. The python libraries are commonly used to get improved performance of the system. Import pandas, import re etc.We here create & load patient chief complaints file for preprocessing. For pattern matching use patient symptom databse file to extract keyterms of patient chief complaints. For pre-processing in the provided algorithm, we adhere to the system flow described above in fig.1. What are these terms, which are briefly explained here, before that.

1. After loading patient chief complaint database find the length of each sentence, length is calculated using 'len' function.

2. Tokenization is the following phase, in which the phrases are divided into tokens. Tokenization involves splitting the text, which may be done with Text. Split(), and sending the list of all the words to the following step:

3.The further step in pre-processing is to remove stop symbols in the tokenized document. Use Sample Marathi Stop words from https://www.kaggle.com/datasets/kmldas/indian-language-stopwords.Also remove punctuation symbols from text by .translate() method.

4. An empty array is constructed to store the count; to calculate this frequency count, use the get () method. A counter will then aid to obtain an accurate count of each word. We must count the frequency of each word since the irrelevant words, i.e.

5. Stemming: Consolidating a word's various spellings into one generic form is a process known as stemming. For instance, the phrases "presentation", "presented", and "presenting" are condensed to the word "present". For the same Google download, use Marathi Suffixes.

6. Stemming is the process of combining a word's many spellings into a single, generic version. For instance, the word "present" replaces the phrases "presentation," "presented," and "presenting." Use Marathi Suffixes to download the same file from Google.

7. Part-of-speech (POS) PosTagging The practice of categorizing words in a text (corpus) in accordance with a certain part of speech, depending on the word's definition and context, is known as tagging in natural language processing.

8. A strategy for organizing or memorizing information into manageable groups or chunks: In the study, a lot of participants employed the "chunking" technique to aid in memory.

3.Algorithm

Algorithm for pre-processing and extracting the number of keyterms occur in patient chief complaints

Input : Sample Patient Chief Complaints : 500 Complaints – In Marathi Input : Symptom database – 82.5 KB – In Marathi

Steps:

1.Open & read patient chief complaints file.

2. For each sentence apply pre-processing:

Use try:

Calculate length of sentence.
Apply tokenization.
Filtered the text.
Find frequency of each word in text.
Apply stemming to tokens.
Apply lemmatization to tokens.
Find Pos for text tokens.
Perform chunking.
Append this tokens to one list valid dataset of chief complaints.

Exceptions

Print exceptions

3.Open & read both files one as a symptom database file and second is valid dataset of chief complaints.

Presentkwl = set(symptom database)
For each sentence in valid chief complaints:
For each word in sentence:
If word in symptom database
Presentkwl.add(word)

Else

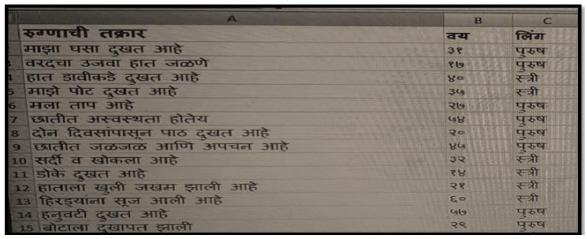
Filteredlist.append(word)

4. Print Presentkwl in .csv format.
5. Stop.

4. Experimental Results

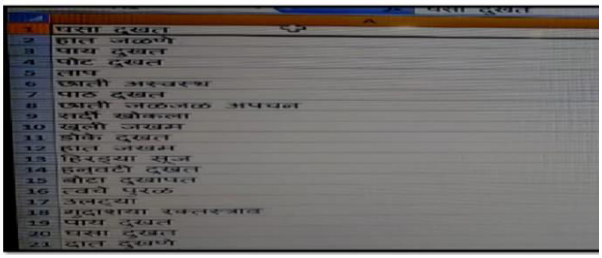
After processing data with the toolkit in Python, we receive the output as keyterms.

Input :Chief Complaint database .csv file



	A	B	C
1	रुग्णाची तक्रार	वय	लिंग
2	माझा घसा दुखत आहे	३१	पुरुष
3	खरदचा ऊजवा हात जळणे	१७	पुरुष
4	हात डावीकडे दुखत आहे	४०	स्त्री
5	माझे पोट दुखत आहे	३५	स्त्री
6	मला ताप आहे	२७	पुरुष
7	छातीत अस्वस्थता होतेय	५४	पुरुष
8	दोन दिवसांपासून पाठ दुखत आहे	२०	पुरुष
9	छातीत जळजळ आणि अपचन आहे	४५	पुरुष
10	सर्दी व खोकला आहे	३२	स्त्री
11	डोके दुखत आहे	१४	स्त्री
12	हाताला खूली जखम झाली आहे	२१	स्त्री
13	हिरड्याना सूज आली आहे	६०	स्त्री
14	हनुवटी दुखत आहे	५७	पुरुष
15	बोटाला दुखापत झाली	२९	पुरुष

Output:Keyterms / extracted keyterms



1	घसा दुखत
2	हात जळणे
3	पाय दुखत
4	पोट दुखत
5	ताप
6	छाती अपचन
7	पाठ दुखत
8	छाती जळजळ अपचन
9	सर्दी खोकला
10	खूली जखम
11	डोके दुखत
12	हात जखम
13	हिरड्या सूज
14	हनुवटी दुखत
15	बोटा दुखापत
16	दुखणे पुरळ
17	उलट्या
18	गुदाशय रक्तस्राव
19	पाय दुखत
20	घसा दुखत
21	हात दुखणे

In order to extract keyphrases, we use a sample of 150 chief complaints. Out of 150 complaints, we identified answers for 120 chief complaints, 10 of which were missing values, and 20 of which did not properly extract essential phrases.

5.Conclusion

It is necessary to concentrate key terms extraction on the regional language. In this study, Marathi, the native tongue of Maharashtra, is highlighted. The algorithm used to pre-process the Marathi text was effective since it changed depending on the language and pre-processing methods used. The study emphasizes the pre-processing carried out on the Marathi text to extract important phrases. First, the sample input file for patient complaints is opened and read. We then pre-process text to create legitimate tokens. We then compare the pattern of each sentence's valid tokens with databases of symptoms to extract key terms.We are developing a system that is considerably more powerful and efficient in order to extract medical key terms from Marathi text.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-16

Computer Assisted learning (CAL) in education: A Outline

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Abstract:- *Computer-assisted learning is our future. In computer-assisted learning, several educational problems to be solved are victimization of different tools to interact and improve the learning methods functionally. Computer-assisted learning was often utilized directly and indirectly in all fields of education, ranging from TV/DVD, audio-visual contents, interactive boards, and play-learn programs for preschool youngsters. CAL is developed by combining knowledge from all fields of education/learning, human-computer interaction (HCI), and psychological features.*
Classical education is replaced by virtual education and online classroom; distance education and exams are conducted online for rapid analysis. The use of visual content and software technology makes education more additional and interactive. Computer-assisted learning is the tutoring, learning, and interacting method expedited through the employment of computers. The main edge/advantage that CAL has over education strategies is additional interaction. Now use of CAL learning will attract students rapidly.

INTRODUCTION

CAL has often the use of the computer base application and technology for many circumstances. In the early days, CAL was used to replace traditional methods instead of software programs or series of programs. Computer Assisted learning can be defined in various subjects like Mathematics, Geography, History, Commerce, and Science through software programs, CD/DVDs, powerpoint presentations, Packages, etc. It can be include all type of computer Enhancement learning. "Computer Assisted Learning or Computer Aided Learning is defined as learning through computers with subject-wise learning packages/materials" ....Mifflin.

Types of Tools Used in CAL

Multiple Choice Questions: Mainly used for computer-based online tests, this exercise is used to assess a student's understanding and learning capabilities they have been taught. It is used for computer-based tests.

Computer base worksheet: It is used for understanding of whole lesson to ask some question that student answer these question.

Visual learning: using of some computer-based software such as YouTube lectures by animation, CD/DVD learning kits, PowerPoint presentations, LCD projectors, 2D and 3D video, etc. Visual learning makes it much more accurate for the learner, so they remember it much longer. Students can see a full concentration of videos rather than book reading.

Fill in the blanks: The student is required to type text in the blanks where some of the words are missing and to provide suitable words to solve the exercise. This type of test can be easily done within a few minutes and can be created with inexpensive software.

Crossword puzzles: Using crossword puzzles student improves their IQ for better learning and also remembers the word easily.

Games: - Educational games are more interactive and make interest in learning. Using the games more and more students are attracted to learning habits.

Google e-content: Using of Google Classroom room students search the e-content lectures that help in their difficult situations and better understand

Listening: - Computer replaced by tape recorders. Computer system attached with speakers or headphones. Students attentively listen to the recording playing on the computer.

Virtual class Rooms: - Some megacities of institutions create virtual classroom for better learning with a full concentration of students. In virtual classrooms some expertise person lectures can be organized to improve the learning power of students.

Internet search: Student can search for their topic by using their own language. On using the internet various content can be searched using search engines.

Simulation: Simulation offers flexibility and control. In simulation, the particular feature of the computer as a rapid calculating and data processing machine is used to its best advantage.

ADVANTAGES OF CAL

CAL provides several advantages to the education sector.

Self-Paced/ Self-Directed Learning: Since the students have control over the CAL process, they can decide on their pace of learning. Students will study as speedily or as slowly as they like through a course

- CAL is expensive other to traditional or ordinary learning.
- Computer learning is based on virtual reality so in some science subjects like Chemistry, biology, and physics students can miss hand experiments when they get to the laboratory.
- CAL require highly expert teacher but efficient and expert teacher are rare in our country.

CONCLUSION:-

CAL is efficient and more power-packed in now day as the fast growth of educational competition. Use of CAL students can easily understand the learning and it can be remembered for a long time. The use of audio-visual facilities can be better understood than traditional learning. Students can also learn about computer literacy by using computer tools. Using

Improved Computer Skill: Students interacting with computers, students who are not computer-literate will be compelled to develop/enhance their computer skills and it also gives them a sense of collaboration when one or a lot of students have to share a computer.

Visualization: A student becomes more alert when a computer-based learning/test is going on. Students are motivated visually by multimedia materials and listening is supported by seeing. It can boost students' natural way of learning.

Learning Efficiency: With CAL, students are better able to pick up ideas or skills faster and with less effort and also retain what they have learned longer.

Stimulation: Humans are multi-sensory beings as we are able to receive and proceed with information. "According to Fletcher (1990), people remember 20% of what they hear, 40% of what they have seen and heard and 75% of what they see, hear and do". Computers encourage learning as they promote enthusiasm and supply stimulating surroundings.

Crossword: - Using crossword it improves their vocabulary and learning capacity with fun.

Virtual classroom: Using the virtual classroom room students can learn without a teacher and can improve their learning capability.

DISADVANTAGES OF CAL

CAL cannot fulfill the student's expectations. The objective and teaching can be decided by the author and the teacher may differ.

kindergarten software and games children can easily remember and understand the learning than traditional learning.

Most of the country can use CAL in their educational institute such as EDUCOMP, kindergarten, software packages, CD/DVD to improve student ability in study.

Computer-aided education eases the process of learning. A life without computers would seem almost unimaginable for many individuals using computers daily. Traditional teaching methods and course contents have all been affected by the introduction of computer technology

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS- 17

Melanoma Skin Image Segmentation Using K-Means, and Thresholding Techniques

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Abstract:- *After preprocessing melanoma skin image, we are interested in finding region of interest (ROI), we can find region ofinterest after segmenting image. For segmentation purpose numerous techniques are available. But all techniques are not suitable for each modality. We have tested our modality with k-mean,and thresholding techniques. For study purpose we considered melanoma skin images for each technique and study their performance based on various performance matrices.*

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1.0 Introduction:-

After preprocessing of images and before extracting features of image it is necessary to find area of interest. And we can find area of interest only after doing proper segmentation of image. There are numerous techniques for segmentations. Segmentations used in many application areas including medical, designing, modeling etc. in medical image segmentation mostly k-mean and thresholding techniques are used. Also found from many research papers that these two methods of segmentations are considers in most research papers. In this paper we considered these two techniques for segmentation k-mean and thresholding. And study their performance based on various performance matrix include IoU, Dice Coefficient, f1 score and pixel accuracy.

2.0 Literature Review:-

Yuheng, consider k-mean technique for segmentation and find better result(Song Yuheng, 2017)Sulaiman discussed various techniques of segmentation and found thresholding better result as compare to other methods he considered. (Sulaiman S N, 2010) Zhou try to considered various technics and performance matrices for comparing various segmentation technics. (H. Zhou, 2018)Celebi study various techniques of segmentations and found thresholding better among others. (M. E. Celebi, 148-153). Zhou considered performance parameter and focus on performance metrics f1 score (H. Zhou G. S., 2009). Yuan worked on segmentation technics and conclude that k mean segmentation technique is better among all other techniques. (X. Yuan, 2009)

3.0 Methodology:-

For our experiment we consider database provided by ISIC challenging data base 2017. This data set provided about 2000 images. This data set also provides ground truth of segmentation.

Steps:-

1. Considered images provided by ISIC Challenging data set 2017.
2. Segment each image by k-Mean and thresholding.
3. Arrange them in tabular manner as original image, segmented image using k-mean and thresholding with their relative mask.

4. Check performance of each segmentation technique using performance matrices IOU, Dice Coefficient, pixel accuracy and F1 score.

3.1 Segmentation techniques:-

Image Segmentation: Segmentation is process in which image or picture is diveided in to parts.Purpose of image segmentation is to divide image into part which will be some how meaningful or understandable. Typically, employed to establish borders and/or locate things.

.K Means Algorithm:

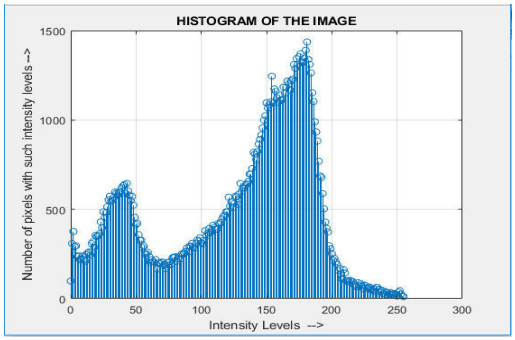
A clustering algorithm is IK Means. Note clustering methods are belongs to unsupervised, tagged data not available. How much data is similar, is use to identify several clusters within data provided. Data points belongs to same group easy to comparable to each another than belong to different groups.

Working of k-means algorithms –

1. Consider number of cluster you want to find that is k.
2. Data points are randomly assign to one of thek clusters.
3. Followed by it centrepoint of the clusters is calculated.
4. Calculate how far data point far is from centre that is distance from centre point.
5. Depending on each point distance, data point is reassign to the cluster nearest to it clusters.
6. Calculate again new centre of cluster.
7. Repeat steps 4 through 6 till no chance to change data points.

Thresholding Algorithm:-

One of the segmentation techniques called thresholding divides a given grayscale image into two zones according to a threshold value, producing a binary image from it. Binary images only use one bit to record pixel intensity because their pixels only have two possible values, 0 and 1.Therefore, in the output image, pixels with intensity levels more than the specified threshold will be classified as white, or 1, and those with lower values will be treated as black, or 0.



Assume that the histogram shown above represents the image f(x,y). One peak is near level 40, while the other is 180. There are therefore two main groups of pixels: one group is made up of pixels with a deeper shade, and the other group is made up of pixels with a lighter shade. Consequently, a background-set item of interest is possible. The entire image will be divided into two distinct parts if a suitable threshold value, such as 90, is used. In other words, the segmented image g(x,y) is calculated as follows if we have a threshold T:Thus, there are only two classes of pixels in the output segmented image: those with a value of 1 and those with a value of 0.

It is referred to as global thresholding if the threshold T remains constant throughout the entire image region. We define variable thresholding as T varying across the image region.

As if there were two distinct objects on a background, multiple-thresholding divides the image into three regions. In these situations, the histogram exhibits three peaks with two valleys in between. Two suitable thresholds, T1 and T2, which correspond to the three distinct intensity values a, b, and c, can be used to complete the segmented image.

The size and depth of the valleys separating the histogram modes are directly related to how well intensity thresholding works, as we can infer from the discussion above. The distance between peaks, the amount of noise present in the image, and the scale differences between the foreground and background are, in turn, the main variables influencing the characteristics of the valleys. The efficiency of thresholding and, by extension, image segmenting algorithms increases with the distance between the two peaks in the histogram. This widely separated two-peak histogram distribution is frequently degraded by noise in an image, which makes it challenging to threshold and segment accurately. When there is noise, it is appropriate to apply segmentation after using a filter to clean up the image.

3.2 Performance matrices:-

IoU:-We must first comprehend two crucial terms in order to calculate IoU: True Positive (TP) and False Positive (FP). True positive occurs when the model accurately predicts that a pixel is aobject's part when in fact it is. If the model predicts a pixel as belonging to object when in fact it belongs to background, this is known as a false positive.

When compared to the union of the two masks, the intersection of the predicted segmentation mask

and the ground truth mask is referred to as the IoU. The formula for calculating IoU is as follows:

IoU = TP / (TP + FP + FN)

where TP is the number of true positives, FP is the number of false positives, and FN is the number of false negatives.
$IoU=|A \cup B||A \cap B|$

Dice Coefficient:-
The Dice similarity coefficient of two sets A and B is expressed as:

$$dice(A,B) = 2 * | intersection(A,B) | / (| A | + | B |)$$

where $|A|$ represents the cardinal of set A.

The Dice index is related to the Jaccard index according to:

$$dice(A,B) = 2 * jaccard(A,B) / (1 + jaccard(A,B))$$

F1 score:-a harmonic mean with precision and memory. In other words, it is calculated by dividing the sum of the pixels in the two images by the intersection of 2 and the intersection. It should be noted that the F-score can be adjusted to favor recall over precision or vice versa. See the F-beta score for more details.

F1 score = 2TP / (2TP + FP + FN)

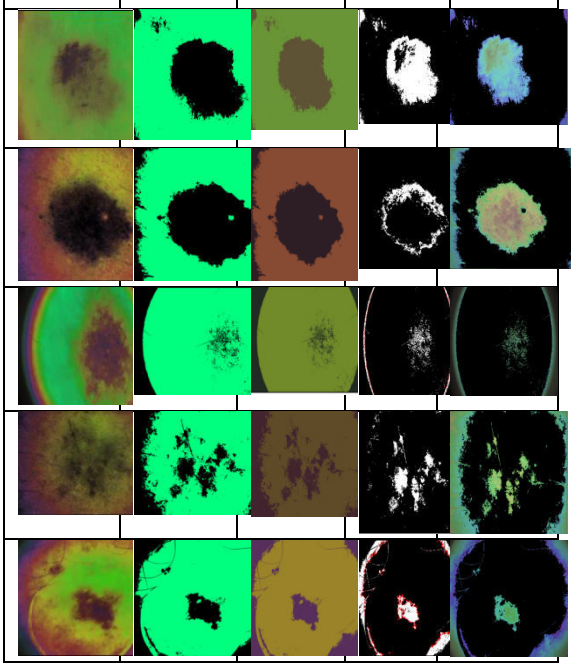
Pixel Accuracy :-

The percentage of correctly identified pixels in the image is measured by the semantic segmentation metric known as Pixel Accuracy (PA). The ratio of pixels that can be correctly identified to all of the pixels in the image is determined by this metric.

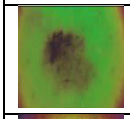
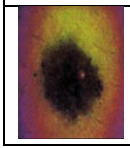
PA=∑=1^njj (j to k) / ∑ 1^tj (j to k)

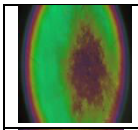
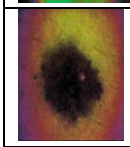
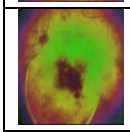
where nij represents the overall number of pixels both labeled and classified as belonging to class j. Njj is the total number of true positives for class j, to put it another way. The total number of pixels classified as class j is expressed as tj.

Image	KMean		Thresholding	
Original	Mask	Segmented	Mask	Segmented



4.0 Experimental Result:-

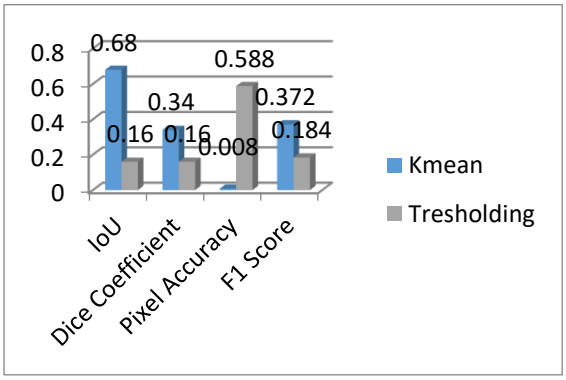
Image	KMean				Thresholding			
	IoU	Dice Coefficient	Pixel Accuracy	F1 Score	IoU	Dice Coefficient	Pixel Accuracy	F1 Score
	0.86	0.33	0.00	0.44	0.33	0.16	0.79	0.30
	0.81	0.44	0.01	0.46	0.28	0.28	0.68	0.32

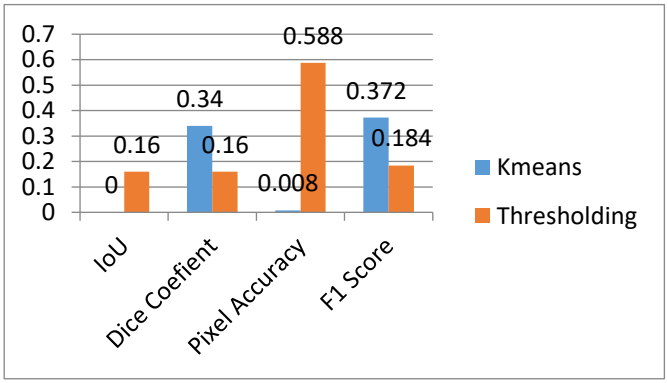
	0.77	0.35	0.02	0.45	0.01	0.05	0.77	0.05
	0.90	0.54	0.01	0.49	0.26	0.24	0.73	0.29
	0.92	0.37	0.00	0.46	0.23	0.23	0.76	0.26
Average	0.68	0.34	0.008	0.372	0.156	0.16	0.588	0.184

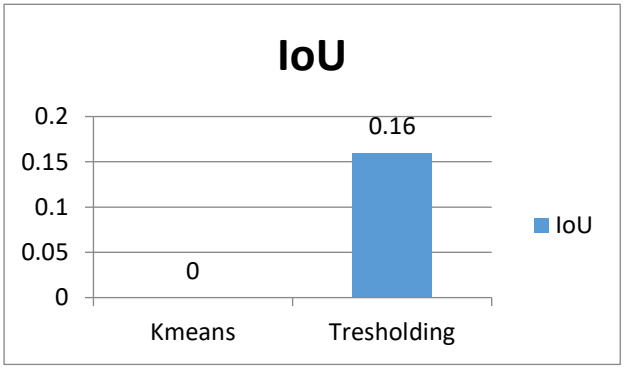
5.0 Discussion:-

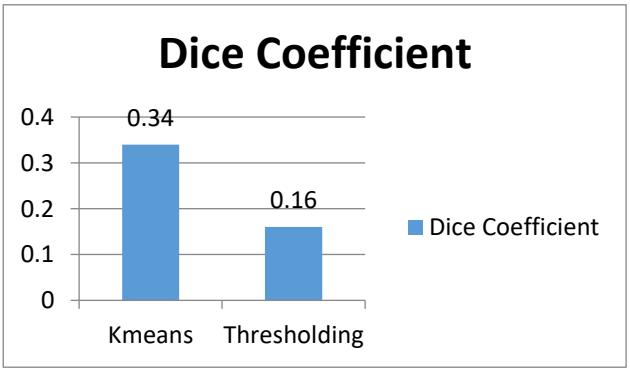
	IoU	Dice Coefficient	Pixel Accuracy	F1 Score
K-mean	0.68	0.34	0.008	0.372
Tresholding	0.16	0.16	0.588	0.184

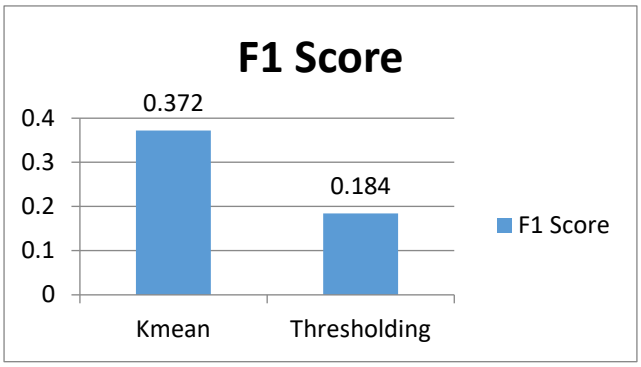
	Kmeans	Tresholding
IoU	0.68	0.16
Dice Coefficient	0.34	0.16
Pixel Accuracy	0.008	0.588
F1 Score	0.372	0.184

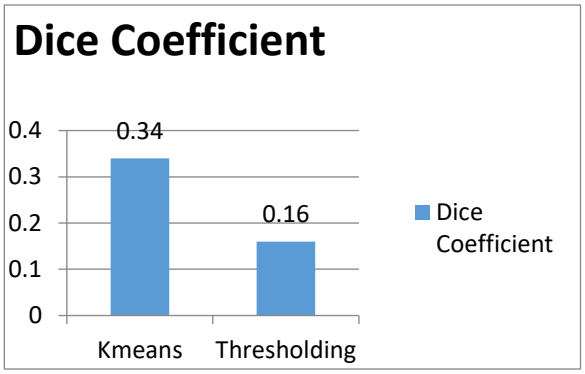












6.0 Conclusion:-

From above discussion thresholding segmentation technique have better performance for IoU and Pixel Accuracy, while if we consider performance criteria dice coefficient and F1 Score thresholding have performance just below kmeans. Overall performance of thresholding is better as compare to k-means.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-18

Design and Development Approaches of Marathi Dialogue System: A Systematic Review

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Abstract— *A Dialogue System is a computer system to interact with a human in natural way. In recent area, dialogue systems are developed in their regional language. In research two ways of dialogue: human to human conversation and human to computer conversation. The second way to elaborate in a Marathi Dialogue system, it is an automated system intended to interact with humans in natural way. Now a days, dialogue system employed text, spoken, graphics and other modes of interaction. In this review, a text-based dialogue system is in we chat in Marathi language with the computer system. This review paper will discuss about dialogue system in Marathi language, dialogue system components, approaches of Dialogue Management System, its objectives and dialogue system assessment techniques. This paper helps the researchers to investigate discover information about the dialogue system.*

Keywords: Dialogue System, Natural Language Processing, Marathi Language, Development approaches

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1. Introduction

A Dialogue is an interdependent between two or more human or machine. Research on dialogue is on two themes human to human conversation and human to computer conversation. The last theme to elaborate in a Marathi Language dialogue system is an automated system to interact with a human in natural way.

Though a lot of research has been done in the domain of dialogue system, but the literature lacks studies that comprehensively review the developments in dialogue technology particular under low resource setting and identify the potential future research directions. Keeping that consideration this article will review the design and development approaches of Marathi dialogue system.

This survey is structured as follows. In Section 2, we define the various forms of dialogue system. Section 3 supports components of dialogue system divide up responsibilities from system to system. Section 4 discuss about design approaches of Dialogue Management System use to control dialogue. Section 5 is devoted to use-cases and challenges of dialogue system. Section 6 concludes this article.

2. Dialogue System

The dialogue system provides an interaction between the human and machine that allow the application in a natural way[1]. The dialogue system can be Chat User Interface(CUI), A Graphical User Interface(GUI), Voice User Interface(VUI) and multimodal etc. are user for communication on both the input and output medium. A spoken dialogue

system is a computer system able to interact with a human with voice. A text based dialogue system in which we converse with the computer system. A multimodal dialogue system allows human to create input for a machine in a natural language. Multimodal system processes two or more combined user input modes such as speech, pen, touch, gestures, gaze and head and body movement with multimedia system output.

System:कोणत्याही मार्गाने स्वतःला इजा करून घेणे किंवा आत्महत्या करण्याचे विचार मनात येणे

User: १.कधीच नाही

२. कधी तरी

३. बऱ्याचदा

४. नेहमीच

Figure 1: Example of Dialogue System

3. Components

Six main components are included in a dialogue system. Their responsibilities are divided from system to system[2,3].

- Automatic speech recognizer (ASR)
- Natural Language Understanding (NLU)
- Dialogue Manager
- Task Manager
- Natural Language Generator(NLG)
- Text to speech in Marathi Language (TTS)

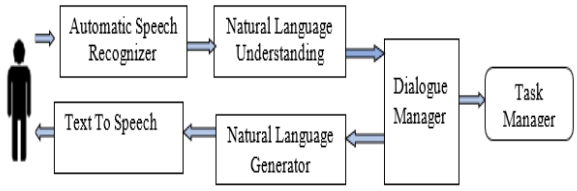


Figure 2

Architecture of Dialogue System

3.1 Automatic Speech Recognizer (ASR)

Automatic speech recognizer component is the one which decodes the input. It converts the input to the Marathi language text. This component transforms the speech sound to Marathi language text. This conversation requires the knowledge of Phonology and Phonetic. Phonology is the branch of Linguistic that studies their sounds. Phonetic is based on the conceptual understanding of how sound is produced and representation of written symbols.

3.2 Natural Language Understanding (NLU)

Natural Language Understanding component will associate what user want to tell in Marathi language. This converts the sequence of words into syntactic or semantic generation for the dialogue manager used. This component recognizes the use of Morphology. Morphology is the study of words, structure. After the text is analyzed it provide to the dialogue manager.

3.3 Dialogue Manager

The dialogue manager manages for the flow of conversation between human and machine. The input to the dialogue manager is the user request converted to semantic representation by the natural language understanding.

3.4 Task Manager

The dialogue manager associate one or more task manager that have knowledge of the specific task. The dialogue manager needs to communicate with external software such as expert system and database. This interaction is handled by the task manager using the Natural Language Query Processing System.

3.5 Natural Language Generator

Natural Language Generator is a part of artificial intelligence and linguistic that is concerned with the construction of automated system. This component can produce understandable text in Marathi language or other user language from some underlying non-linguistic representation of information.

3.6 Text to speech generator

Text to speech generator component converts the text message formed by the natural language generator into spoken form. Two approaches used in text to speech generation.

- The first approach is recorded speech used with spaces to be filled by recorded samples. Example:

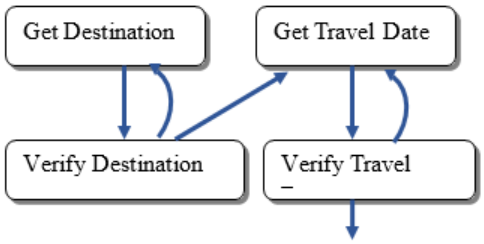
  "भुसावळ हे जळगाव डिस्ट्रिक्ट मधील ठिकाण आहे"
- The second approach is used text to speech synthesis. In this approach speech is generated of Marathi text.

4. Approaches of Dialogue Management System

Dialogue system can be categorized into three systems[4]:

4.1 Finite State Based System

The finite state based system dialogue consisting of a defined sequence of questions. Questions are independent. The flow of dialogue is defined as a set of states.



System: प्रवासाचे अंतिम ठिकाण कोणते?

User : भुसावळ

System :तुम्हाला भुसावळला प्रवास करायचा का?

User :हो

System :तुम्हाला कोणत्या तारखेला प्रवास करायचा?

User : १५-०९-२०२३

System :तुम्हाला १५-०९-२०२३ ला प्रवास करायचा का?

User :हो

4.1.1 Advantages

- Simple to develop
- Suitable for modeling simple task
- More reliable performance

4.1.2 Disadvantages

- Dialogue are not natural
- Finite state based system cannot deal with complex dependencies.

4.2 Frame based System:

The Frame Based System approach is not predetermined but depends on the user input. This system generalizes finite-state approach by allowing multiple paths to acquire information. Information needed for task or query[5].

The example shown in Figure 3

Destination City : भुसावळ **System:** प्रवासाचेअंतिम ठिकाण कोणते?

Departure Day : शुक्रवार User : भुसावळ

Departure Date: सप्टेंबर १५ **System:** तुम्हाला कोणत्या दिवशी प्रवास करायचा आहे?

Departure Time : सकाळी ९ User: शुक्रवार

System: प्रवासाचे अंतिम ठिकाण कोणते

User : भुसावळ, शुक्रवार, सप्टेंबर १५,सकाळी ९वाजता

Figure 3: Example of Frame Based System

4.2.1 Advantages

- More dialogues are allow in frame based system

4.2.2 Disadvantages

- Not easily applicable to complex task
- May not be a single frame

4.3 Agent Based System :

Agent based system enable complex communication between system, the user and the application [6]. In agent based system, interaction is viewed as the conversation between two agents, each of which is capable of reasoning about its own measures and beliefs, and sometimes also about the measures and beliefs of the other agent. The dialogue evolves dynamically as a sequence of related steps that build on top of each other.

4.3.1 Advantages

- Allow full linguistic interpretation
- Employ Artificial Intelligence planning or reasoning process.
- Allow Natural Language Processing in complex domain.
- User friendly, like conversation with human.

4.3.2 Disadvantages

- These systems are hard to build.

The example shown in Figure 4

System needs to know:

दुःखी, निराश, नाराज वाटणे : कधीच नाही,कधी तरी, बऱ्याचदा,नेहमीच

Goal(U, learn,..(prop(कधीच नाही,कधी तरी, बऱ्याचदा,नेहमीच,(exist, X),true)))

Figure 4: Example of Agent Based System

5. Challenges

- To build dialogue system developers faces many difficulties.
- These are due lack of computer's understanding of natural language. This problem arises many challenges for developers.
  - problem of Anaphora Resolution
  - Inferences
  - Ellipsis
  - Pragmatics
  - Reference resolutions
  - Clarifications
  - Understanding the context
  - Uncertainty / Ambiguity
  - Knowledge Embedding
- In the spoken dialogue systems the problem related to utterance of the user occur like ill formed utterance.

6. Conclusion

Dialogue system is very good tool for conversation between human and computer system. This tool can be used various devices like mobile, computer, telephones. It can be a good tool for web site assistance, database assistance which can have domain of online shopping, travelling information, Railway reservation, ticket booking, Remote banking, Travel reservation, Information enquiry, Stock transactions, Taxi bookings, airline reservation booking, Route planning etc.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-19

Comparative Analysis of Facial Expressions and Identification of Happiness Index of University Students during Lecture: A Comprehensive Review

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Abstract— *This article provides a comprehensive review of educational research focusing on the face and wellbeing of college students across a variety of disciplines. The main aim is to gain a deeper understanding of how students feel through face-to-face instruction and to identify factors that influence their wellbeing. The existing literature, inclu ding studies from the last decade, is reviewed and a summary of the main findings is provided. Additionally, the paper explores the implications of these findings on student learning and well -being and recommends action plans.*

Keywords: *Happiness Index, Facial Expression,Students, Academic Performance.*

1. Introduction

university represents a period of personal and academic development for students, marked by exposure to a variety of courses, challenges and learning opportunities. During this key stage, the focus goes beyond the mere acquisition of knowledge to include the overall well-being and happiness of students. Happiness is of particular importance because it profoundly affects students' academic performance and interpersonal relationships. This paper focuses on understanding how college students' express happiness through facial expressions and aims to create a comprehensive happiness index for their well-being during their college journey. Emotions, especially happiness, significantly affect academic performance and the overall experience of college. The review examines recent research to uncover patterns and factors shaping students' emotional expressions. The goal is to create an evidence-based happiness index that can increase both academic success and happiness among college students.

Research Objectives:

Understanding Facial Expressions: The primary goal of this review is to gain a comprehensive understanding of common facial expressions displayed by individuals experiencing happiness during lectures or educational settings.

Develop a happiness index: Another major goalis to develop a systematic happiness index thatcan effectively quantify and measure the level of happiness expressed during lectures.

Identify Common Facial Expressions:

Facial expressions are important indicators of emotional and cognitive states, which aremanifested through the complex manipulation of facial muscles under the skin. This non-verbal way of communication plays a key role in conveying a spectrum of emotional and cognitive information. Human emotions, experienced throughout the day, find effective expression through controlled movements of various facial muscles, with each facial feature contributing to this complex communication system. Basic facial expressions such as Happiness, Sadness, Surprise, Disgust and Anger are widely recognized in contemporary psychology. In addition, precise coordination of facial muscle movements plays a crucial role in the accurate interpretation of human emotionalstates [17].

Literature Review:

This research review delves into therepercussions of the COVID-19 pandemic onacademic performance. It investigates various factors, including disruptions in daily routines and heightened stress levels among students. Furthermore, it explores the emotional aspects of students' experiences during online learning, with the aim of customizing educational contentand interventions based on their emotional states [1]. The study is expected to employ computer vision techniques for the purpose of identifying emotions in the classroom setting. This entails the analysis of facial expressions andbody language to gain insights into the emotional well-being of students. Nevertheless,it acknowledges the inherent challenge of applying these algorithms effectively across diverse educational contexts [6]. Additionally, the paper introduces an innovative approach to recognizing facial expressions in video content.This method integrates the compression and excitation mechanism with a 3D principal component analysis (3DPCA) network to enhance facial expression recognition [16].**Unexplored Aspects and Research Gap: Exploring Student Well-being Through Facial Expressions During Lectures**

Key Factors	Description
Customization for Academic Contexts	Lack of customization of facial expression analysis tools for academic contexts, necessitating adaptation for academic stressors and challenges [8].
Intervention Effectiveness	Lack of empirical evidence on the effectiveness of facial expression-informed interventions for improving students' emotional well-being and academic performance [11].
Integration into Educational Systems	A research gap regarding the practical integration of facial expression analysis tools into educational systems and the development of user-friendly interfaces [13].
Cultural and Gender Differences	Need for research on anxiety disorders among students in diverse cultural contexts, including the UAE and other regions [19].
Longitudinal Studies	Limited longitudinal research on emotional states and expressions in response to academic demands, highlighting theneed for long-term studies [21].
Real-Time Feedback	The importance of developing interventions to support students during academic challenges, highlighting the impact of mental well-being on academic success [22].

[table 1 key factors of co-relation between happiness and facial expression]

Proposed workflow derived from literature review: Introducing a two-phase research methodology intitially developing a video-based facial expression recognition system, follow by evaluating its performance by comparing there result with a aggregate feedback to obtain valuable insights.this study invoves two primary

phases. First, the goal is to develop a method for interpreting facial expression in videos by training a computer model using a diverse set of video data. Then focus on analyzing the computer-generated output in conjunction with the feedback provided by the students.

Methodology

1.Data Collection:Gather facial expression data during lectures using methods like video recording webcams, or facial recognition technology.

2. Facial Expression Analysis: Unlike either manual coding or specilazed software to analyse student's facial expressions. Categorized these expression into different emotional states, with a primary focus on identifying happines.

3. Emotion Recognition: Apply machine learning algorithms to recognize and quantify the levels of happiness based on the collected facial expression data.

4. Weighted Factors: Identify specific facial cues (e.g., smiles, eye expressions) that are particularly indicative of happiness. Assignappropriate weights to these cues based on their significance in conveying happiness.

5. Composite Happiness Score: Calculate an individual happiness score for each student by summing the weighted facial cues observed in their expressions.

6. Normalization: Normalize the individual happiness scores to a standardized scale (e.g., 0-10) for easier interpretation and comparison.

7. Happiness Index: Compute an overall happiness index for the group of students by aggregating their individual happiness scores.

Summarize Findings and Implications:

This research paper conducts a comprehensive review of facial expressions and happiness levels among university students during lectures. The findings suggest that there is a notable variation in facial expressions, with some students displaying happiness while others do not exhibit this emotion during lectures. These differences could be attributed to various factors, such as the teaching style, subject matter, or individual disposition. The implications of this study indicate the need for further research to understand the underlying causes of these variations in happiness levels among students during lectures. It suggests that educators and institutions should consider tailoring teaching approaches to enhance students' engagement and happiness, ultimately improving the learning experience. Additionally, the study highlights the potential of using facial expression analysis as a tool for assessing the effectiveness of educational strategies and interventions.

Conclusion:

In conclusion, this study has centered its attention on the nuanced identification of facialexpressions exhibited by graduate andpostgraduate students engaged in classroom activities. Notably, our findings have illuminated a positive correlation between specific expressions, such as those denoting interest and concentration, and enhanced academic performance among these students. This research endeavor holds significant potential tocontribute to the enhancement of the learning experience by shedding light on the intricate connection between students' expressions of happiness, their emotional states during study sessions, and their subsequent academic achievements. This deeper understanding can inform pedagogical approaches and strategies aimed at optimizing the educational journey of graduate and postgraduate students, ultimately fostering an environment conducive to both academic excellence and emotional well-being.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS-20

A comprehensive review on QoS provisioning using energy-efficient routing protocols in wireless sensor network

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Abstract Wireless sensor networks (WSN), for instance, have played a leading role in distant applications in recent years. Due to the dynamic topology and dispersed nature of WSNs, the design of energy-efficient protocols to route data events is a key issue. The paper's main objective is to examine energy-efficient routing techniques to enhance energy efficiency and the longevity of the network. This study reviews effective routing techniques for energy efficiency. Routing Protocols can be classified based on their energy efficiency, data aggregation, location awareness, QoS, scalability, and load balancing. For the energy-efficient routing techniques described from 2010 to 2019, a systemic literature evaluation has been undertaken. This study provides researchers with technical guidance on the development of routing protocols. In conclusion, we addressed research deficits in the procedures examined and the possible future issues.
Keywords:- *WSN, Energy Efficient, Quality of Service QoS, routing protocols*

INTRODUCTION

WSNs contains a wide range of nodes that let collected data to be sent to sink or base stations (BSs) over the network (Suryadevara, 2015). These networks are attractively suited for various areas like business, medical services, military supervision, air pollution management, monitoring of fluctuations, smart road design and long-distance medical aid, etc. When these applications are developed, sensor nodes use an enormous amount of energy to communicate, analyze, and sensor information (Bai, 2012). Research in the field is still ongoing, with a focus on improving data transmission, reducing energy usage, and maintaining network topology to extend the life of the network. It presents major issues for different QoS-based applications to meet the criteria of quality of service (QoS). In particular, networking protocols must meet energy limitations and guaranteeing exact QoS. As a result, energy and QoS awareness are required for QoS applications in sensor networks at various stack tiers. In many of these applications, network traffic is blended with delayed and tolerant traffic. As a result, QoS routing is a major concern.

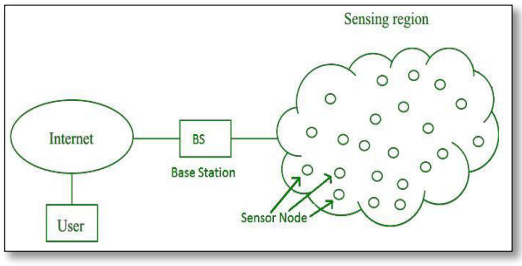

Figure. 1 Architecture of WSNs

WSN architecture is shown in Figure 1. The WSNs can be split into two primary types - tracking and monitoring - based on their application. Monitoring applications include internal and external monitoring of the environment, such as industrial unit monitoring and development, physical condition monitoring and control monitoring. Vehicles, human beings, animals and tracking items comprise tracking applications. The usage of non-

rechargeable batteries in sensors makes energy efficiency a major issue when designing a network. When sending messages from source to destination, route selection is essential. During data transmission, a significant quantity of energy is used. Utilizing a hierarchical routing design has proven to be quite effective in resolving the problem of excessive energy use. The network is divided into multiple clusters through clustering. The intermediate sensor nodes help the source node in sending data packets to the destination via routing pathways during the data transmission process (Villas, 2013). The concept of data aggregation leads to the optimal utilization of limited WSN resources. Today, the protocol based on cluster routing is becoming more important. A cluster (collection of nodes) includes a principal node called the cluster head in cluster-based routing (CH) (Nayak, 2016).

Traditional and swarm intelligence techniques make use of their resources, resulting in an efficient solution for energy usage. The term "classical protocols" refers to conventional protocols. Swarm intelligence-based protocols are self-organized or biologically inspired protocols. Swarm intelligence-based clustering protocols' main objective is to lower energy consumption during setup by performing dynamic grouping on sensor nodes. By clustering nodes, Low-Energy Adaptive Clustering Hierarchy (LEACH) was the first protocol to be utilized to lower network energy consumption. LEACH procedures are divided into two phases for each cycle: setup and steady state. Different rounds of active and passive clustering are performed, leading to behaviour that is energy efficient. Through simulation and analysis, it has been shown that a MAC protocol can be used to lower network power utilization based on node duty cycle.

The network layer's QoS provisioning can be influenced by a number of variables known as QoS metrics. Maintaining these specific QoS matrics for a particular application domain is a challenging task. The QoS Matrics are Energy efficiency, Latency, Reliability, Throughput. To achieve efficient communication one may focus on the QoS Matrics. If these parameters are properly managed then it will lead to efficient communication (Tarunpreet Kaur, 2019).

The majority of research focuses on WSNs' architecture, protocols, energy use, efficiency, and Quality of Service (QoS). Since WSNs are made up of wireless nodes, batteries are typically their main power source. Therefore, most antiquated protocols address with concerns related to energy conservation and extending network longevity. QoS was initially not given much thought during the creation of WSN, but with the introduction of vital, multimedia, and real-time applications, QoS is starting to gain importance. WSNs still have a growing user base and a variety of applications that depend on their performing at a certain level. WSNs should be used sparingly due to their limited resources, adaptability, and variety of applications. Wireless Sensor Networks (WSNs) are advancing quickly, which indicates that they are growing more complicated. Thus, it is tougher to use users and programs. Due to sole characteristics of WSNs, like small dimensions and limited resources and capabilities, Quality of Service (QoS) is imposed as one of the key factors of WSNs ((Bamen1, 2017).

The major contribution of this review is as follows.

1. This paper gives a general overview of energy-efficient routing protocols with a special emphasis on traditional and swarm intelligence SI-based routing techniques.
2. This paper summarizes a comprehensive survey on routing protocols in terms of categorization, energy efficiency, data aggregation, location awareness, quality of service (QoS), scalability, load balancing, fault tolerances, multipath, and query-based surveys.
3. This paper addresses a few of the unresolved issues in the WSN QoS space.

3. Literature Review: -

WSNs have emerged as a viable paradigm for understanding the physical world because they enable relatively affordable network installation. A node's use of energy is crucial in WSNs because it is a limited resource. All protocols at every tier in WSNs must be energy efficient because nodes are tiny devices with constrained storage, processing capability, and power. When installing the WSN, most researchers are focused on energy-efficient routing. So the main focus has been given to the routing protocols which may be different depending on the application and network architecture.

(Wendi B. Heinzelman, 2002) Initially, the author proposed LEACH (Low Energy Adaptive Clustering Hierarchy) which allows cluster heads (CHs) to communicate with the sink directly. LEACH has less energy consumption, but due to the limitation of LEACH, we can't use it for a large network. As LEACH uses single-hop communication it will increase the distance between CH and sink, which in turn increases communication cost and shortens the lifetime of the network.

(Cao Jian, 2014) By partitioning a network into the ideal number of clusters as described in the author's optimal number of clusters algorithm, communication distance between nodes is reduced. Based on the ideal number of clusters, ONCA splits the network region into unequal virtual grids. ONCA chooses and prioritizes the cluster-head and forwarding candidate set in an efficient way that takes into account the remaining energy of nodes. During the data transmission stage, the packet transmission rate can be dynamically optimized. The simulation findings demonstrate that ONCA

satisfies the requirements of QoS in the real-time and reliability domains, as well as having the potential to prolong the network life cycle.

Some of the researchers stated that QoS delivery techniques were employed in different directions, while others concentrated on optimising the output. The QoS delivery methodology is utilised in different direction. (Tiansi Hu, 2010) Introduced the Adaptive Routing (QELAR) protocol for the provision of Q-Learning energy-efficient lifetime that equitably distributes the remaining node energy throughout the network. It was designed particularly for underwater WSN and environmentally friendly nodes and appropriate optimum action was performed. QELAR has improved its competitive protocols for energy consumption and latency reduction, improved delivery rates and improved network life. QELAR is not, however, suitable for large area network due to inefficient routing technique.

(Jalel Ben-Othman, 2010) Proposed EQSR protocol; an energy-efficient and quality of service-aware multi-path routing protocol especially developed to differentiate services by offering absolute preferential treatment of real-time traffic over non-real-time traffic for wireless sensor networks. With the Forward Error Correction method (FEC), the protocol leverages the multi-path paradigm to recover from node failures without using network-wide flooding to find the path. In sensor networks, this characteristic is particularly essential since fluxing consumes energy and therefore lowers network life. The next hop through the path creation phase is predicted by the EQSR protocol using the residual energy, node available buffer size, and signal-to-noise ratio. To increase the likelihood that a critical piece of the packet is received at the destination without experiencing an excessive delay, EQSR divides the sent message into numerous equal-sized segments, adds correction codes, and then transmits it across multiple pathways simultaneously. In terms of greater energy savings and a higher delivery ratio, this protocol significantly outperforms the MCMP protocol. Research continues to show that network size, path length, and buffer size have an impact on performance indicators.

(Jayashree Agarkhed, 2019) Proposed Based on demand for a range of applications, WSNs requires achieving varied QoS. WSN routing protocols have been created to meet various QoS requirements to improve performance and prolong the network lifespan. The utilisation of a cluster-based method and the stochastic scheduling algorithm demonstrates that EESDRCB signage utilising the various QoS measure like minimised energy use and latency compared with current literature approaches. The utilisation of differentiated service increases performance with lower delays.

(Tarunpreet Kaur, 2019) Gives a detailed recent study on QoS provisioning routing techniques. The author mainly focuses on energy-efficient routing by considering major QoS matric like Energy efficiency, latency, reliability, throughput, etc. He used several QoS provisioning techniques at a network layer. The whole paper analyzed Computational intelligence-based QoS aware routing protocols like ACO (Ant Colony Optimization), ABC (Artificial bee colony optimization), PSO (Particle swarm optimization), and BMO (Bird mating optimization). The ACO is a swarm intelligence technique that follows the smart and hunting behavior of real ants in nature.ACO techniques don't have the ability to handle the situation when links fail due to the mobility of sensing nodes. For the optimization of the multi-variable function issue, ABC utilizes the honey bee-fed behavior. Honeybees drill for food sources in the search area using the ABC algorithm.PSO is based on the social conduct of birds while flying and fish groups. Finally, BMO is an evolutionary-based search algorithm that takes its cues from the natural behavior of birds during mating season. The author suggested for future work on the Cross-layer approach, Mobility, Error-free transmission, Fault-tolerant routing, Hybrid intelligence, etc.

(Liu, 2015) An energy-efficient protocols routing survey was submitted. The communication model, the dependability, the network structure, and the topology were classified in different protocols. The Al-Karaki categorization has been further developed to handle energy usage properly. Design concerns were given together with the criteria and characteristics for each category. Also addressed were models of energy usage, strategies of selection of routes, and traffic patterns. He works on different Hierarchical Routing Protocols. The author produces the fact that because of the restricted resources, routing in WSNs is full of difficulties, and logical topology plays an important part in the routing of networks that limit resources. Effective hierarchical routing protocols for WSNs were developed based on several logical topics in the past.

(Tanwar, 2015) Heterogeneous protocols for routing were categorized based on user-defined criteria. The authors proposed a taxonomy for heterogeneous schemes based on energy heterogeneity and computational heterogeneity of node heterogeneity parameters, link heterogeneity, and hybrid category. Protocol comparisons were made for two and three energy consumption node levels, considering CH selection, single-hop/multi-hop topology, energy efficiency, application-specific character, and safety. The delay, stability, energy, dependability, and other aspects have all been considered in issues surrounding the transmission of sensitive information to the destination.

(Vishal Kumar Arora, 2016) The authors examined hierarchical routing methods to avoid energy depletion and therefore to increase network longevity. Certain enhancements were also reported in the context of their work on hierarchical routing techniques.

(Fatemeh Safara, 2020) Proposed DODAG excessive bandwidth use of IoT applications is needed and the network core causes traffic congestion. Routing packages from source to destination, especially in highly packed areas, is a challenge for IoT systems. The growing number of wireless IoT devices has brought energy usage to the forefront. Author uses RPL-based technique to decrease energy usage for IoT devices. The QoS of IoT applications was employed in this technique, where TDMA time slot was used to syncing sender to recipient and reducing energy use. The routing architecture of DODAG was also controlled by the timer. The evaluation carried out using NS-2 with a view to comparing the electrical consumption, overhead routing and final delay of the suggested and existing techniques. The suggested priorities based routing technique utilising the TDMA model has been shown by experimental results. The average end-to-end latency versus the number of nodes efficiently reduces node power use and significantly minimises the end-to-end delay of communication node selection inside the IoT network.

(Payal Jadhav, 2016) Different opportunistic routing methods were conceptually illustrated, along with their performance metrics and advantages. The techniques described were primarily aimed at minimizing data redundancy, increasing energy efficiency, and boosting network usage. Energy-efficient solutions for increasing throughput, efficiency, and dependability were introduced. The forward list selection parameter, priority metric for node selection, synchronization parameter, latency, duplicate packet measure, energy efficiency, and protocol application domain were all included in the opportunistic protocol comparison.

(Nandkumar Kulkarni, 2013) The Multi-Objective Hybrid Routing Algorithm (MOHRA), a brand-new hybrid routing algorithm for WSN, was proposed by the author. To increase the lifespan of the WSN, MOHRA's main goal is to select the best path up to the sink based on multiple objective data. The effectiveness of the suggested algorithm is evaluated against that of two well-known multi-objective hybrid routing algorithms, SHRP and DyMORA. The routing protocol can be expanded using a variety of methods. The protocol was designed with the intention of being compared to existing multi-objective hybrid routing technologies by the inventor.

(Nandkumar Kulkarni N. R., 2014) The performance of a new Mobility-Aware Multi-Objective Hybrid Routing Algorithm (MMOHRA) for WSN is evaluated by the author in this paper. The primary purpose of MMOHRA is to pick the best path up to the sink based on multi-objective measurements to extend the life of the WSN. Under node mobility, the performance of MMOHRA is compared to that of two prominent multi-objective hybrid routing algorithms, SHRP and DyMORA. When compared to SHRP and DyMORA, MMOHRA uses less energy. In terms of packet delivery ratio, average energy consumption, and jitter, MMOHRA beats SHRP and DyMORA. The routing protocol may be modified to account for the heterogeneity of both node and sink.

(Nandkumar Kulkarni N. R., Q-MOHRA: QoS Assured Multi-objective Hybrid Routing Algorithm for Heterogeneous WSN, 2018) The author's aim on Q-MOHRA is to ensure QoS while picking the best path up to the sink based on multi-objective criteria. Q-MOHRA's performance is compared to that of two multi-objective hybrid routing algorithms, SHRP and DyMORA. When compared to SHRP and DyMORA, Q-MOHRA is more energy efficient. In terms of average energy consumption, jitter, normalized routing load, and packet delivery ratio, Q-MOHRA beats SHRP and DyMORA. The routing protocol may be modified to take into account characteristics such as sensor node heterogeneity and mobility. These are the improvements of different Hybrid routing algorithms for wireless sensor networks. But still, the further improvement is required heterogeneity of both node and sink. So the further scope for research is there to think of heterogeneity of both node and sink.

(Aboli Arun Anasane, 2016) The author was briefly explored Multipath routing methods for Wireless Multimedia Sensor Networks to reduce transmission delay and congestion to increase channel usage rate (WMSN). As part of their research, they identified the operating principles, benefits, and drawbacks of multipath routing systems.

(Mohammad Hossein Anisi, 2015) The author stimulated and he observed energy balancing across nodes is often accomplished in two ways: single-path and multi-path techniques. For each data transmission, the optimal path that can fulfil the requisite energy consumption and QoS criteria is chosen in single-path techniques. In multi-path techniques, the load is distributed among the pathways to guarantee energy balance among nodes. Approaches to reducing energy usage in WSNs are classified based on the ability of the BS(s) or nodes to move. The mobility of the BS or nodes moderates the network's energy depletion, resulting in more efficient data routing among the nodes. Currently, energy harvesting equipment is larger in size, necessitating more research to lower the size of the components for better integration with small sensor nodes. Furthermore, it is expensive to transform collected energy into usable electricity, which limits

its application in low-cost WSN. The considerable study is thus required to minimize financial costs while improving conversion efficiency.

The entire review is summarised in the following table.

Reviewing and comparison of the advantage and disadvantages of the selected deterministic articles

Sr. no	Reference	Technique	Advantage	Disadvantage
1	(Wendi B. Heinzelman, 2002)	Low Energy Adaptive Clustering Hierarchy(LEACH)	LEACH has a less energy consumption	Scalability is measure issue
2	(Tiansi Hu, 2010)	QELAR	Its competitive protocols for energy consumption and latency reduction, improved delivery rates and improved network life.	QELAR is not, however, suitable for large area network due to inefficient routing technique (Jayashree Agarkhed, 2019)
3	(Cao Jian, 2014)	Optimal Number of Clusters Algorithm (ONCA)	Satisfies some of the requirements of QoS	During the Selection of CH power is consumed.
4	(Jayashree Agarkhed, 2019)	EESDRCB	Minimised energy consumption and delay	Does not investigate the issue of link failure
5	(Fatemeh Safara, 2020)	DODAG	The average end-to-end latency versus the number of nodes efficiently reduces node power use.	Suffer from the inter-path interference problem
6	(Jalel Ben-Othman, 2010)	EQSR protocol	Recover from node failures without using network-wide flooding to find the path.	Not focused on performance indicators of network size, path length, and buffer size.
7	(Tarunpreet Kaur, 2019)	1) ACO 2) ABC 3) PSO 4) BMO	1) Prevents network congestion. 2) Improves network lifetime and transmission delay 3) Ensures robustness 4) Ensures reliable data transmission Addresses route failure issue	1) High complexity 2) Does not investigate the issue of link failure 3) High computational Complexity. 4) High cost of load balancing
8	(Liu, 2015)	1) PEGASIS 2) CCS 3) EBCRP	1) Has good data aggregation. 2) Implementation cost is low. 3) Has good data aggregation.	1) Scalability is a measure issue. 2) Requires a high load balance. 3) Energy efficiency is very low.
9	(Tanwar, 2015)	1) EDFCM 2) DEC 3) HEED	1) Reliability is very good 2) Stability is adorable. 3) Lifetime of the network is Excellent.	1)Does not provide load balancing. 2) Lifetime of the network is very low. 3)Reliability is very poor.
10	(Vishal Kumar Arora, 2016)	1) Centralized-LEACH 2) Modified LEACH	1) Has less energy consumption. 2) MODLEACH amplify signals on basis of their packet types.	1) Scalability is a measure issue. 2) Require some more energy than centralized LEACH.

11	(Payal Jadhav, 2016)	1) ENSOR 2) SAOR	1) Energy efficiency is very high. 2) End-to-End delay is very low.	1)End-to-End delay is a measure concerned. 2) Possibility of packet duplication
12	(Nandkumar Kulkarni N. P., 2013)	MOHRA	Energy efficiency is more than 10% when compared with SHRP and DyMORA.	Heterogeneity of both node and sink is a major issue
13	(Nandkumar Kulkarni N. R., MMOHRA: Mobility Aware Multi-Objective Hybrid Routing Algorithm for Wireless Sensor Networks, 2014)	MMOHRA	Energy efficiency is more than 14.78% when compared with SHRP and DyMORA.	Heterogeneity of both node and sink is a major issue
14	(Nandkumar Kulkarni N. R., Q-MOHRA: QoS Assured Multi-objective Hybrid Routing Algorithm for Heterogeneous WSN, 2018)	Q-MOHRA	Energy efficiency is more than 24 % when compared with SHRP and DyMORA.	Heterogeneity of both node and sink is a major issue
15	(Aboli Arun Anasane, 2016)	1) GPSR 2) TPGF 3) NIMGR	1) Limited sensor networks and reacts easily to topology changes. 2) It is fast and simple. 3) It is more efficient	1) It sends a packet only to the node closest to the Sink. 2) suffer from the inter-path interference problem 3) it does not take the remaining energy of nodes
16	(Mohammad Hossein Anisi, 2015)	1) ECRPW 2) IRIS 3) GMCAR	1) Optimum clusters. 2) Multiple performance goals 3) Multi-traffic classes	1) High setup costs. 2)Computational overhead. 3)Maintains routing table

4. Conclusion:-

So far, it appears that substantial efforts have been made in creating appropriate routing protocols for WSNs based on various topologies. However, there is a lot of room for improvement in existing routing protocols in the future. **A few important open issues are summarized as follows**:

1. It is a pioneering effort to develop a mix of several topologies for a specific WSN hierarchical routing protocol. For example, the use of grid-based topology for hierarchical routing to implement cluster-based topology remains open.
2. To create cross-layer routing protocols in WSNs, more study is required. The physical layer and MAC layer, for example, may achieve transmission range modification and communication collision avoidance, which can help with network layer routing design.
3. In WSNs, there is a trend toward using numerous sinks and mobile sinks to improve energy efficiency, eliminate energy holes, and extend network lifetime. Multiple sinks and mobile sinks, on the other hand, can quickly result in massive amounts of data flooding. More research is needed to reduce the control overhead.
4. Every form of topology has its own set of benefits and downsides, and figuring out how to combine the benefits of diverse topologies remains a challenge.

By considering these open issues conclude there may be the need for achieving the energy-efficient routing one must have to consider these scopes in future research work.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS- 21

Artificial Intelligence In Image Analysis

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Abstract -*The method of "image analysis" in creating "artificial intelligence models" has created a buzz in the world of technology. "Image analysis" has enabled a greater understanding of the concerned process. A variety of aspects of image analysis have been discussed in detail, such as "analogue image processing", "digital image processing", "and image pattern recognition"and"image acquisition". The learning has been done to explore the techniques used to develop "artificial intelligence".The image analysis with the consistent factor of face recognition will enable the readers to understand the efficiency of the system and cater to the areas where improvisation is needed. The approach has been implemented to understand the working of the on-going process.*
Keywords- *Computer vision, acquisition, encompassing, deterioration*

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INTRODUCTION "Image analysis" could be quick consists of the factors which generate meaningful information regarding any objectifying picture form the digital media."Artificial Intelligence Model (AI Model)" is the exclusive based reasoning system for increasing the usability of any concerning system in the digital world. The following report will brief about how the image analysis can easily set up the different AI models for generating the work in a better manner. Different Image analysis can input their part of the influence in creating the model for generating the resourceful system theory increasing every process. The image recognition with the consisting factor of facerecognition can easily ingest as the key factors of the AI model in generating completing the system.

II) IMAGE ANALYSIS IN THE CREATION OF AI MODEL:

Image analysis could be signified as the scientific regulation which easily provides the theoretical explanation for focusing all the related matters coming to a system Here the image analysis will focus on entailing the budding of AI model by the implementation of the Image Analysis (Bazelier et al. 2015). The following briefing will entail about the different factors of "Image analysis" for creating the AI models:

A) Analog Image processing

This procedures unit of Image analysis can hold the feature of creating the Artificial intelligence system for encompassing the "Facial recognition program". This processing unit can easily built the AI system for the "Facial Recognition model" thereby increasing the competence of the system during an ongoing system process.

B) Digital Image Processing

This processing unit comes with the feature of creating the digital images and in this way, thicken upgrade the AI system for allocating the informational basis with more advanced digital images (Jourabloo& Liu, 2016). This processing can easily consist of the creation of the "Digital AI model" for generating a better image for getting better the focusing matter of a system.

a) Image sharpening and restoration

This feature consists of the core factor of Image analysis, which can easily advance AI models, in that way creating the "AI visualization model". In this way, any regarding "Visualization AI model" can easily sharpen the images according to the needs of the users and it can also over the area of restoration of the images (Laird, Lebiere & Rosenbloom, 2017). In this way, any user depending upon the mentioned model of AI any user can shorten their images depending upon their need and they can easily restore the images and data required for the preferred work.

Figure 1: Example of image sharpening and restoration.

b) Image Pattern Recognition

The image analysis also comes with the "Image pattern recognition program" could easily consist of the improvement factor for the AI system, thereby creating the "Image pattern AI model". This model can signify the different kinds of images pattern by benefiting the users while working with then AI system for getting the right images.

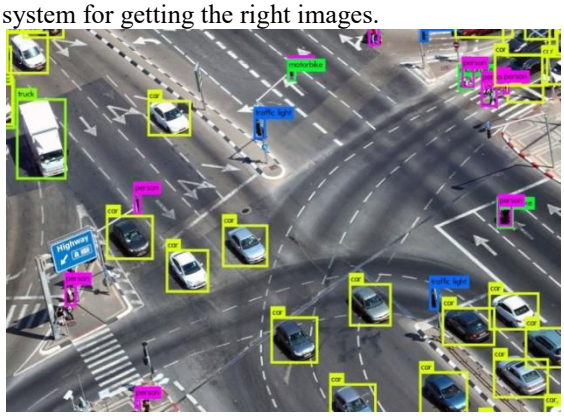

Figure 2: Example of pattern recognition operation

c) Image Compression and Decompression

This criterion could easily increase the working criteria of AI system by introducing the Image compression technique of the AI by the application of Image analysis. These criteria of the analysis come with both the compression and decompression feature of the image, which can be ingested in the AI system for creating the "Image compression and decompression AI model."

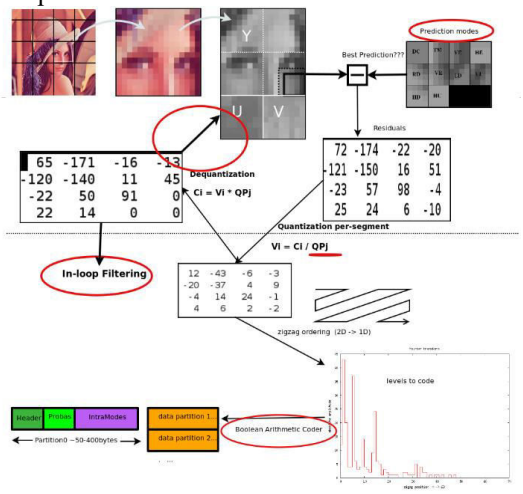

Figure 3: Example of image compression

d) Image Acquisition

This feature consisting within the Image analysis can signify the acquisition of various images consisting within the AI system and thereby it can increase the efficiency of AI system by upgrading the acquisition section of the system (Pigozzi, Tsoukias & Viappiani, 2016).Therefore the mentioned criteria can create the "Image Acquisition AI model". This model can signify improvements in the AI system for getting efficient work.

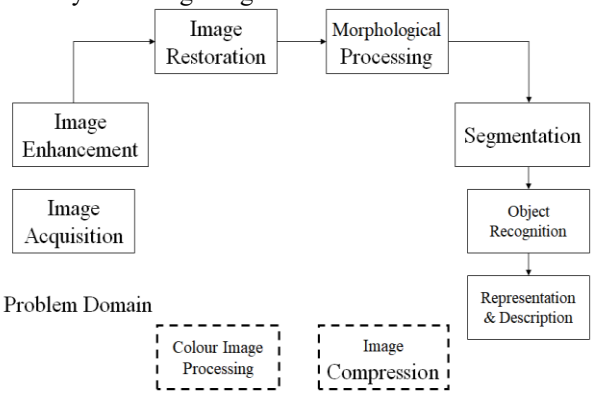

Figure 4: Key Phases of digital Image Analysis

Image analysis example

Visual character detection- reading of labels, sorting mails, reading text Medical image analysis- blood cell count, detect tumors, also used in microscopy to detect the cells. Pattern detection of image is used for algorithms, big data analytics.

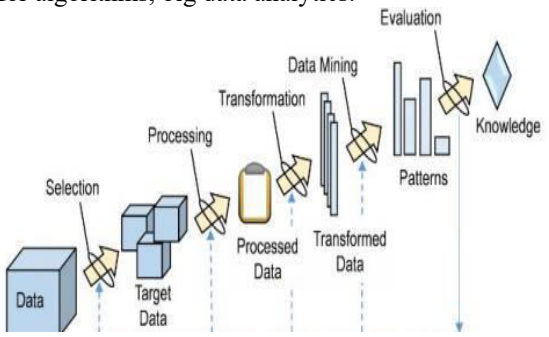

Figure 5: Pattern Recognition Method

III) BUILDING AN AI MODEL BY DIFFERENT TECHNIQUES

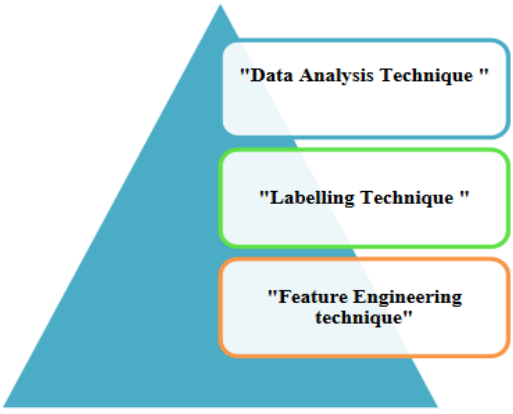

Figure 6. Different Techniques

Data Analysis Technique

"Data analysis technique" easily detects the systematic part of any data, thereby giving the resourceful information, which easily generates focusing factors for understanding the key aspects. Data analysis techniques are consistent with various kinds of ways of technique for evaluating different kinds of the system (Xu et al. 2015). Artificial intelligence is a sort of intelligence system which needs the "statistical data analysis technique, predictive data analysis technique and prescriptive analysis technique" of Data analysis for increasing the liability of the AI model.

Data analysis technique example

Statistical data can be analysed in various softwares that are used to develop deterioration models, logistic regression, multivariate analysis and class data. These are useful in the analysis of data in research. Image retrieval and image sharpening are some greater examples too.

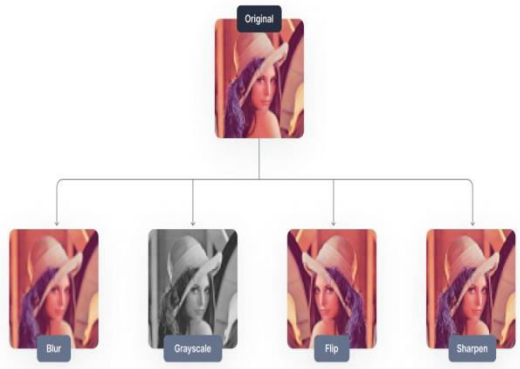

Figure 7:Original image, Blurring, gray image, flip image,Sharpening

Labelling Technique

The Data labelling technique could easily raise the working credibility of Artificial Intelligence for generating the focusing study. Supervising the machine learning consists of the major factor of AI system theory tagging all the concerning data for gathering the informational basis for inputting the needed criteria. The labelling comes with ten unique quality of detailing the problematic data into the AI system for being the charges for combating those challenges in the right manner by labelling the data. Like every method consisted for the up-gradation of the AI model, this labelling model also comes with the pros and the cons for signifying all the advantageous and disadvantageous facts concerning with the technique.

Labelling technique example

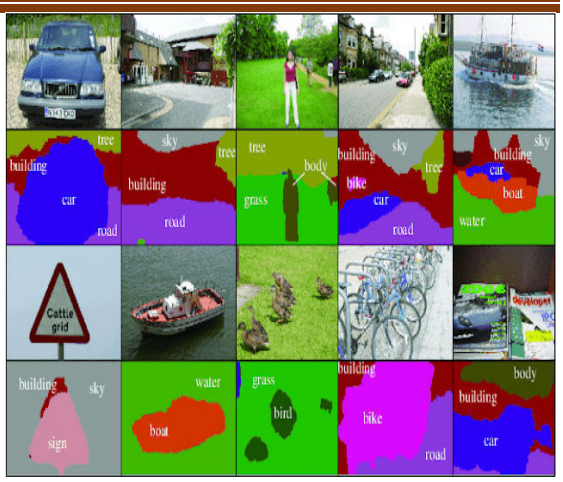

Figure 8: Labelling to specific things

"Feature engineering technique."

This technique easily consists of the critical factors of rising the process of any
cornering system then try increasing working credibility of the AI system. Here the following points will signify the focusing factors of the feature engineering for undergoing the AI system in a better way.

Feature Engineering Example:

Feature engineering can be used to arrange an input dataset that are in accordance with
The machine learning algorithm. The feature can be used to increase the performance of machine learning models. They can be used in data binning, handling outliers, imputation and scaling.

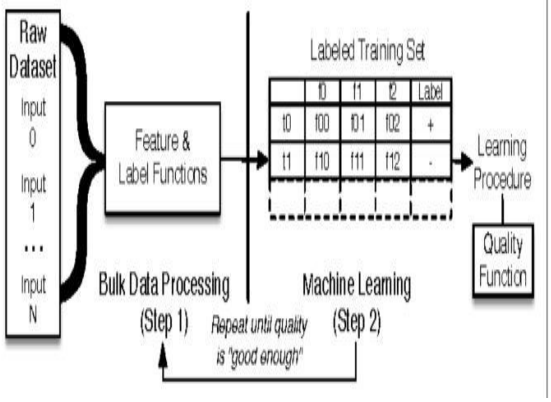

Figure. 9: In the feature engineering evaluation loop, bulk data processing and
machine learning steps are interdependent but to date have been commonly
implemented as separate systems.

End to End Testing

End to end could be easily signified as the methodological software which can be
imposed on any criteria for testifying the usefulness of the project system from start to finish. This testifying procedure evaluate every section of pwkr

form the start point to the end point thereby creating a system base work enforcement for creating the project in a better form. This way any applicatory method could be easily analyzed by configuring all the major elements while the ongoing project.

IV) EXAMPLE

Testifying the webpage by “End to end testing” for image analysis could be easily
signified as the exploratory factor for signifying the core areas of the mentioned criteria of testing. This testifying factor could easily consist of the tester and the developer for checking the webpage and developing actions related with the application. This way the END TO END testing can encompasses all the criteria of the webpage whether the webpage consists all the working criteria or not.

V) CONCLUSION

The above description has given the readers an insight into the use of image analysis for the development of “artificial intelligence” model. The image analysis with the reliable factor of face recognition will enable the readers to understand the efficiency of the system and cater to the areas where improvisation is needed. A variety of aspects of image analysis have been discussed in detail such as "analogue image processing", “digital image processing”, and “image pattern recognition” and “image acquisition.

The study has been done to explore the techniques used to develop “artificial intelligence”. The techniques include: “data analysis technique”, “labelling technique”, “feature engineering technique”.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: CS- 22

ATM Security

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Abstract *An ATM is an automated teller machine. which provides computerized telecommunication equipment. Customers of a financial institution with access to financial services without the need for a human clerk to conduct transactions in public spaces or bank tellers at ATMs by entering the customer's identification into a plastic ATM card or plastic smart card with a magnetic stripe With a chip (which contains a unique card number and some safety information).*

The first ATM was installed by Barclays Bank on 27 June 1967 in Enfield, London. It is known by various other names as ATM Automated Transaction Machine, Automated Banking Machine, Cash Point (in Britain), Hole in the Wall, Ban Comet (in Europe and Russia) and Any Time Money (in India).

.INTRODUCTION

Automated teller machines (ATMs) have revolutionized the way people access financial resources, enabling convenient and fast transactions such as cash withdrawals, deposits, balance inquiries and fund transfers. As these devices become an integral part of modern banking infrastructure, ensuring their security is of utmost importance. Due to the increasing sophistication of cyber attacks and the continuous evolution of hacking techniques, it is imperative to implement strong security measures to protect the financial assets of consumers and the integrity of financial institutions.

a).Need for ATM Security: ATMs handle sensitive financial information and facilitate the transfer of large sums of money, making them prime targets for malicious activities such as card skimming, cash trapping, card trapping and malware attacks. Criminals are constantly looking for new ways to exploit vulnerabilities in ATM systems, requiring a proactive approach to security that comprehensively addresses potential threats.
Challenges in ATM Security:

b).Physical Attacks: ATMs are vulnerable to physical attacks like theft, vandalism and tampering. Criminals often target standalone machines located in remote or poorly monitored areas, making it necessary to implement measures to prevent and detect such attacks. Card skimming involves installing illegal devices that capture card information when users insert their cards into ATMs. This stolen information is then used to clone cards or make unauthorized transactions.

c).Cash Trapping and Card Trapping: Criminals use a variety of methods to trap cash or cards in ATMs, leading users to believe that a transaction has failed. Criminals retrieve trapped items when users exit the ATM.

d).Cyber Attacks and Malware: As ATMs become more interconnected and software-driven, they are more vulnerable to cyber attacks and malware infections. Attackers can exploit software vulnerabilities to gain control of ATM functions or steal sensitive data.
e).Social Engineering: Criminals can use social engineering techniques to manipulate users or ATM technicians into revealing sensitive information or taking actions that compromise security.
Enhancing ATM Security: To meet these challenges, financial institutions and ATM manufacturers are constantly working to enhance security through various strategies and technologies:
f).Physical security measures: Deploying robust physical security mechanisms, such as tamper-evident seals, security cameras, and location-based placement, can prevent physical attacks and provide evidence in case of incidents.

g).Card protection techniques: Implementing advanced card authentication methods such as EMV chip technology and contactless payments can reduce the risks associated with card skimming.

h).Anti-trapping solutions: Using anti-trapping devices, which prevent the insertion of foreign objects into card slots or cash dispensers, can thwart cash and card trapping attempts.

i).Software Security: Regularly updating and patching ATM software to address vulnerabilities can reduce the risk of cyber attacks. Additionally, using advanced encryption and authentication protocols ensures secure communication between the ATM and the bank's network.

j).Behavioral analytics: Implementing AI-based systems that analyze user behavior patterns can help detect unusual or suspicious activity at ATMs, potentially indicating fraudulent behavior.

User education: Educating customers about ATM security best practices can contribute to overall security, including covering keypads when entering PINs and being alert for any unusual attachments or devices.

Literature Review:

Shaikh and Rabaiotti (2010) [7] reviewed the examined United Kingdom identity card and found that there is a trade-off between accuracy, security and adaptability in biometric based identification frameworks where emphasizing one weakens the other.

Amurthy and Redddy (2012) [8] developed an embedded unique mark framework or fingerprint system, in which the client database With some basic data identified with records including client unique fingerprints and cell-phone numbers. As a result when a client hovers over a unique mark module each time an unmistakable four-digit code is generated and that is sent to the client's authorized cell-phone via GSM associated with the micro-controller. A client is given access to an ATM machine against the backdrop of check whether the code entered by the client is significant or not.

Onyesolu and Ezeani (2012) [9] proposed an embedded fingerprint biometric authentication scheme for automatic teller machines (ATM). They surveyed customers and employees of some commercial banks in Awka, Anambra State, South-Eastern Nigeria with a 16-item questionnaire covering participant profile, participant usage and reliability of ATMs and fingerprint biometric characteristics

As three sections they found that all ATM machine customers are aware of ATM fraud and adding fingerprints to existing ATM cards and PINs will provide better security.

ATM. Subha and Vanithashree (2012) [10] proposed a multimodal biometric data framework to provide shared authentication and key generation in ATM access. This framework is suitable for programmed access to ATM machines for confirmed clients. The fingerprint and iris features of the client are verified and the corresponding client is granted access privilege only then.

The currently extracted features generate the key points and the features are matched with the features stored in the database using the derived keys.

Methodology:

Face recognition is a biometric scan technology. Face recognition includes face scan systems that can range from high-resolution cameras, workstations, software and back-end processors. Face scan technology is used to analyze and capture facial features such as the distance between the eyes, mouth or nose, and the person's face.

An ATM system will have a camera embedded in the machine that will recognize a face standing about 2 feet away in front of the system and match it to a facial database. The system will usually make a decision in less than 5 seconds. It is very important that the face is at the right distance from the camera or system, at the right angle and the lighting is right, otherwise the distance from the camera will reduce the size of the face and therefore reduce the resolution of the image.

Facial-scan technology has a unique advantage over all other biometrics in the field of surveying large groups and the ability to use pre-existing static images.

A biometric device works to capture human characteristics such as fingerprints, iris and retina, voice and face. There are many devices that can be used for biometric authentication such as hand print detector, voice recognizer, high resolution camera and retina recognition.

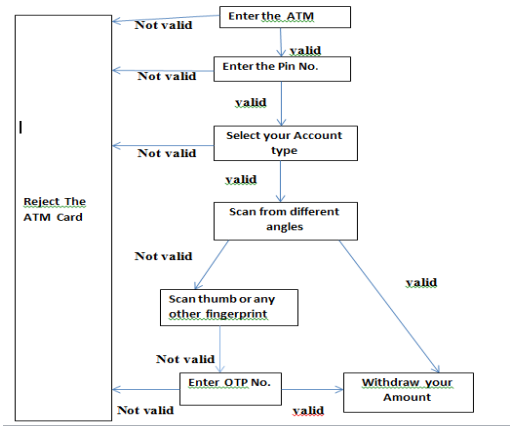

Fig a).Flow diagram of ATM security

How to work above flow diagram?

First enter the ATM card then enter the PIN number of your card. If it is not valid then it will reject the card, if the pin number is valid then select account type. Then scan the face from different angles. If it is not valid then it will scan thumb or any other fingers and if it is also not valid then you will get OTP on mobile then enter it. If it is valid then you can do the transaction. If he is disabled, he will reject the card.

Conclusion:

From the above proposed conceptual model, it is concluded that biometric ATM system is very secure. Provides authentication with body part information ie face recognition from different angles. Authentication with biometric smart cards is a robust method. Validation and verification is uniquely binding. Individuals are a viable approach, as they are easy to maintain andWork at low cost. In this paper, a new quantification ATM system technology has been introduced for secure transactions using an ATM.

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International Journal of Computer Research & Technology
ISSN 2454-7719
** A Blind Peer Reviewed Journal **
Volume-8, Issue-2, July-Dec 2023
Paper ID: LIB-01

Role of Search and Discovery Services in Modern Libraries

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Abstract:- Search and discovery services are commonly used in various contexts, including the internet, libraries, e-commerce, and content streaming platforms. The key goal of search and discovery services is to reduce information overload, improve user experience, and connect individuals with the information or resources they seek, whether it's finding a book in a library, discovering new music, or locating relevant online content. Search and discovery services in libraries streamline the process of finding, accessing, and using library materials, making libraries more user-centric and adaptable to the changing needs of patrons in the digital age.

Keywords- Discovery service, information retrieval, libraries, platforms, tools

INTRODUCTION Search and discovery services refer to tools, platforms, or systems that help users find information, content, products, or services within a vast and often overwhelming landscape of data or resources. These services are designed to make it easier for individuals to locate relevant and valuable information or items based on their specific interests, preferences, or needs. Search and discovery services are commonly used in various contexts, including the internet, libraries, e-commerce, and content streaming platforms.

1. **Search Services:** These services focus on allowing users to input specific queries or keywords to retrieve relevant results from a database or repository. Search engines like Google are a prime example of search services on the internet. In libraries, online catalogues provide search functionality to locate books, journals, and other resources.
2. **Discovery Services:** These services go beyond simple keyword-based searches. They often employ algorithms, data analysis, and user behaviour patterns to recommend content or items that users might find interesting or useful. Social media platforms and content recommendation engines on streaming services are common examples. In libraries, discovery services help users find related resources based on their initial search queries.
3. **Content Discovery:** This subset of discovery services is prevalent in the context of media consumption. Platforms like Netflix, Spotify, and YouTube use content discovery algorithms to suggest movies, music, or videos based on a user's viewing or listening history.
4. **E-commerce Discovery:** Online retailers use search and discovery services to help users find products they might want to purchase. This includes search filters, recommendation engines, and personalized product suggestions based on past shopping behaviour.
5. **Academic and Research Discovery:** In academic settings, discovery services often refer to tools that help researchers find scholarly articles, papers, and other research materials. Databases like PubMed or academic search engines like Google Scholar serve this purpose.
6. **Data Discovery:** In the context of data analysis and business intelligence, data discovery services assist users in locating relevant datasets or sources for their research or analysis. These services often involve data catalogs and metadata search capabilities.

7. **Location-Based Discovery:** Mobile apps and services often use location data to help users discover nearby businesses, services, events, or points of interest. GPS-based navigation apps are an example.

The key goal of search and discovery services is to reduce information overload, improve user experience, and connect individuals with the information or resources they seek, whether it's finding a book in a library, discovering new music, or locating relevant online content. These services rely on various techniques, including natural language processing, machine learning, and user profiling, to enhance their effectiveness.

Usefulness of search and discovery services in the library-

Search and discovery services play a crucial role in modern libraries, enhancing the overall user experience and making it easier for patrons to find and access the information and resources they need. Here are some of the key ways in which search and discovery services are useful in libraries:

1. **Efficient Information Retrieval:** Libraries house vast collections of books, journals, electronic resources, and other materials. Search services enable patrons to quickly locate specific items or topics of interest, saving them time and effort compared to manually browsing through shelves or catalogues.
2. **Expanded Access to Digital Resources:** Many libraries now offer digital collections, including e-books, e-journals, and databases. Discovery services allow users to access these digital resources seamlessly, often from remote locations, increasing the library's reach and accessibility.
3. **Relevant Content Suggestions:** Discovery services employ algorithms and user behaviour analysis to recommend related resources or suggest items of interest based on a user's search queries and past interactions. This helps patrons discover materials they may not have otherwise considered.
4. **Faceted Search and Filters:** Patrons can refine their searches using filters and facets, such as publication date, format, author, or subject. This functionality helps users narrow down search results to find exactly what they need.
5. **Interconnected Resources:** Libraries often have interconnected databases, and discovery services can link users to related resources, whether they are physical materials, e-resources, or references to other relevant works. This encourages deeper research and exploration.
6. **Accessibility and Inclusivity:** Search and discovery services can include features to improve accessibility for users with disabilities, such as screen readers and adjustable font sizes. They also support multilingual search, making library resources more inclusive.
7. **Integration of Multiple Formats:** Libraries house a wide range of materials, from printed books to multimedia and archival materials. Discovery services integrate these diverse formats into a single search interface, making it easier for users to explore different types of resources.
8. **Real-Time Availability Information:** Users can check the availability of physical materials in real-time through search services, allowing them to see if a book is on the shelf or if it's checked out, and even place holds or request items.
9. **Remote Access:** Many libraries offer remote access to their collections, and discovery services provide a user-friendly interface for accessing digital resources from anywhere, 24/7.
10. **Usage Analytics:** Libraries can use data collected from search and discovery services to analyze patron behaviour, assess the popularity of certain resources, and make informed decisions about collection development and service improvements.

Search and discovery services in libraries streamline the process of finding, accessing, and using library materials, making libraries more user-centric and adaptable to the changing needs of patrons in the digital age. They enhance the value and relevance of libraries as information hubs and educational resources for their communities.

Tools used for search and discovery services in the library-

There are several search and discovery tools and services commonly used in libraries to help patrons find and access information and resources efficiently. Here are some examples:

1. **Library Catalogues:**

- Integrated Library Systems (ILS): These are comprehensive library management systems that include cataloging, circulation, and patron management. Examples include Ex Libris Alma, Innovative Sierra, and Koha.
- Online Public Access Catalogues (OPAC): Web-based interfaces that allow patrons to search for library materials, place holds, and manage their accounts. Examples include Koha OPAC and Evergreen OPAC.

2. **Discovery Layers:**

- Summon: A discovery service by ProQuest that provides a single search interface for accessing

- a wide range of library resources, including books, articles, and digital collections.
- Primo: Ex Libris' discovery and delivery solution that combines search, discovery, and delivery in a single interface.
- EBSCO Discovery Service (EDS): A discovery tool that provides access to a library's collection of electronic resources and print materials through a single search.

3. **Open Access Discovery Tools:**

- BASE (Bielefeld Academic Search Engine): A multidisciplinary search engine for scholarly open access resources.
- CORE (Connecting Repositories): Aggregates open access content from repositories and journals worldwide.

4. **Commercial Discovery Services:**

- Many libraries subscribe to commercial discovery services provided by vendors like ProQuest, EBSCO, and Ex Libris, which offer comprehensive solutions for searching and accessing library resources.

5. **Google Scholar:** While not a library-specific tool, Google Scholar is often used by researchers to discover scholarly articles and academic resources.
6. **Library Website Search Engines:** Some libraries integrate search engines into their websites to help users find information on library services, events, and research guides.

These are just a few examples of the many search and discovery tools and services available to libraries. The choice of tool often depends on the library's specific needs, budget, and the types of resources they provide to their patrons. Libraries may also combine multiple tools to create a comprehensive discovery experience for their users.

Conclusion-

Search and discovery services are essential tools in modern libraries, enhancing the accessibility and usability of library collections. These services provide efficient access to a wide range of resources, including physical and digital materials, and facilitate the discovery of relevant content for library users. Whether through integrated library systems, dedicated discovery layers, open access tools, or specialized solutions, libraries employ a variety of tools and technologies to create user-friendly interfaces for searching, exploring, and accessing information. The continuous development and adoption of search and discovery services in libraries contribute to the adaptability and relevance of libraries in the digital age, ensuring that they remain valuable hubs of knowledge and information for their communities.

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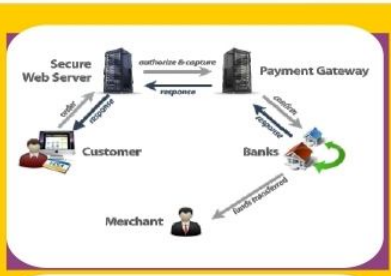
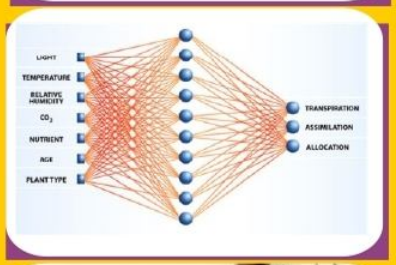
ISSN NO
2454-7719

International Journal of Computer Research & Technology (IJCRT)

A Blind Peer Reviewed Half Yearly Research Journal

Vol -8 Issue -2
July-December,2023





Special Issue

Proceeding of the 9th National Conference on "Emerging Trends in Computer & Information Technology" held on 15th September 2023

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VOL-8-ISSUE-2 IJCRT July-December,2023