FAKE NEWS DETECTION

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ABSTRACT-The misinformation presents a significant threat to societal well-being and stability. The rapid expansion of social media platforms has intensified the spread of fake news, exacerbated by the absence of effective countermeasures. This study aims to tackle this issue by investigating a range of machine learning techniques customized for analyzing and detecting fake news. Leveraging the WELFake dataset, which encompasses diverse textual data sources, we explore various methodologies, including Logistic Regression. Our research is solely focused on textual data, with the primary objective of constructing robust models capable of accurately identifying the propagation of fake news across social media platforms. Through rigorous experimentation and methodological comparison, this research endeavor seeks to push forward the field of fake news detection algorithms, thereby safeguarding society's integrity and prosperity in the digital age.

KEYWORDS: Fake News, Social Media Platforms, Machine Learning, Logistic Regression, Textual Data

I. INTRODUCTION

In contemporary times, social media networks have emerged as the predominant channel for disseminating countless news items, regardless of their nature - be it public or private. Content shared on social media platforms is readily accessible, shareable, and subject to commentary. However, this accessibility also presents a risk of encountering false information deliberately crafted to mislead or advance specific political or economic agendas, as users find it effortless to share their personal viewpoints. Moreover, misinformation tends to proliferate rapidly, extensively, and deeply within the realms of social media.

In today's landscape, the surge in fake news presents a significant challenge. Fake news, intentionally crafted misinformation disseminated via traditional news channels or social media, aims to deceive for financial or political motives[1]. This widespread circulation poses risks, including threats to national security. Regrettably, the authenticity of news shared on social platforms often goes unchecked. Consequently, there's a pressing need for automated systems to detect fake news and mitigate its adverse effects. Various strategies have emerged to protect users from the easily spread of false content on social media.

Finding fake news requires evaluating the information's reliability by looking at its sources, content, and context. It is common practice to utilize machine learning algorithms, data mining techniques, and natural language processing (NLP) approaches to find patterns and traits that distinguish genuine content from fake news. Large datasets of tagged news stories are frequently used in these methods to train models to identify traits of fake news, such as sensationalism, disinformation, or biased reporting.

In the current digital era, where information flows quickly through a variety of internet outlets, identifying fake news is an important difficulty. Misinformation, sometimes referred to as fake news, can have detrimental effects on the general public's perception, political outcomes, and even cause harm in the real world. Researchers and developers are using cutting-edge technology and algorithms to identify and stop the spread of false information in an effort to address the problem identification of fake news in various news articles. In the current digital era, where information flows quickly through a variety of internet outlets, identifying fake news is an important difficulty. Misinformation, sometimes referred to as fake news, can have detrimental effects on the general public's perception, political outcomes, and even cause harm in the real world. Researchers and developers are using cutting-edge technology and algorithms to identify and stop the spread of false information in an effort to address this problem. In order to identify fraudulent content on social media platforms, we create a model utilizing machine learning algorithms like Random Forest and Logistic Regression. And we used the flask framework along with HTML, CSS, and other programming languages to create a user interface for practical use.

This study's[2] primary goal is to lessen the spread of false information on various social media platforms. When customers use a secure online platform, it is to their great advantage. Our goal in this study is to apply a variety of techniques to assess how well algorithms detect authenticity. This will, in our opinion, greatly aid in the detection of rumors and enhance the reliability of news found on social media. It will also deter people from believing everything they see on social media without question.

II LITERATURE SURVEY

Numerous research on the identification of false news using statistical and machine learning methods have been carried out. The following is a noteworthy literature review on the detection of fake news by using news articles and social media:

Farzana Islam et al.'s research [3] used the Naive Bayes classifier technique to categorize news items that were misleading information in various types of news like political, social media news, industrial news, business news,etc. For feature extraction, they used both count vectorization and TF-IDF vectorization approaches. This methodology was used to examine two datasets of fake news from various sources that

were made publically available news in various news articles.

Experiments are conducted by Zongru Shao and Pranav Bharadwaj[4] using a false news dataset obtained by Kaggle.com.In their investigation, RNN, random forest classifiers, and a Naïve Bayes classifier were all implemented. They investigated several feature extraction methods, including Bigram and Trigram.

Fake news can also be identified using a cluster-based technique [5]. Chaowei Zhang et al. suggested a cluster-based framework (2019). The verb comparison-based fake-predicate detection and clustering processes make use of K means and affinity propagation (AP) algorithms. This method uses filters, news that doesn't fit into a cluster, or verbs that don't have a lot in common with other verbs in their cluster. TF-IDF is used to derive utilizing feature weights. A personalized dataset comprises several news stories from websites such as advocate, natural news, politico, green villegazette, and given 91% as the overall average accuracy. However, the author noted that news categories such as satire are outside the purview of this study and may require models that are trained in perspectives and viewpoints, as well as cutting-edge techniques like deep learning to construct a preprocessing module in real time, utilizing a large collection of false information from Facebook, Twitter, Reddit, and other sources.

By contrasting two distinct feature extraction strategies and six distinct classification algorithms, Hadeer Ahmad et al. [6] provide a false news detection model that makes use of n-gram analysis and machine learning techniques. The results of the conducted studies indicate that the so-called features extraction method (TF-IDF) yields the best results. The classifier they utilized, the Linear Support Vector Machine (LSVM), has a 92% accuracy rate. This model employs LSVM, which can only handle scenarios involving two linearly separated classes. Research on feature selection and attribute processing was conducted by Z. Khanam et al. in order to use machine learning models including SVM, Logistic Regression, KNN, and XGBoost. They used the SVM model and obtained an accuracy of 0.92 with a dataset they obtained from Kaggle. Fahim Belal Mahmud et al.[7] used models that included SVM, LR, and Random Forest along with strategies like Spacy and BERT.

A SVM-based model for the detection of fake news was proposed by Manisha Gahirwal [8] and included five predictive features: humor, absurdity, negative affect, grammar, and punctuation. Its goal was to ascertain whether the news article's substance was authentic. They started by obtaining the URL of the article that needs to be verified as authentic or not. After that, text is taken out of the URL. After that, text is sent to several data preprocessing departments. The article's position and the results of a Google search are what determine whether or not the news is bogus. Their model yielded an 87% accuracy rate.

III PROPOSED SYSTEM

The flow chart Fig. 1 represents the outline of our approach to identifying of false news. It involve five steps like Data collection, Data preprocessing, feature extraction model classification, Result& analysis.

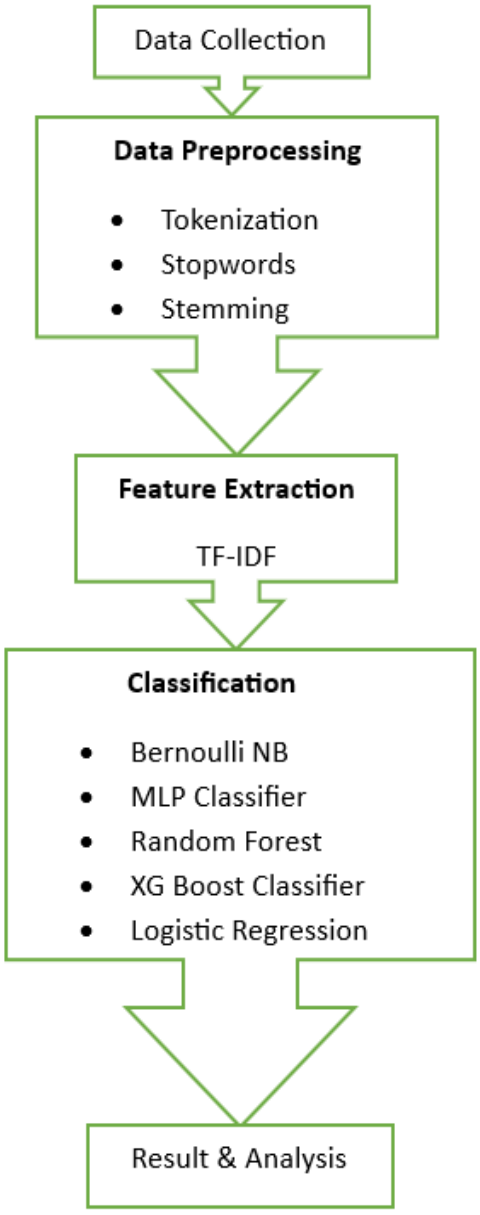

Fig. 1. General Approach for Fake News Detection

Our Model is Proposed based on certain criteria as follows :

A. Dataset Collection

B. Preprocessing Techniques

C. Feature Extraction

D. Model Creation and Evaluation

E. Result & Analysis

A.Data Collection:

The WELFake dataset [Ref. 9] was employed, consisting of 72,134 news stories, of which 35,028 were categorized as true and 37,106 as false. The authors combined four well-known news datasets (Kaggle, McIntire, Reuters, and BuzzFeed Politics) in order to reduce overfitting of classifiers and improve

the machine learning training with a bigger corpus of text data. The four columns in the dataset are the Serial number (which starts at 0), the Title (which is the news headline), the Text (which contains the news content), and the Label (which has the values 0 for fake and 1 for real). Remarkably, the dataframe indicates that only 72,134 of the 78,098 data elements in the CSV file are available for access.

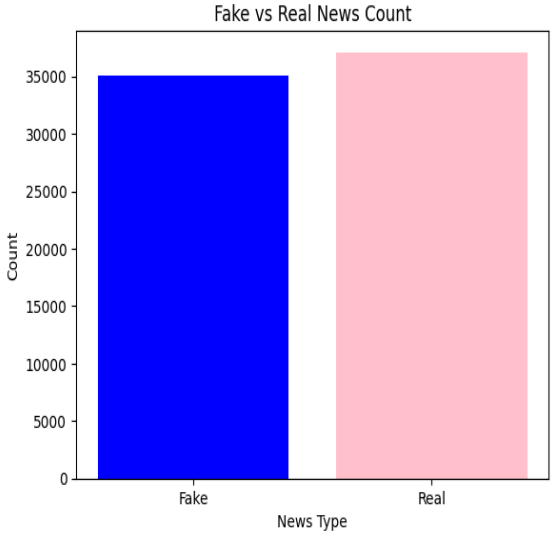

Fig. 2. Representation of Dataset

B. Preprocessing Techniques:

Data preprocessing is vital for readying unstructured data, like text, for analysis. In our study, we addressed text mining challenges using various techniques: removing stopwords, stemming, tokenization, and applying frequency-based precision.

- Convert text into lowercase, remove special charecters, punctuations, digits by using Regular expression. In this technique we get the text in lowercase by removing unwanted punctuation marks.
- Apply tokenization to convert the sentence into set of individual words. Fig. 3 represent the tokens of words before and after applying the tokenization.

```
About Time! Christian Group Sues Amazon and SPLC for Designation

['About',
 'Time',
 '!',
 'Christian',
 'Group',
 'Sues',
 'Amazon',
 'and',
 'SPLC',
 'for',
 'Designation',
```

Fig. 3. Tokenization

- Stopword removal, a typical text classification method, filters out insignificant words like "the" and "with" to refine data categorization. The Fig. 4 represents the stopwords removal in the dataset. By comparing with certain set of stopwords remove the stopwords in given dataset.

```
{'an', 'too', 'the', 'against', "don't", 'by', 'doing', "shan't", "you'll", 'him', 'not'
Before stopwords: ['About', 'Time', '!', 'Christian', 'Group', 'Sues', 'Amazon', 'and',
after stopwords ['About', 'Time', '!', 'Christian', 'Group', 'Sues', 'Amazon', 'SPLC', '
```

Fig. 4. Stopwords Representation

- Stemming simplifies words to their root form. tokenization divides text into separate tokens, ensuring uniformity.
  Ex: Calling is taken as Callin
  Fig. 5 represent removing unwanted words by using stemming.

```
before stemming: ['About', 'Time', '!', 'Christian', 'Group', 'Sues', 'Amazon'
<PorterStemmer>
after stemming ['about', 'time', '!', 'christian', 'group', 'sue', 'amazon', '
```

Fig. 5. Stemming Representation

Fig.6 Represents the wordcloud of fake labeled data from the dataset used.It represent the most frequent words in fake data

Fig. 6. Word Cloud of Fake Label Data From Dataset

Fig. 7. Represents the word cloud of the Real labeled data from given dataset. It represents the most frequent words from data.

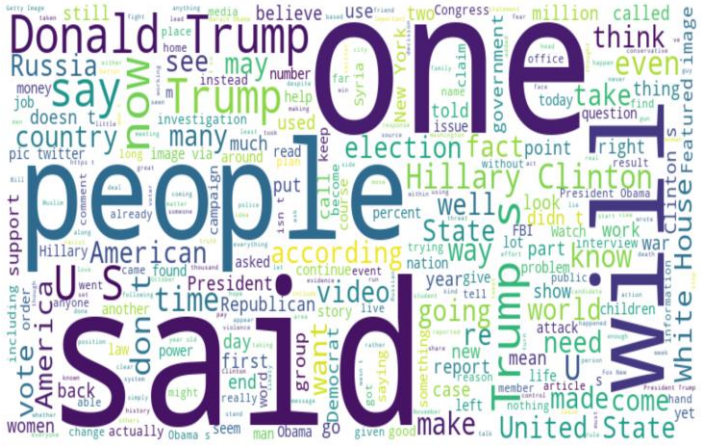

Fig. 7. Word Cloud of Real Label Data From Dataset

C.Feature Extraction:

Using this method, textual input is transformed into binary vectors made up of 0s and 1s. This conversion makes it easier to train algorithms for classification. A new vector is created for every new entry in the example text file.These vectors can be produced using the TF-IDF approach.TF-IDF vectorizer: One of the most popular techniques for the first stage, or feature extraction, is the term frequency-inverse document frequency (TF-IDF) vectorizer [10] This method consists of two steps: the term frequency (TF) is calculated in the first step, and the inverse document frequency (IDF) is computed in the second Term Frequency is calculated by dividing the total number of terms in a document by the number of times a term appeared in it.
Log(Total number of documents / Number of documents containing the word) yields the inverse document frequency.

D. Model Creation And Evaluation:

The following Machine learning and deep learning algorithms were used in this study:

Bernoulli Naive Bayes, Multilayer Perceptron, Random Forest Classifier, XGBoost Classifier, Logistic Regression.

- *BernouliNB:*
  The underlying premise of Bernoulli Naive Bayes is that features are binary or boolean values. To ascertain the probability of each class given supplied features, it computes the likelihood of each feature for each class. In order to determine the joint probability of the input feature vector given the class,it multiplies the likelihoods for each feature. Then, using the input feature vector as a basis, Bernoulli The confusion matrix of BernouliNB is shown in Fig. 8.

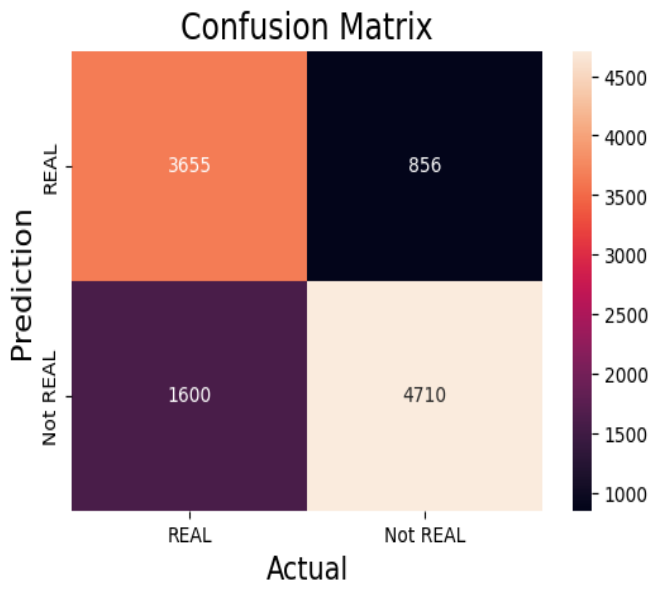

Fig. 8. Confusion Matrix of BernouliNB

Fig. 9 represent the Roc Curve of bernouli NB. An ROC curve (receiver operating characteristic curve) is a graph showing the performance of a classification model at any classification thresholds. This curve plots two parameters True Positive Rate, False Positive Rate.

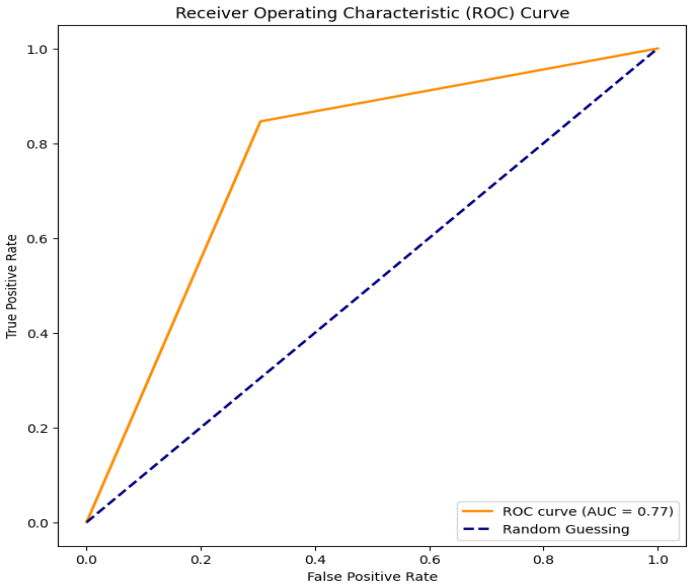

Fig. 9. ROC Curve of Bernouli NB

Fig. 10 reprsent the accuracy,precision,F1-Score,Recall of Bernouli NB.

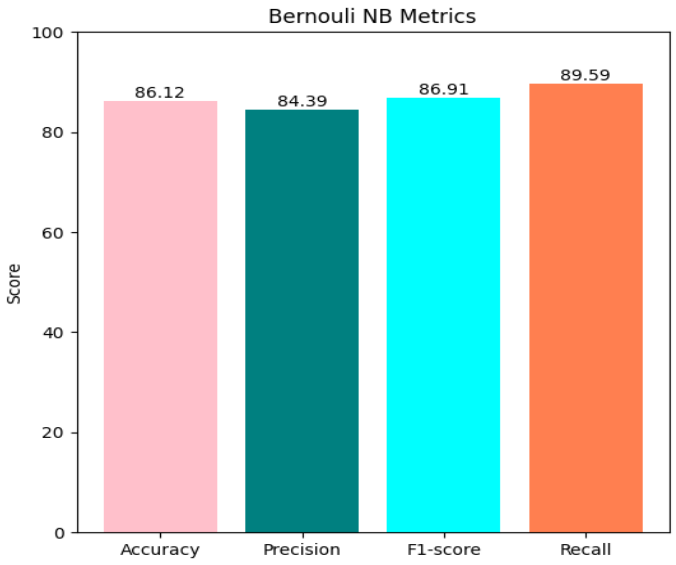

Fig. 10. Metrics of Bernouli NB

Fig.11 represent the classification report of MLP. It includes accuracy,precision,recall,support.

	precision	recall	f1-score	support
0	0.695528	0.810242	0.748515	4511.000000
1	0.846209	0.746434	0.793196	6310.000000
accuracy	0.773034	0.773034	0.773034	0.773034
macro avg	0.770869	0.778338	0.770856	10821.000000
weighted avg	0.783394	0.773034	0.774570	10821.000000

Fig. 11. Classification Report of BNB

- *Multilayer Perceptron:*
  One kind of artificial neural network that is frequently used for supervised learning is the MLP Classifier[11]. It is composed of several interconnected layers of nodes, each of which produces an output by applying an activation function to the weighted sum of its inputs. MLPs are widely used in many different fields, including natural language processing, speech recognition, and image recognition.
  Fig. 12 represnts the confusion matrix of the MLP classifier.It helps to understand the Actual and prediction values for the model

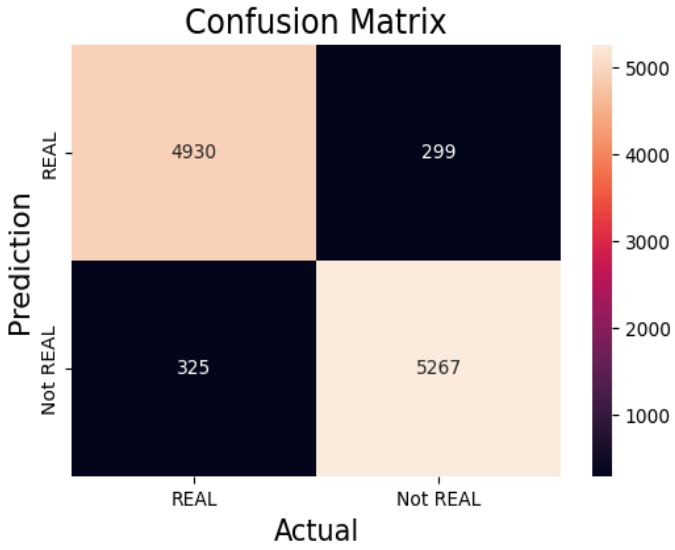

Fig. 12. Confusion Matrix of MLP

Fig. 13 represent ROC Curve of the model and it represents the true positives of model, false positives of model by consider the threshold range.

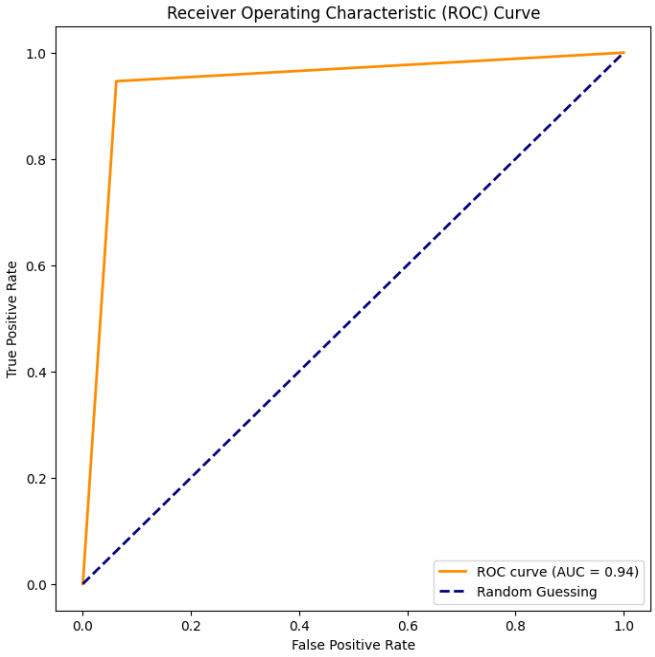

Fig. 13. ROC Curve of MLP Classifier

Fig. 14 represents the Metrics accuracy, precision, Recall, F1-score of the model MLP classifier

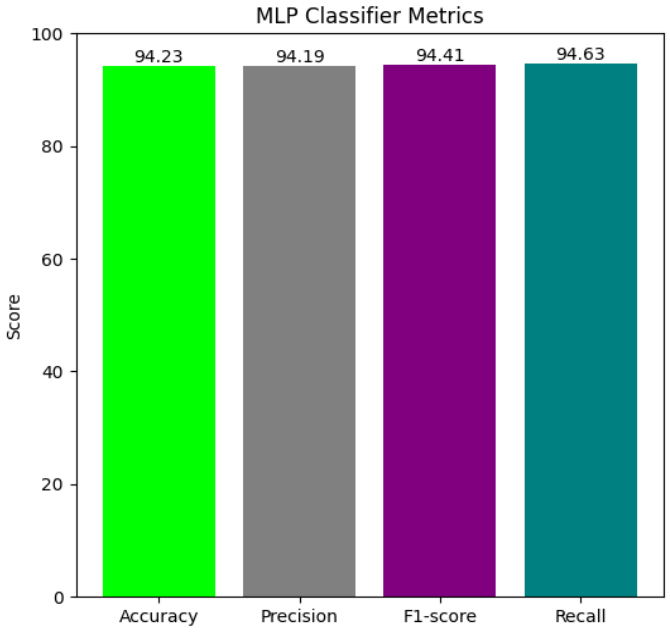

Fig. 14 Metrics Of MLP

Fig.15 represent the classification report of MLP
It includes accuracy,precision,recall,support.

	precision	recall	f1-score	support
0	0.938154	0.942819	0.940481	5229.000000
1	0.946281	0.941881	0.944076	5592.000000
accuracy	0.942334	0.942334	0.942334	0.942334
macro avg	0.942218	0.942350	0.942278	10821.000000
weighted avg	0.942354	0.942334	0.942339	10821.000000

Fig. 15. Classification Report of MLP

- *Random Forest:*
  The Random Forest Classifier is an ensemble machine learning method that combines several decision trees to increase prediction accuracy and consistency. In order to determine the class, it builds a large number of decision trees during training and aggregates the projected classes from each individual tree[12]. Random Forests are very good at capturing nonlinear correlations between input features and output classes and are particularly good at managing big, high-dimensional datasets.
  Fig. 16 Represent the confusion matrix of the Random Forest algorithm. It used to identify actual and prediction values for the dataset.

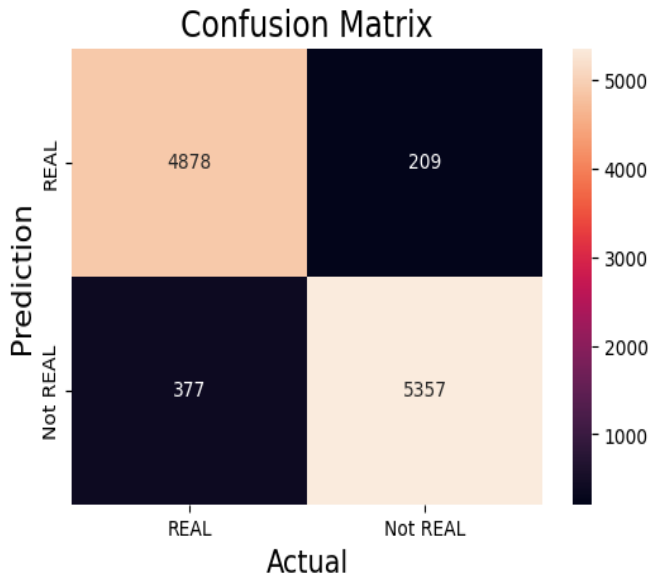

Fig. 16. Confusion Matrix of Random Forest

Fig. 17 represent the Roc Curve of random Forest. It represent the true postives rate of model,false positives rate of the model.

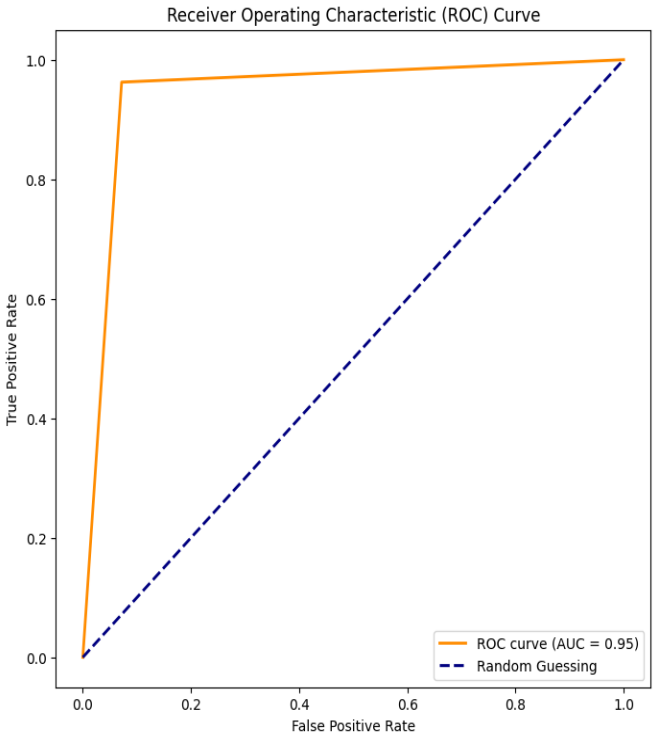

Fig. 17. ROC Curve of Random Forest

Fig. 18 reprsent the accuracy,precision,F1-Score,Recall of Random Forest.we get accuracy 94.58, precision 93.43,F1-Score 94.81 and recall 96.24 for the model Random Forest.

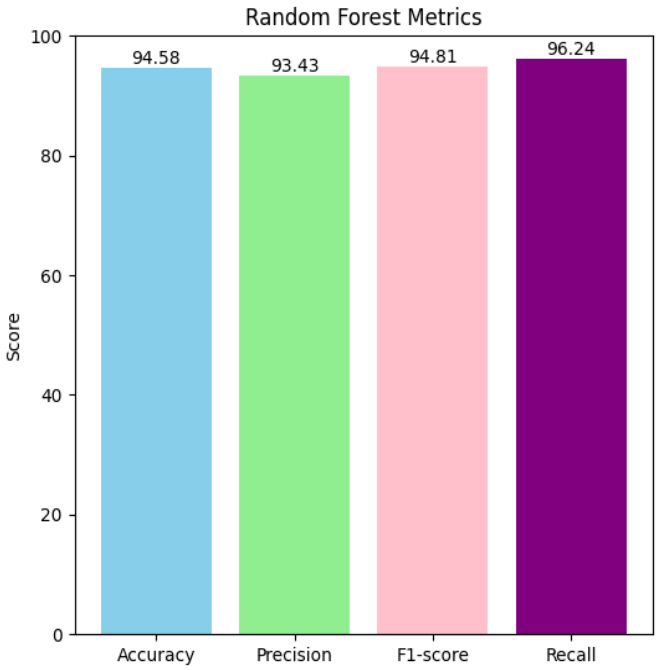

Fig.18 Metrics of Random Forest

Fig.19 represent the classification report of Random Forest. It includes accuracy,precision,recall,support.

	precision	recall	f1-score	support
0	0.928259	0.958915	0.943338	5087.000000
1	0.962451	0.934252	0.948142	5734.000000
accuracy	0.945846	0.945846	0.945846	0.945846
macro avg	0.945355	0.946583	0.945740	10821.000000
weighted avg	0.946377	0.945846	0.945883	10821.000000

Fig. 19. Classification report of Random Forest

- *XGBoost:*
  A potent machine learning technique that is frequently used in supervised learning contexts like regression and classification is called the XGBoost (Extreme Gradient Boosting) Classifier. It is notable for being a highly optimized gradient boosting method implementation that makes use of several decision trees to increase prediction efficiency and accuracy. Gradient descent methods are used by XGBoost[13] to optimize the objective function and trim decision trees to avoid overfitting. Interestingly, it supports parallel processing to speed up model training and can manage missing values and feature interactions.

  Fig. 20, Represents the confusion matrix of XG Boost Classifier.

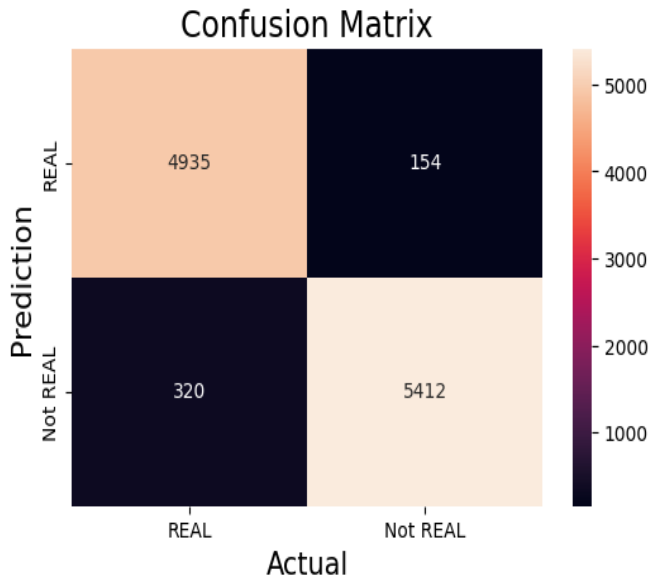

Fig. 20. Confusion matrix of XG Boost

Fig. 21 represent the Roc Curve of XGB Classifier.It represent the true postives rate,false positives of model.

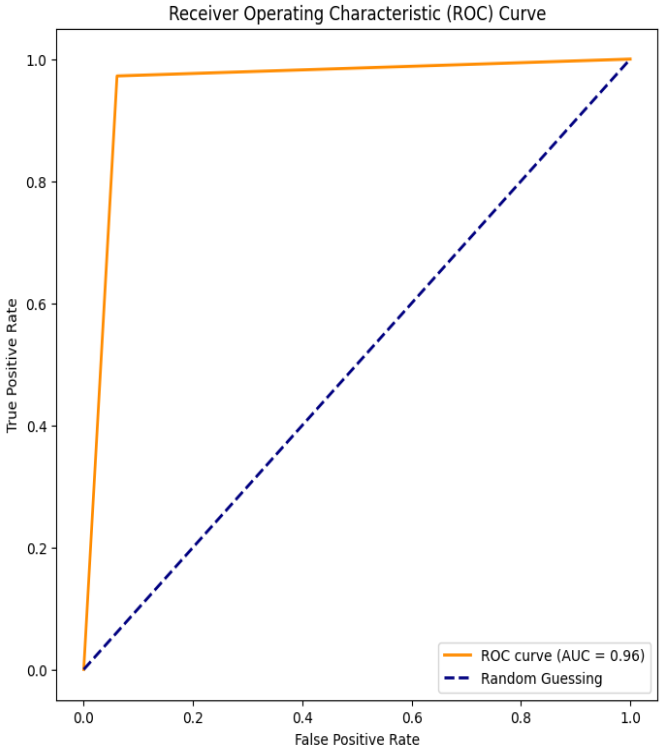

Fig. 21. ROC Curve of XGB Classifier

Fig. 22 represnts the metrics of XGB Classifier like accuracy,precision,Recall,F1-score.

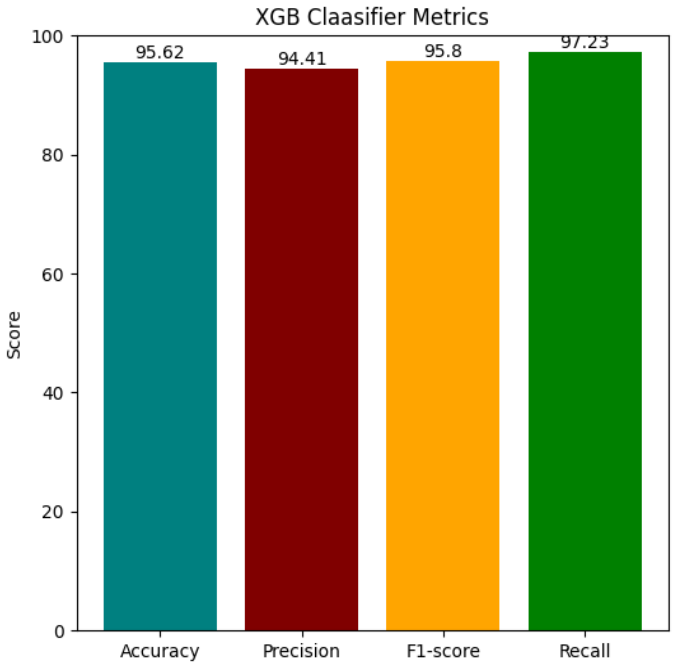

Fig. 22. Metrics Of XGB Classifier

Fig.23 represents the classification report of XGB Classifier.it include accuracy,precision,f1- score,support.

	precision	recall	f1-score	support
0	0.956666	0.939705	0.948110	35028.000000
1	0.944019	0.959818	0.951853	37106.000000
accuracy	0.950051	0.950051	0.950051	0.950051
macro avg	0.950342	0.949762	0.949981	72134.000000
weighted avg	0.950160	0.950051	0.950035	72134.000000

Fig. 23. Classification report of XGB

- *Logistic Regression:*
  Regression using Logistic Regression For binary classification, it is employed. When designing the optimal bit line for binary classification, linear regression is always employed. When two classes can be separated linearly, logistic regression is used to solve the problem.
  The main principle of logistic regression is to use a logistic function, sometimes referred to as the sig-moid function, to estimate the likelihood that an instance belongs to a specific class.

  Fig. 24.Represents the confusion matrix of the model Logistic Regression

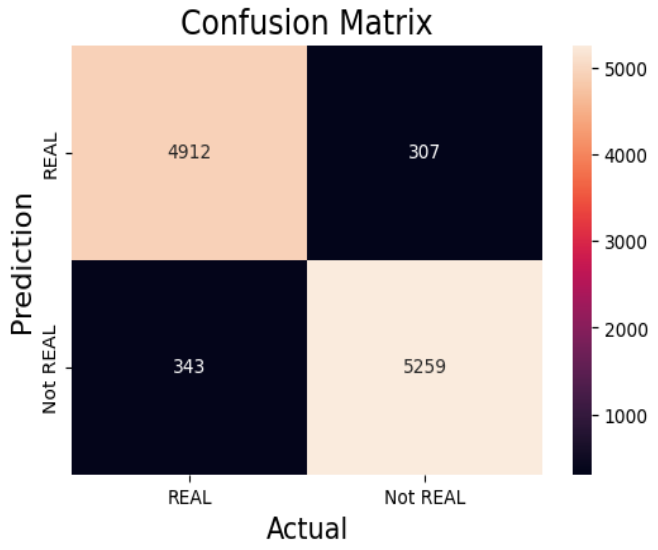

Fig. 24. Confusion Matrix of Logistic Regression

Fig. 25 represent the Roc Curve of Logistic Regression. It represent the true positive rate of model

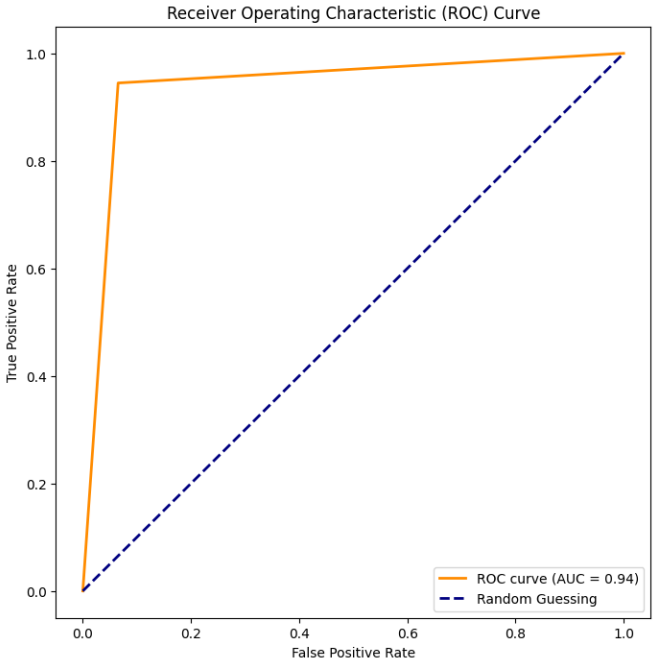

Fig. 25. ROC Curve of Logistic Regression

Fig. 26 represent the metrics accuracy,precision,recall,F1-score of the model Logistic Regression.Here we get 96.12 accuracy, 95.98 precision,96.24 F1-Score,97.30 recall. Accuracy used to find true positives rate of the model. Precision defines the False positives of the model Logistic Regression.

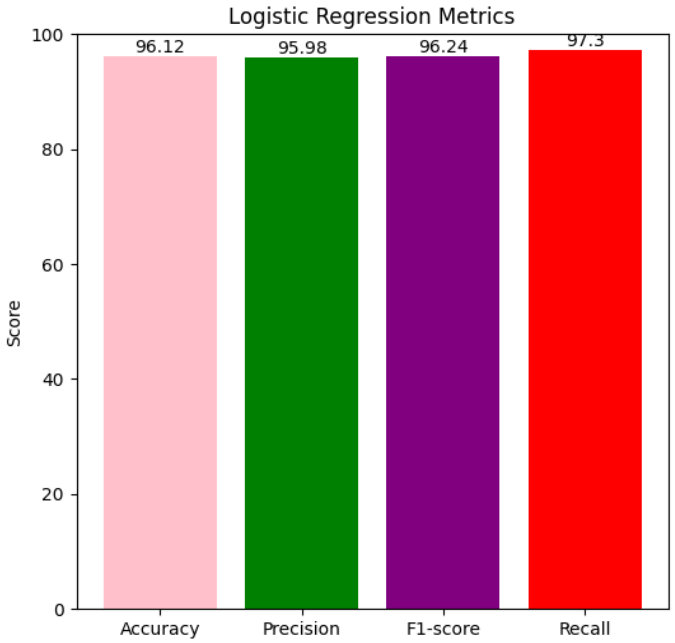

Fig. 26. Metrics Of Logistic Regression

Fig.27 represent the classification report of logistic Regression It includes accuracy,precision,recall,support. For the metrics accuracy.In the figure we identified that we get the macro avg,weighted avg of the accuracy for the model logistic Regression.

	precision	recall	f1-score	support
0	0.956666	0.939705	0.948110	35028.000000
1	0.944019	0.959818	0.951853	37106.000000
accuracy	0.950051	0.950051	0.950051	0.950051
macro avg	0.950342	0.949762	0.949981	72134.000000
weighted avg	0.950160	0.950051	0.950035	72134.000000

Fig. 27. Classification Report of Logistic Regression

E. Result & Analysis:

Among all specified machine learning alogorithms logistic Regression, Random Forest, Bernouli NB,MLP Classifier,XG Boost Classifier.

Fig. 28 represents the accuracy of different models. We have evaluated different models.We get acuuracy for Bernouli NB 86%, for Multi Layer Perceptron 94%,for XG Boost Classifier 95%,for Random Forest 94%,for Logistic Regression 96%. We get highest accuracy for Logistic Regression.So we consider logistic Regression as the best model among all model we consider.By comparing all the evaluated models in this study we conclude that the logistic Regression model get higher accurate results based on all other evaluated models.so we can consider logistic Regression is the best model.

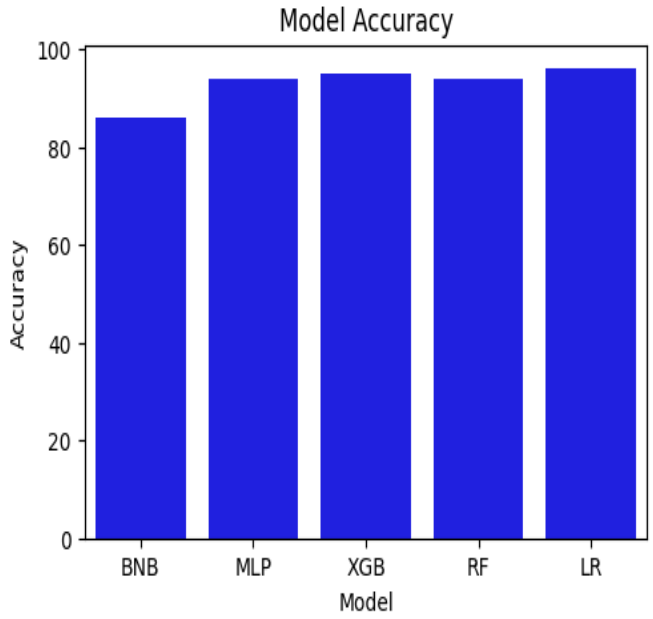

Fig. 28. Repersentation of Acuuracy of all models

Fig. 29 represents the precision of different models. We have evaluated different models.We get precision for Bernouli NB 84%, for Multi Layer Perceptron 94%,for XG Boost Classifier 94%,for Random Forest 93%,for Logistic Regression 95%. We get highest precision for Logistic Regression. So we consider logistic Regression as the best model among all model we consider.

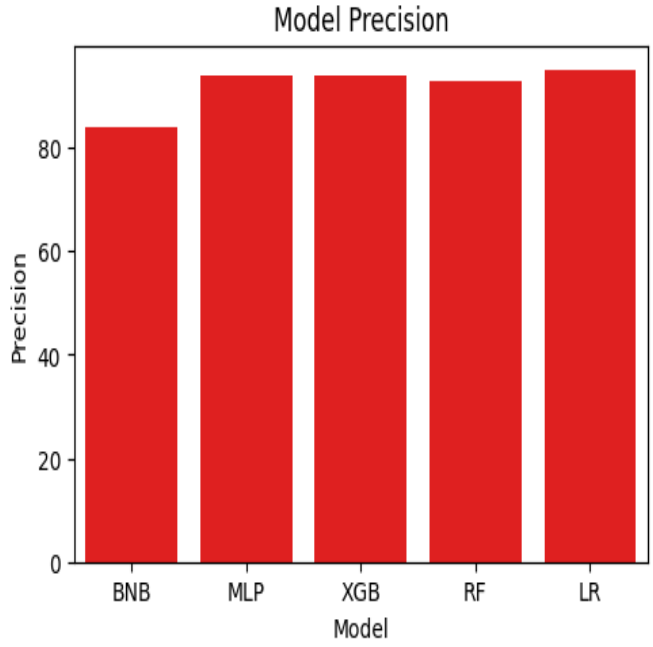

Fig. 29. Representation of Precision of all models

Fig. 30 represents the recall of different models. We have evaluated different models.We get recall value for Bernouli NB 89%, for Multi Layer Perceptron 94%,for XG Boost Classifier 97%,for Random Forest 96%,for Logistic Regression 97%. We get highest precision for Logistic Regression. So we consider logistic Regression as the best model among all model we consider.

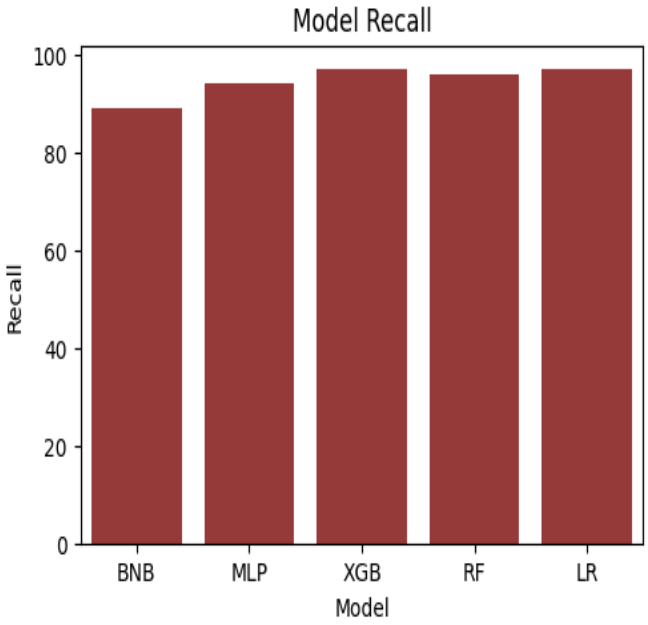

Fig. 30. Representation of Recall of all models

Fig. 31 represents the F1-Score of different models. We have evaluated different models.We get F1-Score for Bernouli NB 86%, for Multi Layer Perceptron 94%,for XG Boost Classifier 95%,for Random Forest 94%,for Logistic Regression 96%. We get highest precision for Logistic Regression. So we consider logistic Regression as the best model among all model we consider.

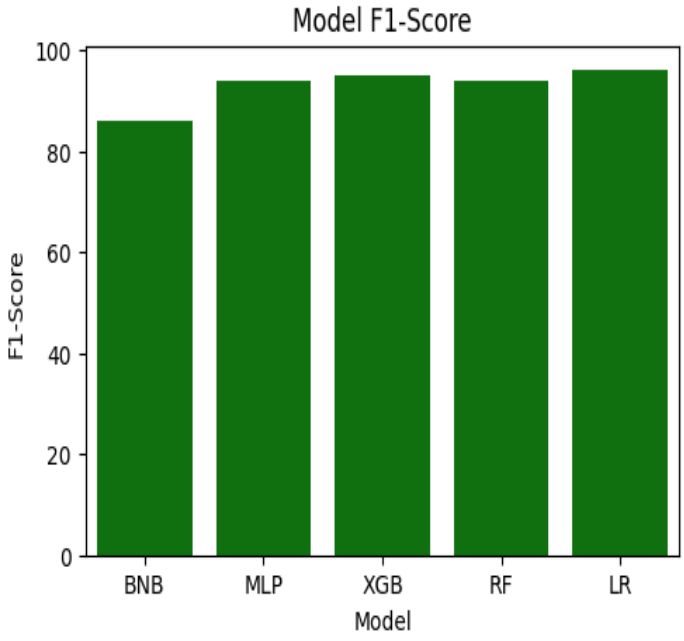

Fig. 31. Representation of F1-Score of all models

The below table 1. Represent the comparision of different models like Bernouli NB,MLP Classifier,Random Forest,Logistic Regression.It represents the accuracy,precision,F1 score,Recall for all evaluated models.Among all the models defined in table we get highest accurate result for Logistic Regression.

Model	Accuracy	Precision	F1 score	Recall
Bernouli NB	**86%**	**84%**	**86%**	**89%**
MLP Classifier	**94%**	**94%**	**94%**	**94%**
XGB Classifier	**95%**	**94%**	**95%**	**97%**
Random Forest	**94%**	**93%**	**94%**	**96%**
Logistic Regression	**96%**	**95%**	**96%**	**97%**

Table1: Comparision of all models

Fig. 32 Represents the comparison all evaluated model of existing system and proposed system.From Fig. 9 we can conclude that we get same accuracy 95% for both XGB Classifier,Logistic Regression. precision 95% for Logistic Regression,F1-score 96% for Logistic Regreesion,Recall 97% for Xgb Classifier and Logisctic Regression.

By this we conclude that Logistic Regression get highest values for all metrics.So,we consider this as best model.

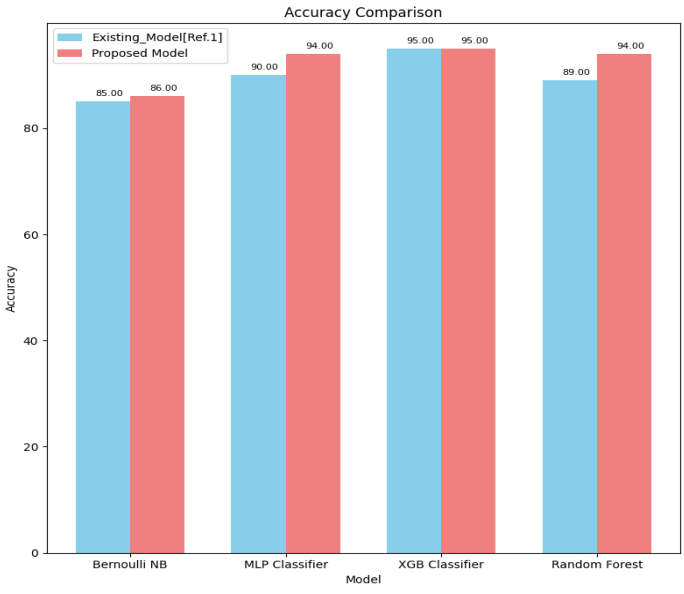

Fig. 32.Comparision of models with existing system

IV.Conclusion And Future Scope

In conclusion, this study explored the application of five popular machine learning algorithms,[15] Random Forest, Bernoulli NB,MLP Classifier,XGB Classifier and Logistic Regression, for predicting the Real and Fake news.The results obtained indicate that the five algorithms can be effective in generating accurate predictions for Logistic Regression than remaining algorithms in terms of accuracy and efficiency. Future research can expand on this work by using more complex features, exploring alternative algorithms, and analyzing the model's performance on a larger dataset of different categories of News

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