



A Survey of Machine Learning Based Fake News Detection Methods

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Abstract: *Because they are free to use, easy to access, and widely disseminated, social media platforms have emerged as one of the most convenient news sources available in the modern world. Nevertheless, this comes with a few confusing indicators, in addition to large risks of being vulnerable to fake stories, which are stories that are made up to misdirect consumers. These kinds of data have the potential to sway the public's opinion and give corrupt organizations the ability to manipulate the outcomes of public events like races. Fake and misleading news can have a significant impact on the people who end up being its targets. This article focuses on an evaluation of previously published papers and an examination of alternative methodologies for discovering fake news. This overview provides a comprehensive review of the most recent as well as previous analyses on the identification of fake news by applying a variety of Machine learning computations.*

Keywords: Fake News, Machine Learning, Deep Learning, Rumor, Twitter.

Introduction

Once in a while, we all have come across the term what's App University. This is not just the term which is specifying the access of information through social media sites but is also concerned with the reliability of information through sources like social media and various other platforms of information and entertainment. The widespread accessibility of the internet gives information to the masses at a click, but it also made it hard to verify the information. With the question of reliability and verification, the question of fake news also comes.

The information and news regarding the spread of global pandemic covid-19 like self-verification of being infected, spread based on temperature, vaccination; the speech of political figures during public addressing and the unverified statement of them regarding the military invasion, about developing and doing public goods; false and misleading images of people for malign or praise them; manipulation of videos and audios are some of the cases and example of fake news.

Fake news is not a very new thing, but its extensive penetration is very new and this is highly supported by various media sources. Facebook, WhatsApp, blogs, Twitter, YouTube, and sadly but news channels are also included in the list of spreading fake news. This can't be said that these channels and online platforms are unaware of this. Not long ago Facebook owner Mark Zuckerberg was called by Senate and questioned about its minimum control over the spread of fake and hate news through its platform and even after this interrogation, FB is still used in the same way.

A view of an individual becomes information for others and based on those biased and unverified information others build their surroundings. The increase in information based on this approach made a society run with



false ideas. This falsification of information is hardly verified by an individual as they busy themselves in their individual and virtual world. But a society based on false and biased ideas is a bomb that tickles every time to burst whenever a new idea intervenes and becomes a threat to the dominance of the existing idea which is neither good for an individual or a society.

In the last few years, we have heard and read about the statement of ministers in the national science congress about saying Darwin's theory of evolution was a myth, saying the first plastic surgery was done millions of years ago with some verse on Ganesha, the first airplane of Ravana with much advancement than today's plane, and the utility and usefulness of cow's waste are an example of fake news which are building people's perception and making them doubt of sciences. Similarly, during the time of demonetization, the news channels were spreading false news about the chip in new notes of rupees 500 and 2000. Also, with the help of social media one's view about the other community is used to create division at political, religious, caste, and nationality levels.

These examples show how fake news is controlling and making our scientific, religious, social, and other beliefs and relations. Although the main beneficiaries of this fake news are the party in power for their political gain, others are also gaining momentary.

Table 1: DEFINING SOME TERMS RELATED TO FAKE NEWS.

Word	Meaning
Rumor	"A moving information whose truth status was not at the time of posting"
Fake News	"A news article that is false"
Hoax	"An intentionally created falsehood made to pose as truth"
Clickbait	"An intentional strategy which is intended to attract attention and encourage visitors to collect revenue"

The rest of the paper is organized as follows: in section 2 we explained related work done previously in the field of Fake News detection, in section 3 we discussed various parameters of Evaluation, in section 4 future research directions are defined, in section 5 we conclude our paper with future research directions followed by references used in this paper.

II. Related Work

In 2013, Aditi Gupta, Henmark Lamba, and Anupam Joshi achieved more than 90% correct results in identifying false images from Twitter of Hurricane Sandy which impacted the United States. Meanwhile, they did a characterization analysis to analyze the impact patterns of the fake pictures by analyzing more than 10,000



images on Twitter. During this time, they worked on NaiveBayes and the Decision tree model. After applying these two ML algorithms they arrive at a good result having an accuracy of 97% by Decision Tree. [1]

In 2017, Elena Kochkina, Arkaitz Zubiaga & Maria Liakata worked on the classification of rumor stances on social media platforms with the help of sequential classifiers. In this, they use Twitter as their social media platform and describe tweets into 4 categories: 1. Support, 2. Deny, 3. query, and 4. Comment on an earlier post. They used four sequential classifier-Hawkes processes, Long Short Term Memory (LSTM), linear CRF, and tree CRF on 8 data sets, and all data are related to breaking news. They discover sequential classifiers that use the recitation property in social media interaction outperform nonsequential classifiers also LSTM works better than other sequential classifiers. [2]

In 2018, Kalina Bontch., Ahmet Aker, and Maria Liakata work on rumor detection using NLP and data mining Methods. They define false news that circulates on social media into two types: long standing rumors and new emerging rumors generate during recent events. They develop a rumor classification system that consists of 4 parts: 1. Detection of rumor, 2.Tracking of rumors, 3. Stances of rumor and 4. The veracity of rumor. And use this system on the PHEME dataset which is publicly available for rumors and nonrumors. [3]

In 2018, C.M.M Kotteti, Na Li, and Lijun Qian worked on increasing the detection of fake news with data imputation. To improve performance they used a novel data preprocessing method to fill the missing value in the raw dataset. With the help of data modeling, they applied missing values for numerical and hierarchical attributes. For hierarchies, they select the most frequent value in columns and are numeric for the average value of the column. He did 3 things to cover the missing values. 1 is Removed columns with missing values, 2 is Missed values with empty text and 3 is Used data impersonation techniques to apply missing values and found that multilayer perceptron (MLP) classes improved accuracy by 16%. [4]

In 2018, Supanya Aphiwongsophn and Prabhas Chongstitvatana purpose the ML algorithm to identify fake news. In this paper, three popular methods are used: 1. Naive Bayes 2. Support Vector Machine and 3. Neural Network. They used the normalization method for cleaning data so that it works better with correct data. In this paper, they found that Naive Bayes has an accuracy of 96.08% and the other two complex techniques have an accuracy of 99.90%. [5]

In 2018, a. Jain and A. Kasbe work on detecting fake news and they proposed a method so that we can implement this method on Facebook. He used Naive Bayes for forecasting. They used a dataset from Github with 11000 articles divided into (index, text, title, and label). Apart from politics, this data contains news related to science and business. For implementation, they used both the title and text for their primary source and also added some references by n-gram then he compared the results and find that Naive Bayes (on text with n-grams) gives the accuracy of 0.931 and they also showed some ways to improve this model. [6]

In 2019, Deepayan Bhowmik, Oluwaseun Ajao, and Shahrzad Zargari proposed a model that identifies false news tweets from the Twitter post using a combination of (CNN) and (RNN) models. For the dataset, they collected 5,800 tweets centered on five rumor stories: Charlie Hebgo, Sydney Siege, Germanwings Crash, Ottawa Shooting, and Ferguson Shooting. Their proposed work on a hybrid of CNN & RNN intuitively identifies important feature related to false news stories without any prior knowledge of news and achieve more than 80% accuracy. [7]

In 2019, Varshil Mehta and Wenlin Han worked on the performance evaluation of fake news detection methods. They divide the dataset of fake news into 2 categories. The first is the news and the second is the social context model and they divide news into 2 categories visual (picture, video) and linguistic (text, title) based. They



compared performance between traditional ML methods (NaiveBayes, Random forest) and the latest deep learning methods (LSTM DROP, LSTM-CNN). The purpose of this paper is to provide a basis so that people can choose between these two approaches. They found that the hybrid CNN - RNN model gives better performance/ results. [8]

In 2019, J. C.S. Reece, A. Correia, F. Murai, A. Veloso, and F. Benevuto works on searching a wide variety of features from news articles, posts, and stories that can help predict fake news with greater accuracy. He showed the importance of these new features for the evaluation of fake news. Some of those features are bias, reliability/trustworthiness, engagement, domain location, and temporal patterns. They used a dataset containing 2282 BuzzFeed (news articles). They used KNN, Naïve Bayes, Random Forest, Support Vector Machine, and XGBoost algorithm for evaluation and to discuss the opportunities and challenges of this approach and they found out that XGBoost works better than all with an accuracy of 0.86. [9]

In 2020, Iftikhar Ahmad, Muhammad Yousaf, Suhail Yousaf, and Muhammad Ovais Ahmad classified fake news articles using machine learning models and ensemble techniques (Logistic Regression, Random Forest, Perez- LSVM). In this paper, various textual properties are used to differentiate fake news from real news. The experiment was conducted on 4 publicly available datasets which are of different domains and also calculated the performance by performance metrics. The maximum accuracy is 99% achieved by random forest and Perez-LSVM on ISOT Fake News Dataset. [10]

In 2020, C. Yuan, Q. Ma., and W. Zhou proposed a model structure-aware multi-head attention network (SMAN) based approach to detect fake news. This method is based on the reliability of both publishers and users. The datasets used for this approach were real-world datasets. This approach can be used for the early detection of fake news that optimizes the detection process with the help of asymmetric graphs between publishers and users. They use this model on 3 different datasets (Twitter 15, Twitter 16, and Weibo) and find that this model gives very high accuracy. [11]

In 2021, S.M. Shifath, Md. S. Islam, and Md. F. Khan proposed a transformer-based approach for detecting COVID-19 fake news. They performed experiments on traditional language models and CNN. The dataset is social media posts related to COVID-19 and labels indicating whether the posts are fake or real. They also experimented with transformer-based models and tested different hyperparameters. The highest accuracy is 0.979 which is shown by RoBERTa. [12].

III. Evaluation Parameters

Multiple supervised classification algorithms used to evaluate accuracy:

Accuracy - Accuracy is the display of the most natural illustration and is only part of the preconceived notion of complete ideas. One might think that, if we could achieve higher clarity, our model is correct. Indeed, precision is a rare measure but as long as you have metrics data where positive and negative estimates are almost the same.

$$\text{IV. Accuracy} = (\text{TN} + \text{TP}) / (\text{TP} + \text{FP} + \text{TN} + \text{FN}).$$

Precision - It is a measure of positively anticipated ideas in the perfectly expected positive outlook. Higher accuracy indicates a lower deceptive value.

$$\text{Precision} = \text{TP} / (\text{FP} + \text{TP})$$

Recall or Sensitivity- It is the measure of the number of positive ideas that are expected of all ideas in the original class - yes.



$$\text{Recall} = \text{TP} / (\text{TP} + \text{FN})$$

F1 score -The F1 Score is standard with Precision and Recall weights. As a result, the score is looking for false negatives and false positives both. Naturally, it's not as straightforward as precision, but the F1 score is often more important than accuracy, like if it is still distributed in separate categories. Exactness works best when counterfeit and illegal pros and cons have costs to compare.

$$\text{F1 Score} = 2 * (\text{Recall} * \text{Precision}) / (\text{Recall} + \text{Precision})$$

Where TP, TN, FP, and FN indicate genuine positive, genuine negative, false positive, and false negative, individually.

IV. Relative Study of Techniques in Fake News Detection

Author & Year	Dataset	Technique	Accuracy
A. Gupta & H. lamba [1]	Twitter feeds (total 1,782,526 tweets)	Naïve Bayes	0.91
		Decision Tree	0.97
Arkaitz Zubiaga & Elena Kochkina[2]	Supporting tweets on Twitter	SVM	0.657
		Linear CRFTree	0.603
		CRF	0.552
M. kotteti, X.	LIAR	SVC	0.245
Dong, Na Li & L.Qian [4]	the dataset containing (12,836 records)	LinearSVC-CSDecision	0.195
		Tree	0.394
		MLP Classifier	0.457
		Gradient boosting	0.442
Supanya	Twitter		0.96
Aphiwon. & Prabhas	feeds	Naive Bayes	0.99
		Neural Network	
Chongsti. [5]		SVM	0.99
A. Jain & A.	From	NB (on title)	0.806
kasbe [6]	Github (11,000 articles)	NB (on text) NB(on title with n-grams)	0.912
			0.807
		NB (on text with n-grams)	0.931
Oluwaseu	5800 tweets	LSTM	0.82



Ajao, & Shahrzad Zargari	On five rumored stories	LSTM- DROPLSTM-CNN	0.73 0.80
[7]			
Wenlin Han	Collect data	Naïve	0.67
& Varshil Mehta [8]	in (multi-media, text, audio, hyperlink	Random forest LSTM LSTM DROPLSTM-CNN	0.56 0.82 0.73 0.80
J. C.S. Reece,	2282	KNN	0.80
A. Correia, F.	Buzzfeed	NB	0.72
Murai, & A. Veloso [9]	news article	RF SVMXGB	0.85 0.79 0.86
Iftikhar Ahmad, Md Yousaf & Suhail Yousaf [10]	ISOT Fake News Dataset	Logistic Regression Random Forest Perez-LSVM	0.97 0.99 0.99
C. Yuan, Q. Ma, W. zhou & J. Han [11]	Twitter 15 Twitter 16 Weibo	SMAN SMAN SMAN	0.929 0.935 0.956
Md. Faiyaz	Social	Bi-LSTM	0.928
Khan and Md. Saiful Islam [12]	media posts related to COVID-19	1D-CNN BERT ROBERTa	0.926 0.971 0.979

V. Future Research Scope

This part contains the impediments of the current work on recognizing counterfeit news and the thought for future work. As there is a ton of work previously done on recognizing fake News work, ensemble procedures for various calculations for information preprocessing for future work. In the paper [4] they filled the missing worth with attribution strategies, yet they played out this just on 1 dataset, so later on we can chip away at these methods with various sorts of datasets and look at the outcomes.



VI. Conclusion

In this research paper, our primary focus was on the work that has recently been accomplished on the subject of recognizing fake news using a variety of methodologies and strategies. Additionally, this study illustrated the tools that are available to work on the inquiry cycle and to think about existing tactics and methodologies. Our investigation will be geared toward implementing a more effective advanced outfit strategy and will also include some outstanding word installing strategies. In addition, one of our goals is to produce consistent results with the support of standardized techniques applied to the dataset, which incorporates data collected from a variety of sources. Group techniques can produce more accurate projections and lead to improved execution, all while reducing the amount of scattering that occurs.

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