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A Review of Fake News Detection Methods using Machine Learning

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***Abstract*: The widespread use of social media has had a terrible impact on our society due to the spread of fake news. In particular, the author has seen the idea of the quality of fake news before its origin. Like the internet, publishers used false and misleading information to further their interest. People often get involved in social media as social media provides low cost, quick access, and fast spread of news. It has been seen for many years that fake news harms persons as well as society. So, the challenge of fake news detection arrived. Inappropriate news took place to attract people so the sender can start putting the rumor of news. This had led to a negative impact on people about social media for their news. This led to inconvenience for offline news as well because when people will too much depend on online platforms that will reduce the offline users. This survey deals with a review of existing machine learning algorithms Naïve Bayes, Convolutional Neural Network, LSTM, Neural Network, Support Vector Machine proposed for detecting and reducing fake news from different social media platforms like Facebook, whatsapp, twitter, etc. This review provides a comprehensive detail including data mining perspective, evaluation metrics, and representative datasheets. Further, a comparison of the state-of-the-art is presented and untackled challenges in detecting fake news are highlighted. Research in the field of detecting fake news has been hampered to a great extent by the lack of quantity and quality of existing datasets. Therefore, this review compares the existing approaches to build models and with further improvements to be expected by using the combination of different machine learning techniques.**

Keywords: N-gram analysis, Clickbait Detection, Machine Learning, Naïve Bayes.

I. INTRODUCTION

Fake news is one of the biggest discouragements in our digitally connected world. Fake news spreads at lightning-fast speed impacting millions of people in the form of clickbait, trigrams everyday [4]. Therefore, noticing fake news becomes a vital problem attracting huge research efforts. Detection of fake news from social media always creates a new challenge. It is written on social media to mislead readers. In the 2016 US presidential election, fake news propagated more on Facebook than authentic news[5]. Fake news detection on social media has attracted politicians to researchers. The detection of fake news on social media is very important because fake news can change the mindset of people or society or country. So, it is very important for those readers who read news on daily basis on social media to know whether the news is real or fake. So, they always try to read news from authenticating sites or authors.

In this report, we present a survey on the state of the art pertaining to the type of fake news and solutions that are being proposed. The research in this field has been going on for a long time and in the Indian context, the ill effects of spreading fake news are far from what anyone might think.

Unlike in the context of other countries, WhatsApp is the prime distributor of fake news as compared to other social networking sites like Facebook and Twitter. Due to the increase of internet users in India, which has increased 137million (in 2012) to over 600 million (in 2019) facing unique challenges day by day.

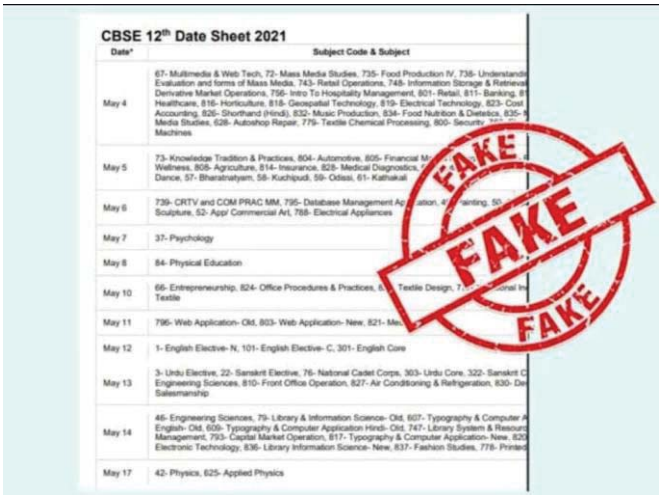

Fig. 1. CBSE Fake News Datesheet
Sources: https://images.app.goo.gl/ArYa2Ajro57x5KWu8

The year 2020 was a full pandemic year due to coronavirus. So all the school examinations and university exams had been postponed for some months. As usual, the CBSE 10th and 12th

exams are taken in the month of March but due to a pandemic situation, it was extended to May and June. The CBSE board only released the timetable of the exam but on some social media sites, the exact date of each paper was also showing which was false. This fake news distracted the mind of students and they started to follow this fake timetable of the exam. After confirmation of CBSE regarding the timetable of the exam that it has not published yet, all the students get very disappointed. This one example of fake news shows how much fake news can poorly affect human beings' lives. One fake news can suppress the image of society and can change the thinking skill of human beings. Due to this, it is very necessary to detect fake news before spreading it. So a powerful and strong module is required which can be easily available to detect fake news. Also, the module should be less expensive so that it can be available on each and every necessity.

Following are the types of fake news:-

1. For entertainment purpose
2. Use a fake image or title for irrelevant content.
3. Missinterpreted information
4. Completely baseless content.
5. Rumors spread by blind followers

These are such fake news that is easily available on social media. Though most fake news is not defective, they are used only for entertainment purposes but the readers do not understand the fact of this news and they change themselves according to the theme of the news. So it is very difficult for readers to understand the motto of news whether it is released for entertainment purposes or any other purpose. That's why it is very necessary to develop a such model which can easily indicate the motto of news so that readers will not get distracted.

II. RELATED WORK

In [1], H. Ahmed et al. have proposed false news detection by using the N-gram model to segregate between false and truth information through machine learning techniques. They have experiments using both linear-based as well as nonlinear-based classifiers and compared those six different machine learning techniques: K-Nearest Neighbor, Support Vector Machine, Logistic Regression, Linear Support Vector Machine, Decision tree, and Stochastic Gradient Descent, which are good at detecting fake news. The authors have shown their experimental results using compiled datasets from truth and inappropriate news websites so that they have to achieve results with great expectation. They have used 5-fold cross-validation in their experiments so, around every validation of datasets is used 80% for training datasets, the rest 20% for testing datasets. The authors have achieved the highest accuracy of 92% by using unigram methods and a linear support vector machine classifier.

In [2], authors have proposed a model that creates a whole network for learning a depiction of news, reports, authors, and titles simultaneously. To achieve better accuracy, they have used several ML algorithms: Support Vector Machine, Convolution Neural Networks, Long Short-Term Memory, K-nearest neighbors, and Naive Bayes. The author proposed a model that was first tested initially on CNN based machine learning algorithm that provides accuracy with 94% in a combined dataset (Liar and Kaggle) but, it has seen that using the KNN model only predicts 70% that's the very worst model. When they have examined their dataset using SVM with an accuracy of 73% that was almost similar to their previous algorithm, then they have to demonstrate their model after using Naive Bayes with 91% accuracy which was much better. The author has performed their models on data that had taken from large datasets with 25680 data information. Finally, it has lastly achieved better accuracy of 97% by using LSTM. In this paper, a goal has been set for the author to examine small sentences and news in concern and construct the reliability count with the news by putting serially feature extraction and credibility scores. Finally, they have evaluated their overall very high accuracy of 94% with a combination of three algorithms as Naïve Bayes, CNN, and LSTM, and based on their accuracy, recall, and F-1 count on each step, they would be achieved their performance and effectiveness.

In [3], Jain et al. (2019) have demonstrated a model with the support of ML and NLP techniques to assemble articles using a Support Vector Machine (SVM) and resolve whether the news is real or fake. They have used a support vector machine algorithm for binary classification to systemize the articles and based on that model works to categorize the articles either real or fake. They have used three main modules for refining their articles or contents in their proposed models as an aggregator, authenticator, and suggestion or recommendation system. In this paper, they have also used the Naïve Bayes algorithm to test the articles either true or false and for obtained with an accuracy of 93.50% achieved by the combination of these three algorithms i.e. Naive Bayes, SVM, and NLP.

In [4], a report of Pew Research Center U.S.A. suggests that adults got around 70 percent of news from social media. With the news of Donald Trump as president, this information has led to an increase of 9 lakh and 60 thousand Facebook users. In this paper, linguistic features or visual features play their role. Moving onto network features it deals with diffusion networks as well as co-occurrence networks. So, the authors have achieved an accuracy of about 83 percent.

In [5], authors observed the influence of people on social media and find that 62 percent of American adults depend on social media for news in 2016 which is 13 percent higher than that of 2012. The major source of information includes television. We have seen that this information is either free or of very low cost which leads to the beginning of fake news on this platform. The beginning of fake news started in 1439 which was the same time which printing press started.

In [6], authors observed that fake news was categorized into clickbait, influential, and satire. To stop fake news, the methods that were adopted were spam detection, stance detection, benchmark dataset. On further author saw the sentiment analysis which came under NLP techniques. A fake news story that has been discussed was China Airport Security Robot Electoroshocks that took place in 2016 and led to over 12 thousand fake news in 2016, in China, which was in 244 different websites as sources.

In [7], authors have noticed that the impact of fake news in our daily life is very spacious. They discussed 3 approaches for detecting false news: Naive Bayes, Neural Network, Support Vector Machine. The accuracy result by using Naive Bayes is 96.08% for detecting fake news whereas by using the other two methods as Neural Network & Support Vector Machine the accuracy result is 99.90% for detecting fake news. The Authors through this paper try to give messages that how big the impact of fake news can affect human being's life. They discuss the example of Thailand (2017) who faces a big disaster by spreading fake news of climate. The Authors say before using the Machine Learning method they use the normalization method for cleaning the data.

In [8], authors observed how to figure out forged news messages from Twitter posts. The Authors are generally working on the Twitter post i.e whether it is real or fake. They talk about the misinformation of the Chilli earthquake (2010) & the US Presidential election. NLP has been proposed for detecting fake news. Firstly, they have to classify the news to know whether it is real or fake after that different types of models are applied to get the result. The main focus of authors is to make more efficient of detection of fake news, So, they have included a method of word length which include counting of words given by a sentence. The Authors have used five different machine learning algorithms and python is used as a programming language. The five several ML techniques are Naive Bayes, Logistic Regression, Support Vector Machine, Recurrent Neural Network, and Long-short term memory. The Authors work on text data so they have used some different ideas to process the dataset i.e. Count Vectors, TF-IDF, Word-Embedding. The Authors have also proposed four feature vectors: Count Vectors, Word-level Vectors, N-Gram Vectors, Character Level Vectors. The order of Machine learning algorithms which is discussed above according to their accuracy after applying on four feature vectors is Logistic Regression (69.47) <Recurrent Neural Network (74) <Long Short-Term Memory (78) <Naive Bayes (89.06)<Support Vector Machine(89.34). So SVM is the best model for detecting fake news.

In [9], authors have noticed that social media is the key problem of today's life. Anyone can register himself as a news publisher on social platforms and they spread the news. It misguided society very fast. So, the Authors say social media is the platform for spreading misinformation. The Author has proposed some features to find out false news that are features discarded from the news article, news source, and from the environment. Textual features are also used to detect fake news. The image processing technique is used for extracting text from images and videos. The total textual features which are evaluated by the author is 141. Lexical features, semantic features, Language features, and Psycholinguistic features are grouped in a set. The author has used a classifier for measuring the power of features. The classifier is K-Nearest Neighbors, Naive Bayes, Random Forest, and Support Vector Machine. For measuring the effectiveness of each classifier, the Author has used Area Under the ROC Curve and Marco F1 Score. Area Under Curve is more relevant for fake news detection whereas Macro F1 score gives the overall function of a classifier.

III. FAKE NEWS DETECTION TECHNIQUES

How to find out fake News from Social Media using a different ML algorithm?

Fake News has a spacious impact on our daily life. Detecting fake news is an important step for human beings, for this, we use ML algorithms. Four types of ML algorithms have been used for detecting fake news from social media:

1) *Neural Network*
2) *SVM*
3) *Naive Bayes*
4) *N-Gram analysis*

1) *Neural Network*

It is an arithmetic gaining system that is used to transform the data input of one form into a craved output by using a network of functions[23]. A neural network[21] is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial nature. Neural networks can adapt to changing input, so the network generates the best possible result without needing to redesign the output criteria[22]. The concept of neural networks, which has its roots in artificial intelligence, is swiftly gaining popularity in the development of trading systems[24].

2) *Support Vector Machine*

It is a strong and supple supervised algorithm, generally for classification and reverting SVM is used[20]. SVM was discovered in 1960 and then again in 1990 it was modified. It is used to differentiate the datasets into classes to find hyperplanes. It is used to reduce the error with the help of a hyperplane.

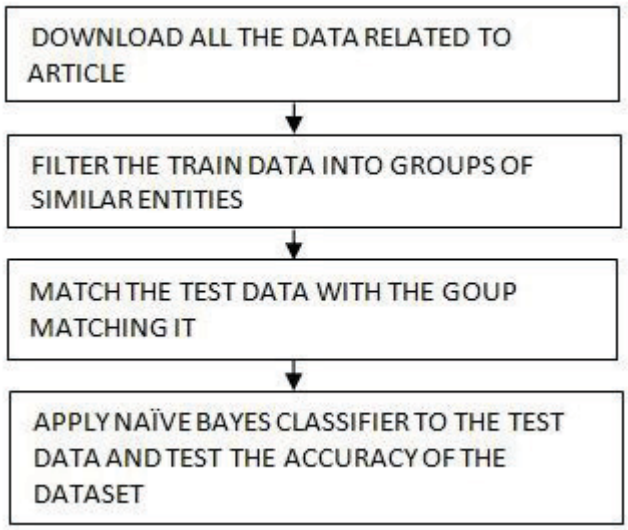

Fig. 2. Use of Naïve Bayes Classifier

3) *Naive Bayes*

It is an ML algorithm [20] works on Bayes' theorem. It is another supervised learning algorithm that is used for finding classification difficulty as earlier it is mentioned that it is

working on Bayes' theorem, so the formula of Bayes' theorem is :

The probability of X is divided by the probability of Y then it is equal to = P(X/Y) * P(X)/P(Y)

Where Probability of X is divided by probability of Y is the posterior probability

P(X/Y) is a Likelihood probability

P(X) is Prior Probability

P(Y) is Marginal Probability

4) N-Gram Analysis

It is a contiguous sequence of 'n' items from a given sample test.

Example:-

Let's DNA sequence:- XXYZWYYYX

unigram:- X,Y,Z,W,W,Z,Y,X

bigram:- XY,ZW,YZ,WZ,ZY,YX,ZX

trigram:- XYZ,YZW,ZWW,WWY,WYX

A. System Architecture

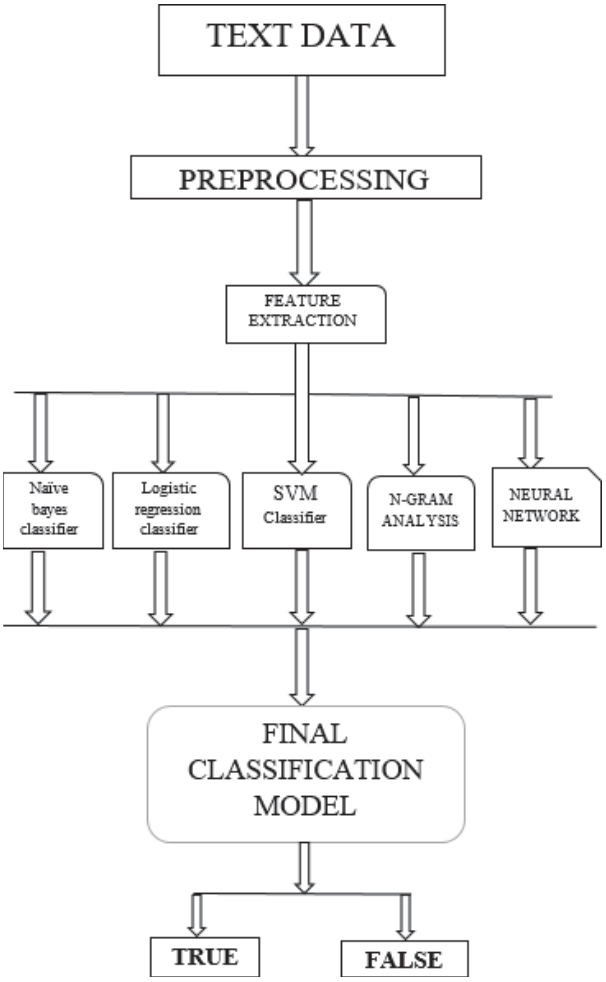

Fig. 3. Classifier Prediction Model

IV. COMPARITIVE STUDY OF EXISTING APPROACHES

Table 1 shows a comprehensive summary of an existing ML approach for fake news detection. Among these approaches, some classifiers have given the desired result. In 2018 the authors Supanya et al. have achieved the highest accuracy rate of 99.90% by using SVM, Naive Bayes, and Neural Network, and the rest authors had not achieved the better result compared to the author Supanaya et al. All the classifiers which have been discussed in the table used some textual features, N-gram, F-1 Score, etc. By using these features classifiers work better and the authors try to increase the detecting accuracy rate of fake news. This table shows which classifiers are better compared to others. So, among all these classifiers SVM and Naive Bayes are the best which are giving the highest result.

V. EMERGING CHALLENGES AND TRENDS

It is very difficult to know about the fact of news that is spreading through different parties on social media which are conflicting with each other. These types of news mostly related to politics. So, it is a big challenge to classify news whether the news is real or fake among political news. For distinguishing such types of news in real or fake, more potent and sophisticated models are required which can easily and in less expensive classify the news. Another big challenge on social media to know the authentication of news authors or publishers.

Nowadays it is very easy to create a page on Facebook, Instagram, or any other social media platform and also creating a channel on youtube. So anyone can create their page on social media or channel on youtube and post the news through this platform. So it is a very big problem to know which authors are fake and which are real. That's why it is very necessary to develop a model which can easily verify the authentication of news authors and publishers. These models will help online news readers decide which author's news should be read and which should be neglected.

Fake news has put a lot of negativity in humans and society. So, detection took place to reduce redundancy. The earlier author has used a different approach to detect fake news like

Naive Bayes, Neural Network, Support Vector Machine, N-Gram analysis, etc. In the future, our idea is to detect more and more fake news and try to reach an accuracy of around 100 percent. We, have to use fewer methods to reduce complexity and size. If one person gives an accuracy of 99 percent by combining three methods then it's no better than one who gives an accuracy of 90 percent by combining two methods. So, we will write the code to detection of fake news which tries to connect original news. For this, we will work on datasets and all the programming will be done in python.

TABLE I. RESULT COMPARISON OF EXISTING APPROACHES

Author	*Approach*	*Dataset*	*Accuracy*
Ahmed et al. (2017)	unigram features and Linear support vector machine classifier	News articles from Reuters.com(News website), ISOT dataset, and kaggle.com (for fake news).	92%
Agarwal et al. (2020)	Naïve Bayes, CNN and LSTM	Collected news articles from the World Wide Web and Kaggle.com	94%
Jain et al. (2019)	Naive Bayes, SVM, and NLP language	Various news websites, RSS Feeds.	93.50%
Supanya et al. (2018)	SVM, Neural Network and Naïve Bayes	The data was collected from 948,373 messages under Twitter API.	99.90%
Abdullah et al. (2019)	. SVM, Naive Bayes, Logistic Regression, LSTM, and RNN	20,360 data has been collected from the chile earthquake 2010 dataset.	89.34%
Julio et al. (2019)	KNN, SVM & Naive Bayes	News articles from Buzzfeed	89%

VI. CONCLUSION

The review study discusses pioneering existing work in the field of false news detection. Machine learning-based classification algorithms play a very important role in the detection of fake news or rumors from social media, which is a very complicated and difficult process due to the diverse political, social and economic, and many other related factors. This review discusses various machine learning approaches such as NLP, Linear Regression, KNN, SVM, LSTM, Artificial Neural Networking, and many more.

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