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Accurate Fake News Prediction by Comparing Performance of Machine learning algorithms

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Abstract

With the advancement of technology and the widespread use of media there has been an increase, in the circulation of fake news. Unfortunately, some individuals intentionally spread information to manipulate opinion and drive traffic to specific websites. One such instance occurred during the Covid 19 pandemic when misleading rumors started circulating falsely claiming that Covid vaccines were linked to heart attacks and infertility. These baseless claims created hesitancy among people regarding vaccination. To assist individuals in identifying news accurately this paper compares the performance of various machine learning algorithms such as Passive Aggressive Classifier, Decision Tree, Random Forest, Logistic Regression and Naïve Bayes. After evaluating their results, it was determined that the Passive Aggressive Classifier achieved an accuracy rate of 98.2% followed by Naïve Bayes with 96.59% accuracy Random Forest with 96.95% accuracy, Decision Tree with 96.23% accuracy and Logistic Regression with 97.22% accuracy. Based on these findings it can be concluded that the Passive Aggressive Classifier is the algorithm for predicting fake news among all five models tested in this study. The data used for building these machine learning models was obtained from Kaggle website. The primary objective of this research paper is to provide guidance to individuals seeking to choose an algorithm that offers accuracy, in detecting news.

Keywords: *Decision Tree; Logistic Regression; Naïve Bayes; Passive Aggressive Classifier; Random Forest;*

1. Introduction

The push of social media to the top as a major medium for capturing information has had a huge impact in spreading fake news. The ease with which data can be shared on social media without proper verification has increased the spread of fake news As a result, it has become increasingly difficult for users to distinguish authentic data from fake news between Additionally, the algorithms used by social media systems tend to engage first with virality over accuracy, promoting sensational or fraudulent content This has created an environment where fake news can use pull faster and reach more people targeted side, apart from the persistence of misinformation and public acceptance of the facts as to the truth of the equitable property as the ultimate outcome it is important that those who social media uses and policies take proactive measures to prevent the spread of false information. This has blurred the tension between real and fake news, making it harder for consumers to tell what is genuine and what is not because of this as a way to protect you this we use the tool to learn certain rule mechanisms to identify real and gaming issues. The use of gadget learning algorithms to obtain real and fake information is a really important way to prevent misrepresentation. The capabilities of algorithm information, such as deliverability, language style, content consistency and ability to detect fake information can be investigated by studying different methods and comparing analysis with property information a of reliable acceptance.

2. Literature Survey

Dr.S.Gowri et al [1] says about the computational model for detecting fake news using machine learning techniques. This model utilizes a machine learning technique and TF - IDF vectorizer on a

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proposed dataset to achieve better efficiency in detecting fake news. This paper includes models based on content, user reaction and source quality. The authors highlight the social impact of fake news and need for improvised method in detecting fake news. Shwetha D.Mahajan [2] discusses the news classification using machine learning techniques, focusing on a news related dataset with various categories such as entertainment ,education ,sports and politics. They use classifying algorithms and word vectorizing techniques to improve performance of classification model. They compare the model with Naïve Bayes and TF-IDF vectorizer. Results evaluated based on precision, recall, F1 score and accuracy. Jithin Joseph et al [3] discusses a hybrid approach for fake news detection using multinomial voting algorithm. It achieves a precision score of 94% on phony dataset. Algorithms used are Naïve Bayes, Decision tree, Random Forest, K Nearest Neighbours and Support Vector Machine. The impact of fake news on individuals and organizations is highlighted and solved the problem using machine learning techniques.TF-IDF method also used for information retrieval. Dr.S.Madhavi et al [4] proposes fake news detection using machine learning algorithms like Support Vector Machine and Naïve Bayes. Decision tree classifier used in data mining and information analysis. Sentiment analysis and text mining techniques are employed to identify fake news and spams in online platforms. Decision tree and along with property-oriented induction are used for efficient classification. Tao Jiang et al [5] focuses on social media as a major source of news and challenge of identifying fake news. Five machine learning algorithms performance are evaluated (i.e.) Logistic regression, Naïve bayes, Decision tree, Random Forest and Support Vector Machine and used two deep learning algorithms such as CNN and LSTM based on ISOT dataset and KD nugget dataset. They use accuracy, precision, recall, F1score as evaluation metrics and corrected version of McNemar's test to determine the model's performance. Ahm Al Ayub Ahmed et al [6] proposes a systematic literature that focusses on use of machine learning techniques for detecting fake news. Supervised machine learning algorithms are also used. Naive bayes, Logistic regression, Recurrent neural network, Random Forest and K Nearest Neighbours. It shows how difficult to use supervised learning for detection of fake news and advises to use unsupervised algorithms. Rohit Kumar Kaliyar et al [7] proposes a Bert based deep learning approach for fake news detection in social media. They combine the single layer of deep convolution neural network with Bert to handle ambiguity and improve classification. Experiments are performed on CNN and LSTM algorithms along with pretrained word embedded techniques such as BERT and GloVe. The performances are analysed and compared with benchmark results. Hagar Saleh et al [8] addresses the issue of fake news and its impact on social cohesiveness and political polarization. This paper aims to provide optimized convolution neural network model (OPCNN-Fake) for detection of fake news and compares the results with RNN and LSTM. NGram, TF-IDF and Glove word embedding are used to extract features from datasets. Grid search and hyper opt optimization techniques used to optimize parameters of ML and Dl models. Faraz Ahmad et al [9] proposes deep learning methods to detect fake news and uses different types of neural networks such as CNN, LSTM and feed forward and were trained and evaluated on labelled dataset of real and fake news. The models performed effectively in detecting fake news with convolutional and LSTM showing the most effectiveness. Supanya Aphiwongsophon et al [10] says machine learning techniques as effective means to predict fake news. Naive bayes, Neural network and Support vector machine have been used to predict fake news. Normalization method is used for cleaning the data. The results show that Naïve Bayes shows that accuracy 96.08% and Neural network and Support machine shows the accuracy of 99.90%. The results provide the highest accuracy for fake news detection. Sheng How Kong et al [11] aims to apply Natural language processing methods and deep learning methods to detect fake news. Tensor flow with built in Kera's is used as a framework. Model evalution is done using recall and precision metrics. This study aims to compare the performance of different deep learning algorithms such as RNN and LSTM. Sherry Girgis et al [12] proposes RNN models such as vanilla, GRU, LSTM to detect fake news. They were evaluated on LAIR dataset and GRU provided the

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highest accuracy .217 followed by LSTM having 0.216 and Vanilla having 0.215. To increase the accuracy a hybrid model by combining GRU and CNN is applied to the dataset. Chaitra.K.Hiramath et al[13] proposes to detect fake news by using Deep neural network, Logistic regression ,Naïve bayes ,Support vector machine and Random Forest.The framework is based on java system and uses Netbeans and SQL for database. The performance comparison shows DNN has higher accuracy than others. The dataset used to train the models are PHEME dataset and Liar dataset. Ethar Qawasmeh et al[14] proposes the challenge of identifying the fake news in online communication platforms. The author proposes the automatic identification model based on bidirectional LSTM.The dataset used is FNC-1 dataset derived from Craig Silverman. The proposed model achieves a accuracy of 85.3%. Junaed Younus Khan [15] focusses on fake news in social media and its potential impacts. Various pretrained language models, deep learning models and traditional models for fake news detection were used.BERT was found to provide the best results. Models were all based on article length and article topics. They used three different types of datasets the largest and most diversified ones.

3. Algorithms Used in This Paper

3.1 Logistic Regression

Logistic regression is one of the immensely useful statistical techniques in use for evaluating information. Using mathematical principles, it can establish relationships between variables. It is often used in classification and predictive analytics because it correctly predicts the probability of an event, yes or no, on the basis of a given set of independent variables. It is, in fact, an extension of the linear regression techniques. Logistic regression function

$$f(x) = \frac{1}{1 + e^{-x}}$$

3.2 Naïve Bayes

One of the most frequent algorithms applied in text classification is probably Naïve Bayes. It's based on the famous Bayes theorem, one of the ideas that comprise the core of probabilistic machine learning. The unique property of this algorithm is that it learns to distinguish between classes without learning the most significant features, unlike discriminative classifiers, like logistic regression.

$$P(Y \,/\, X) \;=\; P(X \; and \; Y)\; P(X)$$

3.3 Random Forest

Random forests are powerful machine learning algorithms that consist of many decision trees. Their main function is to classify email and news with a good degree of accuracy as either spam or not spam. This algorithm will turn out with very high precision and has significant feature importance, hence making the cross-validation or a separate test set in the estimation of test errors null.

$$m = sqrt\ root(p)$$

3.4 Decision Tree

The Decision Tree has a strong classification and regression ability, both of which help in supervised learning. But it often deals with a problem of course. In this technique, the data can be branched efficiently under some conditions of features, having a tree-like structure. There exist two faculties on the Decision Tree: the Decision Node faculty and the Leaf Node faculty. While the former would be the decision maker, the latter would be the result obtained from that decision and hence would not reach any further funding. The building of the tree was done using the CART algorithm, which stands for `Classification and Regression Tree algorithm`.

$\boldsymbol{G(t) = 1 - \sum i = 1C(pi)2}$ where C is the number of classes, and p is the proportion of class i instances in node t.

3.5 Passive Aggressive Classifier

The passive aggressive algorithm is a relevant tool of machine learning, heavily utilized in the online field, principally for classification problems. It turns out to be very useful with large amounts of data, often happening in big data applications. In these instances, the size of the data might be small enough that it is not possible to train the whole dataset. Therefore, the passive aggressive algorithm will become one of the prime options. In summary, the passive aggressive classifier is one of the great algorithms for systems dealing with a stream of data.

$w' = w + \Delta w$

$b' = b + \Delta b$

where w' and b' are the updated weight vector and bias term

4. Dataset

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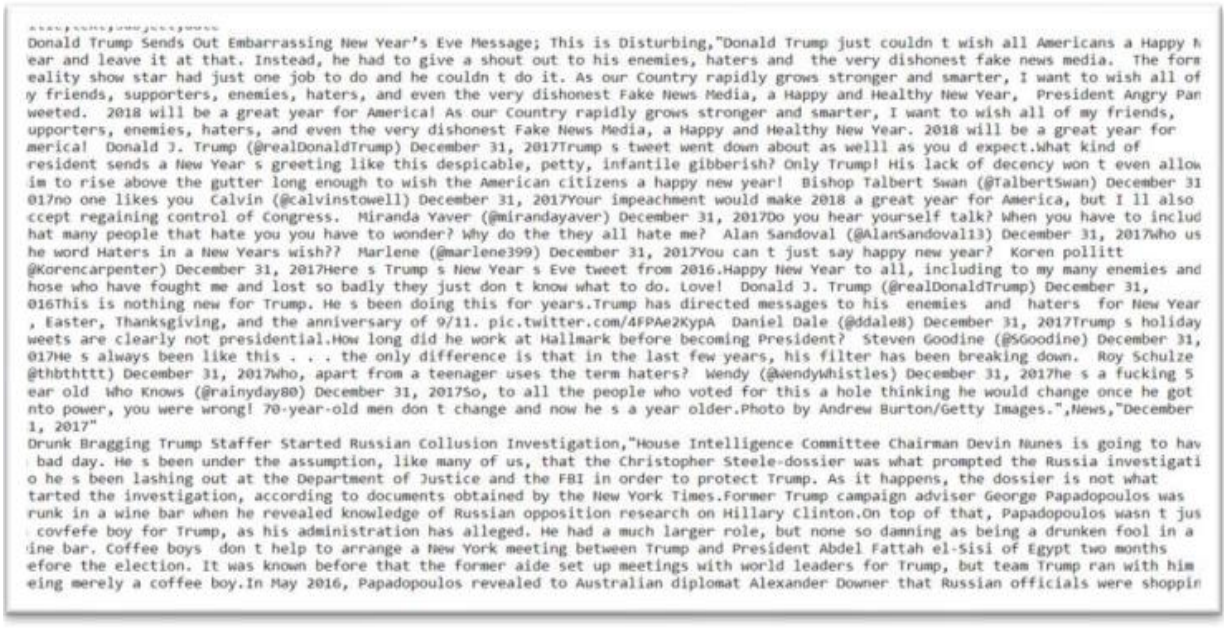
Kaggle is a international information technology and machine learning competition platform that gives access to a wide variety of datasets for diverse programs. Right here, statistics scientists and system getting to know practitioners can locate and put-up datasets, as well as discover and construct fashions in an internet-based statistics technological know-how environment. They also can collaborate with different experts inside the subject and participate in competitions to clear up facts technology challenges.

By way of utilizing the energy of crowdsourcing and the understanding of statistics scientists, Kaggle enables individuals and agencies to address complex troubles and drive innovation inside the field of statistics technological know-how and system studying. In this venture we've use fake news shown in Figure 1 and real news shown in Figure 2 dataset from Kaggle, shown in Table 1.

title,text,subject,date
"As U.S. budget fight looms, Republicans flip their fiscal script","WASHINGTON (Reuters) - The head of a conservative Republican faction in the U.S. Congress, who voted this month for a huge expansion of the national debt to pay for tax cuts, called himself a "fiscal conservative" on Sunday and urged budget restraint in 2018. In keeping with a sharp pivot under way among Republicans, U.S. Representative Mark Meadows, speaking on CBS' "Face the Nation," drew a hard line on federal spending, which lawmakers are bracing to do battle over in January. When they return from the holidays on Wednesday, lawmakers will begin trying to pass a federal budget in a fight likely to be linked to other issues, such as immigration policy, even as the November congressional election campaigns approach in which Republicans will seek to keep control of Congress. President Donald Trump and his Republicans want a big budget increase in military spending, while Democrats also want proportional increases for non-defense "discretionary" spending on programs that support education, scientific research, infrastructure, public health and environmental protection. "The (Trump) administration has already been willing to say: 'We're going to increase non-defense discretionary spending ... by about 7 percent,'" Meadows, chairman of the small but influential House Freedom Caucus, said on the program. "Now, Democrats are saying that's not enough, we need to give the government a pay raise of 10 to 11 percent. For a fiscal conservative, I don't see where the rationale is. ... Eventually you run out of other people's money," he said. Meadows was among Republicans who voted in late December for their party's debt-financed tax overhaul, which is expected to balloon the federal budget deficit and add about $1.5 trillion over 10 years to the $20 trillion national debt. "It's interesting to hear Mark talk about fiscal responsibility," Democratic U.S. Representative Joseph Crowley said on CBS. Crowley said the Republican tax bill would require the United States to borrow $1.5 trillion, to be paid off by future generations, to finance tax cuts for corporations and the rich. "This is one of the least ... fiscally responsible bills we've ever seen passed in the history of the House of Representatives. I think we're going to be paying for this for many, many years to come," Crowley said. Republicans insist the tax package, the biggest U.S. tax overhaul in more than 30 years, will boost the economy and job growth. House Speaker Paul Ryan, who also supported the tax bill, recently went further than Meadows, making clear in a radio interview that welfare or "entitlement reform," as the party often calls it, would be a top Republican priority in 2018. In Republican parlance, "entitlement" programs mean food stamps, housing assistance, Medicare and Medicaid health insurance for the elderly, poor and disabled, as well as other programs created by Washington to assist the needy. Democrats seized on Ryan's early December remarks, saying they showed Republicans would try to pay for their tax overhaul by seeking spending cuts for social programs. But the goals of House Republicans may have to take a back seat to the Senate, where the votes of some Democrats will be needed to approve a budget and prevent a government shutdown. Democrats will use their leverage in the Senate, which Republicans narrowly control, to defend both discretionary non-defense programs and social spending, while tackling the issue of the "Dreamers," people brought illegally to the country as children. Trump in September put a March 2018 expiration date on the Deferred Action for Childhood Arrivals, or DACA, program, which protects the young immigrants from deportation and provides them with work permits. The president has said in recent Twitter messages he wants funding for his proposed Mexican border wall and other immigration law changes in exchange for agreeing to help the Dreamers. Representative Debbie Dingell told CBS she did not favor linking that issue to other policy objectives, such as wall funding. "We need to do DACA clean," she said. On Wednesday, Trump aides will meet with congressional leaders to discuss those issues. That will be followed by a weekend of strategy sessions for Trump and Republican leaders on Jan. 6 and 7, the White House said. Trump was also scheduled to meet on Sunday with Florida Republican Governor Rick Scott, who wants more emergency aid. The House has passed an $81 billion aid package after hurricanes in Florida, Texas and Puerto Rico, and wildfires in California. The package far exceeded the $44 billion requested by the Trump administration. The Senate has not yet voted on the aid. ",politicsNews,"December 31, 2017 "

Figure 1 **Fake News**



Donald Trump Sends Out Embarrassing New Year's Eve Message; This is Disturbing,"Donald Trump just couldn t wish all Americans a Happy N
ear and leave it at that. Instead, he had to give a shout out to his enemies, haters and the very dishonest fake news media. The form
eality show star had just one job to do and he couldn t do it. As our Country rapidly grows stronger and smarter, I want to wish all of
y friends, supporters, enemies, haters, and even the very dishonest Fake News Media, a Happy and Healthy New Year, President Angry Pan
weeted. 2018 will be a great year for America! As our Country rapidly grows stronger and smarter, I want to wish all of my friends,
upporters, enemies, haters, and even the very dishonest Fake News Media, a Happy and Healthy New Year. 2018 will be a great year for
merica! Donald J. Trump (@realDonaldTrump) December 31, 2017Trump s tweet went down about as welll as you d expect.What kind of
resident sends a New Year s greeting like this despicable, petty, infantile gibberish? Only Trump! His lack of decency won t even allow
im to rise above the gutter long enough to wish the American citizens a happy new year! Bishop Talbert Swan (@TalbertSwan) December 31
017no one likes you Calvin (@calvinstowell) December 31, 2017Your impeachment would make 2018 a great year for America, but I ll also
ccept regaining control of Congress. Miranda Yaver (@mirandayaver) December 31, 2017Do you hear yourself talk? When you have to includ
hat many people that hate you have to wonder? Why do the they all hate me? Alan Sandoval (@AlanSandoval13) December 31, 2017Who us
he word Haters in a New Years wish?? Marlene (@marlene399) December 31, 2017You can t just say happy new year? Koren pollitt
@Korencarpenter) December 31, 2017Here s Trump s New Year s Eve tweet from 2016.Happy New Year to all, including to my many enemies and
hose who have fought me and lost so badly they just don t know what to do. Love! Donald J. Trump (@realDonaldTrump) December 31,
016This is nothing new for Trump. He s been doing this for years.Trump has directed messages to his enemies and haters for New Year
, Easter, Thanksgiving, and the anniversary of 9/11. pic.twitter.com/4FPAe2KypA Daniel Dale (@ddale8) December 31, 2017Trump s holiday
weets are clearly not presidential.How long did he work at Hallmark before becoming President? Steven Goodine (@SGoodine) December 31,
017He s always been like this . . . the only difference is that in the last few years, his filter has been breaking down. Roy Schulze
@thbthttt) December 31, 2017Who, apart from a teenager uses the term haters? Wendy (@wendywhistles) December 31, 2017he s a fucking 5
ear old Who Knows (@rainyday80) December 31, 2017So, to all the people who voted for this a hole thinking he would change once he got
nto power, you were wrong! 70-year-old men don t change and now he s a year older.Photo by Andrew Burton/Getty Images.",News,"December
1, 2017"
Drunk Bragging Trump Staffer Started Russian Collusion Investigation,"House Intelligence Committee Chairman Devin Nunes is going to hav
bad day. He s been under the assumption, like many of us, that the Christopher Steele-dossier was what prompted the Russia investigati
o he s been lashing out at the Department of Justice and the FBI in order to protect Trump. As it happens, the dossier is not what
tarted the investigation, according to documents obtained by the New York Times.Former Trump campaign adviser George Papadopoulos was
runk in a wine bar when he revealed knowledge of Russian opposition research on Hillary Clinton.On top of that, Papadopoulos wasn t jus
covfefe boy for Trump, as his administration has alleged. He had a much larger role, but none so damning as being a drunken fool in a
ine bar. Coffee boys don t help to arrange a New York meeting between Trump and President Abdel Fattah el-Sisi of Egypt two months
efore the election. It was known before that the former aide set up meetings with world leaders for Trump, but team Trump ran with him
eing merely a coffee boy.In May 2016, Papadopoulos revealed to Australian diplomat Alexander Downer that Russian officials were shoppin

Figure 2 **Real News**

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Table 1 Comparison of Five Algorithms

	Logistic Regression	Naïve Bayes	Random Forest	Decision Tree	Passive Aggressive Classifier
Definition	Logistic regression is a statistical method which is used in analysis technique which is used in analysis technique	The way that naïve bayes functions is by utilizing the principle of conditional probability.	The random forest technique utilizes the power of multiple decision trees to produce one unified outcome.	The decision tree serves the dual purposes of classificati on and regression.	The Passive Aggressive algorithm boasts the highest accuracy among all others, making it
Type	Linear	Probabilistic	Ensemble	Tree-based	Online learning
Interpretability	Moderate	High	Moderate	Moderate	Low
Complexity	Low moderate	Low	High moderate	Moderate	Low
Training Speed	High	High	High moderate	Moderate	High
Feature Importance	Varies	Low	High	High	Varies
Memory Usage	Low	Low	Moderate	Moderate	Low

5. Proposed Method

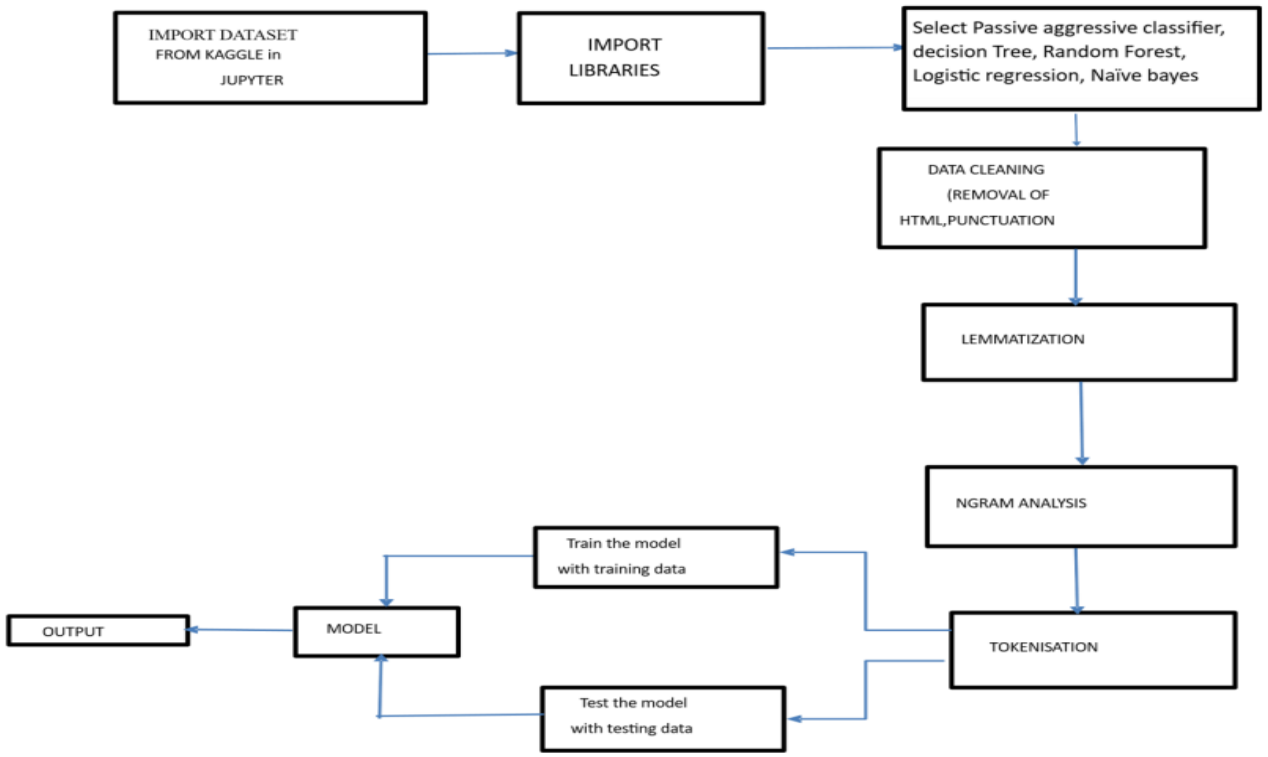

Figure 3 Block Diagram

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We have imported both fake and real dataset from Kaggle website. Imported the necessary libraries such as NumPy, Pandas, Matplot.lib, re. Chose the algorithms Naïve Bayes, Logistic Regression, Passive aggressive classifier, Random Forest, Decision tree. The next step is the data pre-processing, where data is cleaned to remove the punctuation marks, html contents and stop words. Next step in pre-processing is Lemmatization where words are converted to root word. N gram analysis is done to test the frequency of words. Tokenization is done to decrease the word limit. As a greater number of words can decrease the execution speed of the process. Split the data into training and testing data to find the accuracy of the model. After data pre-processing train the data with the training data. Test the model with the testing data to predict the accuracy of the model. At last compare the results of five algorithms and select the best one, shown in Figure 3.

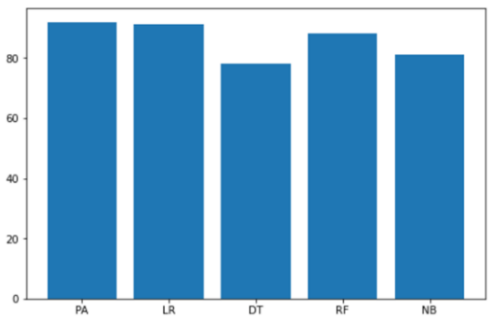
6. Implementation

Bar chart Results after comparing the Five Algorithms as shown in Table 2.

Table 2 Bar Chart Results After Comparing the Five Algorithms

```
fig = plt.figure()
ax.set_title('a')
ax = fig.add_axes([0,0,1,1])
status = ['PA','LR','DT','RF','NB']
value = [92,91,78,88,81]
ax.bar(status,value)

plt.show()
```



Conclusion

We have detected the fake news from fake and real dataset from Kaggle by using five machine learning algorithms and compared their results. By the end of the implementation, we found Passive aggressive classifier to provide the highest accuracy. Passive aggressive classifier provided accuracy of 98.02%, Logistic regression provided accuracy of 97.22%, Decision tree provided accuracy of 96.23%, Random Forest Naïve bayes provided accuracy of 96.59%. Passive aggressive classifier turned out to be the best algorithm.

Future Work

We have done these predictions on a predefined dataset so we are trying to extend our predictions in real time data like the news websites. We are even trying to predict fake audio, video, images and integrating them into an app /web which are easily accessible by people and preventing them blindly trusting the unknown messages.

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