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# ANALYSIS ON FAKE NEWS DETECTION USING MACHINE LEARNING

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**Abstract -** *Due to the COVID-19 pandemic, several health and economic challenges come to play awkwardly. This has introduced misinformation and confusion around the globe. The issues of fake news have attained an increasing eminence in the diffusion of shaping news stories. Many of them stop to depend on the newspapers, magazines, etc and started to rely on social media completely. Social media became the main news source for millions of people due to their easy access, cheap, more attractive and rapid dissemination. The fake content started to spread at a large pace to gain popularity over social media to distract people from the current critical issues, in some occasions spreading more and faster than the true information. People spread fake news on social media for financial and political gain. Fake data in all forms need to be detected as soon as possible to avoid a negative impact on society. This project makes an analysis of the research related to fake news detection, we trained and tested different machine learning algorithms separately to demonstrate the efficiency of the classification on the dataset. This project was implemented in the Jupyter notebook platform and performance was evaluated.*

***Key Words: SVM, PAC, Fake News, Social Media, Machine Learning, Classifiers.***

## 1. INTRODUCTION

Social media has been in our lives for centuries and has reached even in remote villages. Even though social media has made life in the view of interacting with people, some people spreading and posting fake news has been a major problem for the past few decades. 90% of the population depend on social media for their news reading because of the availability of the internet and the use of smart devices. Facebook and Google are constantly taking measures considering these issues. For example finding out fake news by flagging them as fake, use of hoax sites, fact-checking labels etc. These techniques have not yet gained their purpose, that is why people need to be aware of what to believe and not believe, even though the line between the true and fake is thin, moreover the spreading rate of these fake news is faster which give greater obstacle to predicting their credibility. There arises a need for fake news detection.

The motive of this publication is to reach a solution that can be used by people to identify and scrutinize the websites that contain false and misleading information. Natural language processing is a part of artificial intelligence (AI), which comprises techniques that can use text, create models and algorithm which helps in prediction. This work aims to create a model that can use the information or data of the past or present news reports and predict whether the news is fake or not.

This project demonstrated the ability of machine learning and AI to be useful for this task [1]. These machine learning techniques are applied with the compilation of Natural language processing's feature extraction method. Analyzing the performance of each technique is done which also helps to see their accuracy. These machine learning algorithm helps to train system to predict the credibility and reliability based on the text, words used and stop word, etc.

Our work is on text-based fake news where we have used three datasets to analyze the best detector. We carry out the process through machine learning algorithms. Three publically available datasets were chosen from the websites. The classification of fake or real news was done using the framework. Datasets were trained using natural language processing techniques for feature extraction to acquire the best accuracy. After the processing classification on the algorithms done and the performance was noted down. The best method is selected based on accuracy, f1-score, recall and precision [4].

## 2. LITERATURE REVIEW

The article by Monther Aldwairi el. al. [10] comes up with a solution that can be utilized by users to detect and filter out sites containing false and misleading information. Click baits are phrases that are designed to attract the attention of a user who, upon clicking on

the link, is directed to a web page whose content is considerably below their expectations. This leads to irritation and waste of time by the user. The solution includes the use of a tool that can identify and remove fake sites from the results provided to a user by a search engine or a social media news feed. These tools can be directly downloaded and installed by the user in their system.

Farzana Islam et. al.[7] in their paper proposed a model for detecting fake news in the Bengali language. This work is done on fake news classification in the context of Bangladesh and South Asia. They have used data mining algorithms as classifiers. A Bengali newspaper scrapper was developed to create a Bengali news dataset. Text mining is used to create a new corpus dataset. Word cloud is shown as a part of data visualization. Experiments are done with varied features and models. This project is creating an end-to-end pipeline of data collection, ingestion, web-based demonstration of fake news classification along with visualization.

In S D Samantaray's et. al. [8] work the proposed system is divided into two subparts, first is text analysis and then performance evaluation. Text analysis is done for the transformation of text into numerical features. The found out numerical features are used for matching the similarity between queried articles and other articles. For article similarity, we have used a hybrid of three text similarity approaches namely N-gram, TF*IDF and Cosine Similarity. The text similarity algorithms are applied recursively to each article to broaden the search and collect a higher number of text article matches. So as the performance is evaluated for the detector.

Uma Sharma et. al. [3] aims to perform binary classification of various news articles available online with the help of concepts of Artificial Intelligence, Natural Language Processing and Machine Learning. The author provides the classification of fake and real news and also helps to find the authenticity of the websites which help to publish this news online. The author implemented a system that works in three-phase. The first classification of news using a machine learning classifier then takes a keyword related to the classified news from the user and finds the truth probability then check the authenticity of the URL. All these details are clearly explained in his paper.

Inna Vogel et. al.[9] explained three different approaches to automatically detect possible fake news spreaders on social media for limiting the propagation of fake news among online users. They have used the PAN 2020 author profiling corpus and conducted different learning experiments from a multilingual perspective. They evaluated differently handcrafted and automatically learned features, most of them language-independent. These features were extracted and had their importance evaluated in the detection task. Additionally, they also provided some corpus statistics that show that there are objective differences between fake and true news spreaders.

Hence, with the existing system study we have considered five machine learning algorithms to train and test the datasets provided. We are trying to build an algorithm that gives high accuracy in detecting fake news.

## 3. DATASET

The first step included in this work was to find the dataset that can be used to achieve the goal. News data can be gathered by Expert journalists, Fact-checking websites, Industry detectors, and Crowd-sourced workers. News datasets for our work have been found out from Kaggle. These datasets were used in different research papers for determining the specification of news. Three datasets have been used. Real-world data are incomplete, inconsistent or non-relatable, and are likely to contain many errors. So we had done some error corrections to carry out the classification. After the dataset has been imported data pre-processing is done to get better results through the classification algorithms. Data pre-processing like removing stopwords, count vectors, TF-IDF vectorization, word embedding etc are also done on the dataset. The TF-IDF vectorization converts the text to number format which helps to fit the machine learning algorithms easily. In the inputted dataset, no missing values are there and the input dataset will be tokenized. The tokenized dataset will be again processed and unwanted information will be removed from the dataset.

Feature selection is also known as the attribute selection method that searches among the available subsets of primary features and selects the acceptable ones to create the ultimate selective subset. In this technique, the primary features are transferred into a new space with fewer dimensions. No new features are made but only several features are chosen and therefore the irrelevant and redundant features are removed. We used Pandas for importing datasets, Numpy, Sklearn library, genism for the data processing and classification. Seaborn, matplotlib and wordcloud

were used for visualization of the statistics. We divided our dataset into training dataset and testing dataset to carry out the evaluation process.

Our three datasets include news content completely. Dataset-1 contains 44898 data which includes the target class as 'fake' or 'true'. Dataset-2 contains 6310 data which has the label class with value 'FAKE' or 'REAL'. Dataset-3 contain 4049 records with label class having values '1' or '0'. Value '1' for fake and value '0' for real. The news contents of the dataset have been visualized using wordcloud.

## 4. SYSTEM OVERVIEW

Our proposed system works step by step. Here the news content we have collected is coming under the label fake or true. To start with the process we have to understand the problem clearly and then go for the model representation and at last, evaluate the result. The awareness of Fake news becomes a famous issue starting from the American Presidential Selection in the year 2016. From then onwards the fake news issue acquires great attention among the people. During this election time, much more different fake news is discussed and posted on social media. Some posts are even concluded that Trump had won the president referendum due to the influence of fake news. Due to uncontrolled excitement created by social media, after this, some interest is shown on fake news and its problems, and also concerns have been raised about the bad effects of wide growth of false news[13].

The stages involved in our system are shown below.

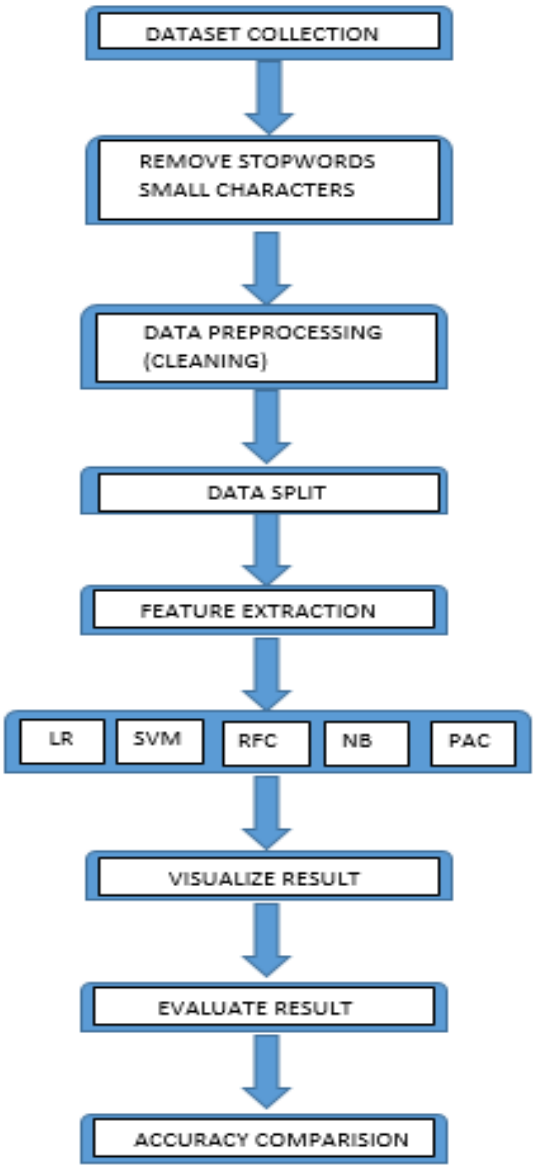


Fig.1. Overview of work

### 4.1. CLASSIFIERS

In our model, we used 5 differing types of machine learning algorithms and for the implementation work, we used the Jupyter notebook platform with the assistance of Python programmable language. The classification models that we implemented using the above-mentioned dataset are the naive Bayesian Model, Logistic Regression, Support Vector Machine, Random Forest classifier, passive-aggressive classifier. These algorithms are good for various classifications and that they got their properties and performance supported different datasets. For analysis and classification problems we have used four features including id or URL, title or headline, text or body, label or target. Features like date, subject are eliminated.[7]The frequent words used in the news content are expressed using a word cloud.

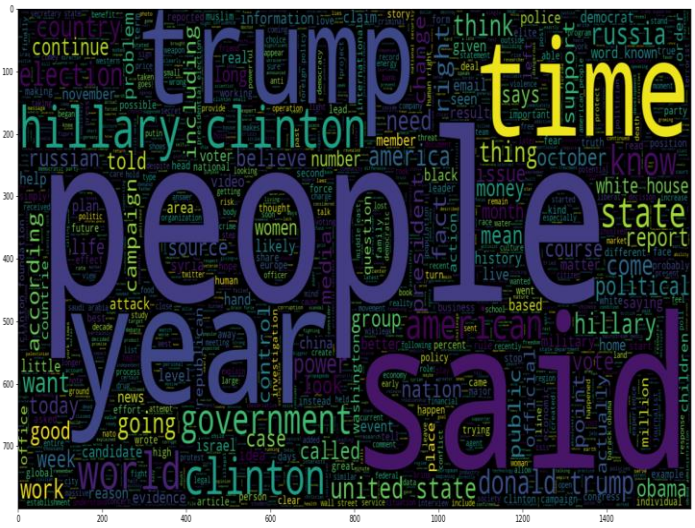


Fig.2. word cloud for fake news (DATASET-2)

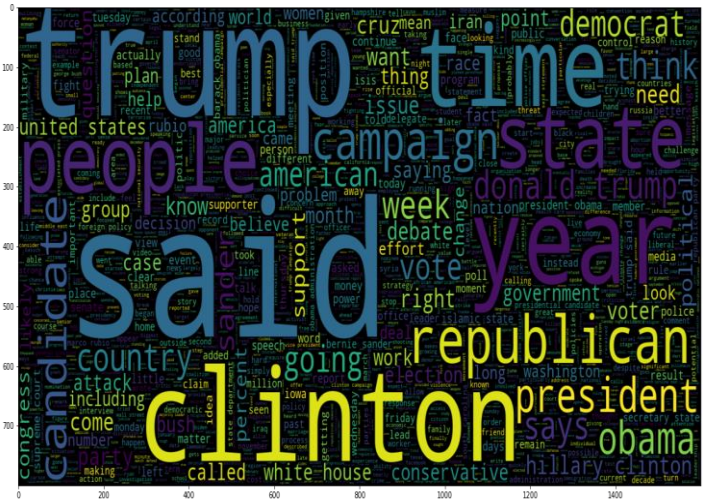


Fig.3. word cloud for real news (DATASET-2)

### 4.2. MODELS

#### 4.2.1 Logistic Regression

Logistic regression is a kind of statistical analysis method which predict a knowledge value supported prior observations of a knowledge set. The approach allows an algorithm getting used during a machine learning application to classify incoming data supported historical data. As more relevant data comes in, the algorithm should recover at predicting classifications within data sets. Logistic regression also can play a task in data preparation activities by allowing data sets to be put into specifically predefined buckets during the extract, transform, load (ETL) process so as to stage the knowledge for analysis. A logistic regression model predicts a dependent data variable by analyzing the connection between one or more existing independent variables.

| | F1-SCORE | RECALL | PRECISION |
|---|---|---|---|
| **DATASET -1** | FAKE=98.77 ; REAL=88.66 | FAKE=98.97 ; REAL=98.44 | FAKE=98.57 ; REAL=98.88 |
| **DATASET -2** | FAKE=90.12 ; REAL=89.72 | FAKE=86.83 ; REAL=93.41 | FAKE=93.67 ; REAL=86.32 |
| **DATASET -3** | FAKE=96.96 ; REAL=97.42 | FAKE=95.72 ; REAL=98.51 | FAKE=98.24 ; REAL=96.35 |

Table.1. performance evaluation LR

#### 4.2.2 Support Vector Machine

A support vector machine is a type of supervised learning algorithm that sorts data into two categories. It's trained with a series of knowledge already classified into two categories, building the model because it is initially trained. The task of an SVM algorithm is to work out which category a replacement datum belongs in. This makes SVM a sort of non-binary linear classifier. A support vector machine (SVM) is a machine learning algorithm that analyses data for classification and multivariate analysis. SVMs are utilized in text categorization, image classification, and handwriting recognition and within the sciences[12].

| | F1-SCORE | RECALL | PRECISION |
|---|---|---|---|
| **DATASET -1** | FAKE=99.48 ; REAL=99.43 | FAKE=99.51 ; REAL=99.4 | FAKE= 99.46 ; REAL=99.46 |
| **DATASET -2** | FAKE=92.79 ; REAL=92.76 | FAKE=90.84 ; REAL=94.81 | FAKE=94.83 ; REAL=90.8 |
| **DATASET -3** | FAKE=98.69 ; REAL=98.9 | FAKE=98.26 ; REAL=99.26 | FAKE=99.12 ; REAL=98.54 |

Table.2. performance evaluation SVM

#### 4.2.3 Random Forest

Random forests are another kind of supervised learning algorithm. It is often used both for

classification and regression. It's also the foremost flexible and straightforward algorithm. A forest is comprised of trees. It's said that the more trees it has the more robust a forest is. Random forests create decision trees on randomly selected data samples, get a prediction from each tree and selects the only solution through voting. It also provides a fairly good indicator of the feature importance. Random forests feature a kind of applications, like recommendation engines, image classification and have selection. It is often used to classify loyal loan applicants, identify fraudulent activity and predict diseases. It lies at the rock bottom of the Boruta algorithm, which selects important features during a dataset [11].

| | F1-SCORE | RECALL | PRECISION |
|---|---|---|---|
| **DATASET -1** | FAKE=98.92 ; REAL=98.81 | FAKE=98.89 ; REAL=98.84 | FAKE=98.94 ; REAL=98.78 |
| **DATASET -2** | FAKE=89.46 ; REAL=89.87 | FAKE=89.52 ; REAL=89.81 | FAKE=89.41 ; REAL=89.93 |
| **DATASET -3** | FAKE=96.48 ; REAL=96.91 | FAKE=93.78 ; REAL=99.42 | FAKE=99.34 ; REAL=94.53 |

Table.3. performance evaluation RFC

### 4.2.4 Passive Aggressive Classifiers

The Passive-Aggressive algorithms are a family of Machine learning algorithms that aren't alright known by beginners and even intermediate Machine Learning enthusiasts. However, they will be very useful and efficient surely applications [12]. Passive-Aggressive algorithms are somewhat almost like a Perceptron model, within the sense that their doing not require a learning rate. However, their doing include a regularization parameter. It works by responding as passive for proper classifications and responding as aggressive for any miscalculation.

| | F1-SCORE | RECALL | PRECISION |
|---|---|---|---|
| **DATASET-1** | FAKE=99.56 ; REAL=99.51 | FAKE=99.57 ; REAL=99.5 | FAKE=99.54 ; REAL=99.53 |
| **DATASET-2** | FAKE=92.55 ; REAL=92.74 | FAKE=91.96 ; REAL=93.32 | FAKE=93.15 ; REAL=92.16 |
| **DATASET-3** | FAKE=98.9 ; REAL=99.09 | FAKE=99.33 ; REAL=98.73 | FAKE=98.46 ; REAL=99.45 |

Table.4. performance evaluation PAC

### 4.2.5 Naïve Bayes

Naive Bayes is a kind of probability-based classification technique that predicts class membership supported by the previously observed probability of all potential features. This system is employed when a mixture of a variety of features, called evidence, affects the determination of the target class. Naïve Bayes can take under consideration features which will be insignificant when considered on their own but when considered accumulatively can significantly impact the probability of an instance belonging to a particular class. All features are assumed to hold equal significance, and therefore the value of the first feature isn't hooked into the worth of the other feature. In other words, the features are independent. It is a baseline classifier for comparing more complex algorithms and may even be used for incremental learning, where the model is updated supported by new example data without the necessity for regenerating the entire model from scratch.

| | F1-SCORE | RECALL | PRECISION |
|---|---|---|---|
| **DATASET-1** | FAKE=94.41 ; REAL=93.77 | FAKE=93.77 ; REAL=94.5 | FAKE=95.06 ; REAL=93.06 |
| **DATASET-2** | FAKE=79.73 ; REAL=85.39 | FAKE=96.17 ; REAL=76.02 | FAKE=68.09 ; REAL=97.39 |
| **DATASET-3** | FAKE=93.93 ; REAL=94.66 | FAKE=91.12 ; REAL=97.3 | FAKE=96.92 ; REAL=92.15 |

Table.5. performance evaluation NB

## 5. EXPERIMENTAL RESULT

As there is an increase in social media users, the spread of fake news also increased the trice. People are getting distracted and confused most of the time because of fake news. Experiments are going on to resolve this problem. As a contribution, we dedicate this work towards fake news detection. In this work, we have used three the dataset data dataset which was collected from a public source. Along with the well-known machine we had learning we evaluated the performance of five algorithms. The comparative study was carried out by looking at the accuracy value. Depending on the accuracy the best model was selected. As the initial stage, the dataset was divide into training and t t testing datasets. The training data set is

used to fit the model and the prediction is done on the test data set. The performance measure of five different machine learning methods is shown in the following tables.

| | LR | SVM | RFC | PAC | NB |
|---|---|---|---|---|---|
| **DATASET-1** | 98.72 | 99.46 | 98.87 | 99.54 | 94.11 |
| **DATASET-2** | 89.92 | 92.78 | 89.67 | 92.65 | 83.09 |
| **DATASET-3** | 97.21 | 98.8 | 96.71 | 99.0 | 94.32 |

Table.6. performance evaluation of accuracy

The following figures represent the accuracy score of classification techniques for the three datasets. According to the study, the PAC algorithm has the highest accuracy of two datasets (DATASET-1 and DATASET-3) out of three. SVM has the highest accuracy in one (DATASET-2) of the three datasets. The Naïve Bayes classifier has the least performance as compared to the other four in all the datasets.

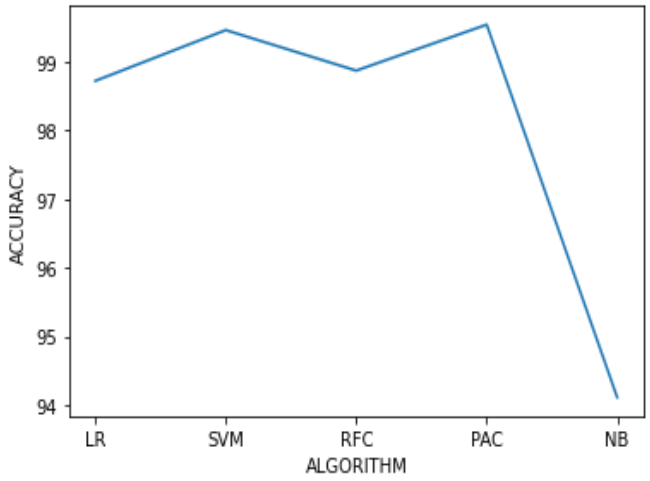


Fig.4. Accuracy comparison on DATASET-1

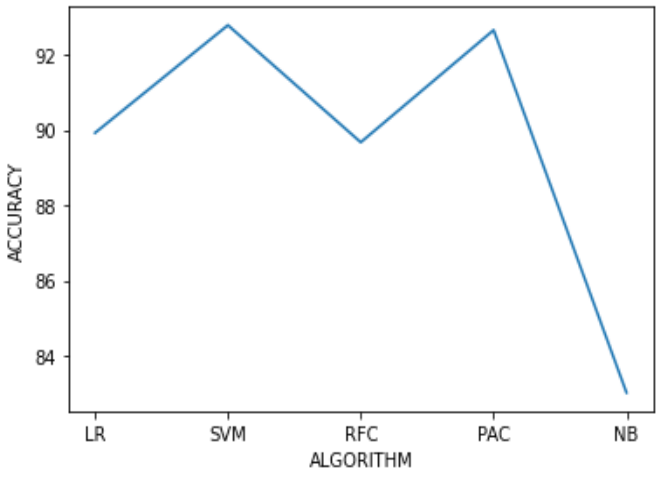


Fig.5. Accuracy comparison on DATASET-2

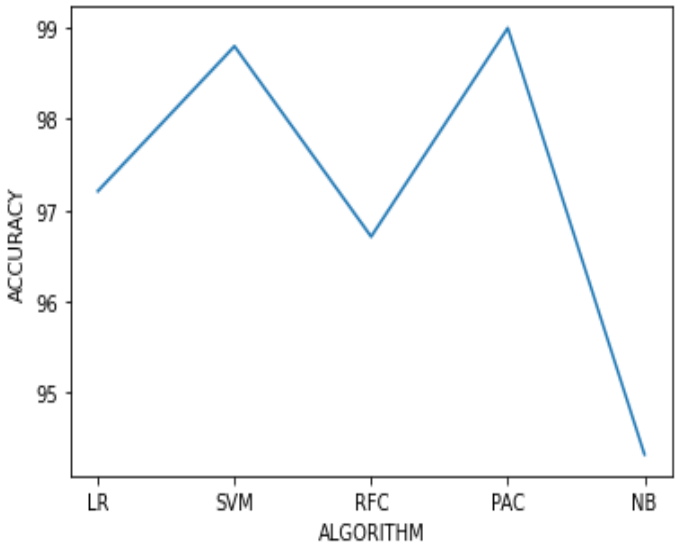


Fig.6. Accuracy comparison on DATASET-3

## 6. CONCLUSIONS

In this paper, we have examined and explored the performance of five algorithms that are dedicated to the detection of fake news. From our critical analysis, we have reached an interpretation that the Naïve Bayes classifier has shown the least performance when comparing to the other four models. This paper has also revealed the accuracy of each model in identifying fake news. As mentioned earlier the use of social media has been spread vastly, this research can be used as a skeleton for other investigators to interpret which models are precisely and accurately completing its mission in identifying fake news.

However it is to be highlighted that we have some ways or mechanisms for the detection of fake news, or a way to aware people to know that everything is they read is not true, so we need critical thinking and evaluation. In that way, we can help people to make choices so that they won't be tricked or fooled into thinking what others want to guide or exploit into our thoughts.

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