

# Analysis on Fake News Detection Methodologies

Vaishnavi R, Anitha Kumari S

*Abstract: Fake news is a coinage often used to refer to fabricated news that uses eye-catching headlines for increased sales rather than legitimate well-researched news, spread via online social media. Emergence of fake news has been increased with the immense use of online news media and social media. Low cost, easy access and rapid dissemination of information lead people to consume news from social media. Since the spread rate of these contents are faster it becomes difficult to identify the fake news from the accurate information. People can download articles from sites, share the content, re-share from others and by the end of the day the false information has gone far from its original site that it becomes very difficult to compare with the real news. It is a long standing problem that affects the digital social media due to its serious threats of misleading information, it creates an immense impact on the society. Hence the identification of such news are relevant and so certain measures needs to be taken in order to reduce or distinguish between the real and fake news. This paper provides a survey on recent past research papers done on this domain and provides an idea on different techniques on machine learning and deep learning that could help in the identification of fake and real news.*

**Keywords:** Deep Learning, Fake News, Machine Learning Natural Language Processing.

## I. INTRODUCTION

Nowadays people try to spend more time on social media platforms as it is free of cost and easily accessible. It also act as a good platform to share ones opinion and an excellent source to consume information. As anyone can spread an information through social media the quality of news on the social media is less than the news spread through traditional news organizations as these news are difficult to be considered authentic. A European wide survey conducted on 2018 claims online social medias as the news provider which is to be least trusted [1]. Fake news is spread deliberately to deceive people. The reasons for the spread of such news are to confuse the readers, for gaining political or financial incentives or to damage the status of an organization or individual. It is difficult to detect whether a generated news content is fake or not. Even the used language style can attempt to distort the truth. Due to the large dissemination capabilities of the social media the news can reach to millions of users within minutes. Even before a latest breaking news comes out through a conventional media it is out through the microblogs. The news that comes through the social media

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**Vaishnavi R**, Department of Computer Science and Engineering, LBS Institute of Technology for Women, Trivandrum, India. E-mail: vaishnavi27.tv@gmail.com

**Anitha Kumari S**, Department of Computer Science and Engineering, LBS Institute of Technology for Women, Trivandrum, India. E-mail: lekshmi03@gmail.com

has the ability to deceive people and the majority of the population believe in these news even after knowing that they are not put forward by any trusted source .At times fake news mentions truth injected within incorrect context, and also the language used in fake news is similar to genuine news as they are created in the intention to be trusted.

## II. METHODOLOGIES

This section deals with some of the methodologies in the field of Fake News Detection. Different classifiers used for the purpose of classification are as follows:

### A. Naïve Bayes Classifier

Naive Bayes Classifier follows the concept of Bayes theorem. Being a probabilistic classifier, it deals with the probability distribution of variables in the dataset and follows word frequencies as the feature for checking which category the given document belongs to [9][17]. It is a method used for the purpose of text categorization. As per Naïve Bayes, the presence or absence of a feature does not influence the presence or absence of another as they are unrelated to each other. The concept of classifying fake news is that, it often uses the same set of words whereas real news will have another set of words, which means certain set of words will have higher frequency of appearance in fake news and certain set of words will have higher frequency of appearance in real news [10]. But it is impossible to claim that an article is fake just because it has appeared frequently. Hence it is unlikely to provide perfect accuracy [2]. To get a baseline accuracy for the data a Naïve Bayes classifier is used [3]. The estimation of parameters can be performed using a small amount of training data on comparison to other classification methods and hence it is one of the biggest advantage of Naive Bayes classifier. Sivasangari et.al in the paper gives the detailed information on how gossips have spread after a twitter trending incident has happened and how one could manage it [4].

### B. K-Nearest Neighbour

It is an algorithm used for instant based learning done by approximation and classifies a data based on the similarity measures [18]. The data value is arranged in feature space and the feature is found out by using the value of 'k', the nearest k neighbour is chosen and the most occurred feature is found. Prabhjot et. al in the paper used a hybrid of KNN and Random forest method of classification [5]. The nearest neighbours can be identified using different methods and they have used Euclidean distance formula for the same.

Based on the  $k$  number of values the data is classified into different classes. The performance of the model was analysed based on the accuracy, precision and recall. There is an improvement of 8% in result with the use of hybrid model. In one of the paper KNN is used for finding the similar points in the training data. It computes the distance value between the items that needs to be classified and picks the  $k$  closest data points. It then performs the majority voting scheme among the data points and the dominating class is chosen in the final classification [7].

### C. Random Forest

Random forest is an ensemble tree based algorithm which is a combination of many individual decision trees where each of it builds a random subset of training dataset [19]. The random subset of variable is used to divide the dataset at each of the nodes. In a paper the proposed model uses a hybrid algorithm which includes Random forest as one of the algorithm. It is highly efficient and gives greater results without the presence of hyper-parameter tuning. During the training period the multitude of Decision tree is calculated and the prediction of each of the individual tree is given as the output [5].

### D. Support Vector Machine

SVM is a two group classifier also known as a discriminative classifier which comes under the category of supervised learning and can be used both for classification and regression purposes. It is defined using a separating hyperplane [20]. In the paper, the dataset is pre-processed and a feature matrix is formed out of it, which is then passed to the classifier consisting of LSVM and KNN. The model could give an accuracy of 92%. The classification and regression purposes can be satisfied using Sklearn.svm package [6]. In Curci et.al.'s paper, the Radial basis function kernel was used and the reason for its usage is that if the documents are similar the Doc2Vec feature vector will be close to each other. The distance computed should represent the original distance [3].

### E. Long Short Term Memory

It is an artificial recurrent neural network (RNN) that consists of feedback connections [21]. The advantage of an LSTM over traditional neural network is that it can remember what all has been passed before it is executed. For example if one needs to classify an event occurring at each point of a film it is unclear how a traditional neural network can be made into use to inform the later events about the previous events LSTM's are networks with loops and it allows the information to persist and hence it can address the above information. LSTM units are building blocks for RNN consisting of cell, input-output gates and forget gate. This cell is responsible of remembering or keeping record of the values. It also helps to maintain a relation between a word in the starting to the word in the output. When a hybrid of CNN and LSTM was used the accuracy was reduced from 98.3% to 97.3%. Even when the accuracy got reduced the precision and recall was effectively improved [8]. In one among the research paper LSTM is used as it is good in classifying serialized objects as it can memorize the previous input and combine it with the current input to make predictions. LSTM is suitable as the order of the word is important as it carries information of the sentence.

While using LSTM one cannot use Doc2Vec for pre-processing because while transferring the entire document into a single vector the order of the information might get lost. Instead one could use the word embedding technique. The pre-processing converts the raw text into fixed sized matrix [3].

### F. Convolutional Neural Network

It is a deep neural network that has its applications in various areas like natural language processing, image classification, video recognition, recommender systems. The network includes convolution, kind of a linear operation and hence the name. The network is made of input, hidden layers and output. The RELU layer otherwise known as the activation function is followed by the hidden layers [22]. The hidden layers are namely pooling layers, fully connected layers and normalization layers. In one of the paper a model named FNDNet was put forward, which uses CNN to extract features from each of the layers. This model was compared to other baseline models and was found an accuracy of 98.36% on the test data. To validate the result several evaluation parameters such as false positive, precision, recall, F1, accuracy, true negative etc. were considered [16].

## III. LITERATURE SURVEY

Conroy et.al. in the paper talks about assessment methods that uses linguistic cue approaches and network analysis approaches and have developed a hybrid approach to detect the fake news. The linguistic approach was used to find whether there exists any language leakage in the content and network approaches can also be used to provide deception measures. The method also uses the degree of accuracy or correctness to categorize the news. Machine learning techniques were used by both of these approaches for training the classifiers [11].

Buntain et.al. proposed a method that performed fake news detection on twitter data using two different twitter datasets - CREDBANK and PHEME, where CREDBANK consists of tweets annotated by humans related to real world events and PHEME consists of rumours and non-rumours associated with a veracity value. The same strategy was applied to Twitter content taken from Buzz Feed's fake news. Each of the three datasets is adjusted into a uniform arrangement. The paper proposes an automated system that classifies the tweets into genuine and counterfeit news [12].

Bajaj et.al. in their paper has put forward a classifier that predicts fake or real purely based on the content using the natural language processing.

Different models were explored for the same. The NLP techniques exploited the linguistic features of both real and fake news [13].

Wu, Liang, et.al. in their paper classified the social media content including text with hashtags and words using an approach called TRACEMINER which models the information and makes predictions. It provides high classification accuracy and plays a better role in interpreting real world dataset when compared with the traditional approaches.

They provide optimization methods to guarantee the correctness and also evaluates the performance of the real world social network data [14]. Granik et.al. used the machine learning method, Naïve Bayes Classifiers to develop a software system. The system was tested using a dataset that includes the facebook posts on news articles and has an accuracy of about 74%. They were collected from different political pages that are verified with a blue checkmark. The manipulation of news on social media occurs due to the ability to give public opinion on certain matters [10].

Natali Ruchansky et. al. proposed a model called CSI, divided into three modules: Capture, Score, and Integrate. They created a technique to solve three main problems in fake text: evaluation of a matching score to check whether there exists any relation between the body and the headline of an article, identifying which kind of an emotion the reader will have on reading an article, knowing the source of the article to find its credibility by checking the structure of the URL [15].

**Table 1. Brief Note On Literature Review**

Year	Author	Topic	Remark
2015	Conroy et.al.	Automatic deception detection: Methods for finding fake news	The paper talks about assessment methods that uses linguistic cue approaches and network analysis approaches and have developed a hybrid approach to detect the fake news.
2017	Granik et.al.	Fake news detection using naive Bayes classifier	Performed the implementation of Fake News Detection using Naïve Bayes Classifiers. The manipulation of news on social media occurs due to the ability to give public opinion on certain matters.
2017	Buntain et.al.	Automatically identifying fake news in popular Twitter threads	The paper proposes an automated system for arranging Twitter threads into genuine and counterfeit news stories. The classifier used for the purpose was random forest classifier and provides an accuracy of about 66.93% and 70.28% for PHEME and CREDBANK datasets.

2017	Bajaj et.al.	The Pope Has a New Baby! Fake News Detection Using Deep Learning	The NLP techniques were used to detect fake news by exploiting the linguistic features of both real and fake news.
2018	Wu, Liang, et.al.	Tracing fake-news footprints: Characterizing social media messages by how they propagate	Here the author proposes an approach called TRACEMINER. It provides high classification accuracy and plays a better role in interpreting real world dataset when compared with the traditional approaches. In this paper TRACEMINER itself is represented in two versions: TM(Deepwalk) and TM(LINE). TM(Deepwalk) outperforms TM(LINE) when the training information is less and vice versa.

#### IV. RESULTS

Sl. No.	Techniques Used	Remarks
1.	Naïve Bayes	Avg acc- 85%
2.	K-Nearest Neighbour	Avg acc -87%
3.	Random Forest	Avg Acc- 87%
4.	Support Vector Machine	Avg Acc-92%
5.	Long Short Term Memory	Avg Acc – 92%
6.	Convolutional Neural Network	Avg Acc – 95%

## V. CONCLUSION

Fake news detection can be performed using machine learning or deep learning technique which uses supervised learning algorithms. From the above review it can be concluded that, in the case of Naïve Bayes, the test data can be easily classified. It also has the ability to perform well in multiclass prediction. Naive Bayes can perform well compared to other models even when the training data is less, by holding the assumption of independence. The limitation found in Naïve Bayes is the assumption of independent predictors as it is almost impossible to get predictors which are completely independent in real life scenarios. For LSTM, it is difficult to calculate the network output and apply back propagation as the explicit memory adds more weight to each node. SVM works well when there is a clear margin of separation between classes. If training data sample is less when compared to the features for each data point, then SVM will underperform. The limitation of random forest is that it does not give precise continuous nature prediction. KNN requires only two parameters for the purpose of implementation i.e. the value of k and the distance function. Once it is decided to build KNN using distance function, it is necessary that the features must have same scale.

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## AUTHORS PROFILE



**Vaishnavi R** is pursuing (4<sup>th</sup> Semester) Master's Degree in Computer Science and Engineering from LBS Institute of Technology for Women, Kerala, India affiliated under Kerala Technical University. She received her Bachelor's degree in Computer Science and Engineering from John Cox Memorial CSI Institute of Technology, Kerala, India in the year 2018, affiliated under Kerala University.



**Anitha Kumari S** has done her Ph D research work in cloud computing at National Institute of Technology Karnataka. She published several papers in reputed conferences and peer reviewed journals. Currently the author is working as Associate professor in computer science and engineering at LBS Institute of Technology for Women, Poojappura, Thiruvananthapuram. The author is a member of many professional bodies and the research areas are: Algorithms and Analysis, Cloud computing, Machine learning and Natural Language Processing.