Fake News Detection using Machine Learning

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***Abstract*—Fake news can originate from several sources such as social media, blogs, and websites and can spread like wildfire. Social media, in specific, is a medium through which fake news can spread among large masses as it is free, and a large number of people use it regularly and more than often, people believe what they read on social media. This has become a problem for governments as well as individuals because any influential piece of fake news spread during an important event like elections can lead to a chain of unlikely events. We aim to build a machine learning model in this paper that will help us in detecting the fake news successfully from the vast pool of news over the internet and, in turn, help us to stop the spread of fake news among people or make people aware of which one is a piece of fake news.**

I. Introduction

News has a great impact on our day-to-day life, even more than we realize, and in this digital era, the spread of fake news has become a serious problem that needs to be dealt with. Fake news can be spread due to a number of reasons, such as political endeavours or for the betterment of one organization over another. This can create an unfavourable environment for the general public as well as governments. And with the evolution in the field of AI, it has become a larger problem now that bots can be designed to post fake news articles over the website in a humongous amount of numbers. [1]

Text or natural language, in specific, are the ones that are hard to tackle as they differ in many aspects, such as linguistics, the figure of speech, and satire. We have built a model that can process different words style from the news article using "**Wordcloud**" and "**NLTK**". Our aim is to derive a model that can take advantage of the linguistic irregularities in the news article and differentiate between fake and real news.

Some studies have shown that people fly off through a news article instead of reading it as they overestimate their political knowledge, [11]. In contrast, other people might share news without understanding it completely.

This gives a chance to the bad elements of society to falsify the facts of the news article. It is seen that false news articles are a collection of disconnected content and lack editorial strategy. [10]

Therefore the need of good model that can classify the fake news from the humongous pool of data has become dire and in this paper we are going to focus of building effective models that will help us gear up for this problem and classify the fake news from the pool of news articles.

II. Related Work

We can find various papers that have tried to resolve the problem of fraud news in several ways. Some articles handled the subject from a data mining standpoint that includes feature extraction process from data and model creation. [2] Feature extraction and metrics such as Precision, Recall and f1 score can give us desirable results, but the problem is not this easy because variables like AI bot spamming, clickbait blogs also affect prediction done by model.

Apart from these data mining approaches, we see development in the field of AI. Therefore researchers are now more inclined toward using the deep neural network. A paper discussed the method by which we can tackle the problem. They used the technique that includes 'catch', 'tally', 'amalgamate' and hence create a neural network for the detection of the fake news. They use cyclic neural networks which track a user's activity around news articles and hence extract some useful features from them. This information is used for the classification of fake or real news in our data pool. [3]

Some papers talks about the Sentiment analysis. Sentiment analysis focuses on the emotions in the news article. It uses language resources such as Lexicon of the sentence and the sentiment database. Each word has given the scale of -5 to 5 based on their constructive or destructive structure. [12]

Other papers have used LSTM and CNN to assort and classify online blog posts. Also the libraries such as GLoVe is used. [4]

Many attempts have clearly been made to address the issue of false news, but each solution has its own set of difficulties and limits. There is a vast scope left for development in this area, especially in these times as it has become hard to classify fake and actual news articles because of lingual, satire variables. There have been efforts to create a vast data set that can provide all-around features for our model. One such data set has been sued in this paper.

III. Methodology

We will be making three different models and testing them against our dataset with three metrics per model.

A. Dataset

For this paper we are using the dataset from the University of Victoria. [5] [6]
Link: www.uvic.ca/ecs/ece/isot/datasets/fake-news/index.php

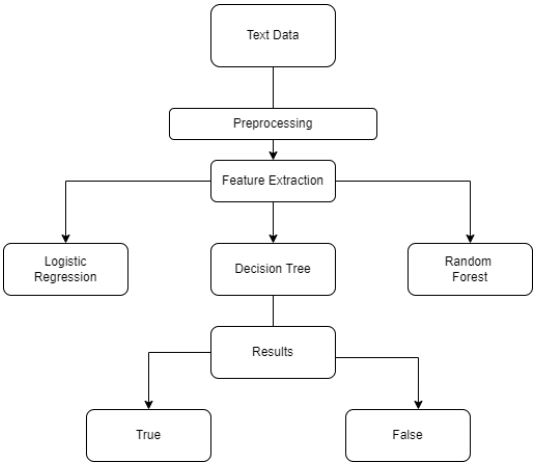

Fig. 1: Project Plan

The National University of Victoria ranks in the top 2 per cent of the universities, and the provided dataset has two types of articles fake and real news.

The dataset consists of 2 CSV files with true and fake news articles. We have total of 38338 samples combining both fake and real news. In which instances of respective articles are as follows.

Fake News Articles	16921
Real News Articles	21415

TABLE I: Number of samples

We have columns 'title', 'text', 'subject', 'date', and we'll be extracting our features from the column **'text'**. Features will be extracted with the help of **'Wordcloud'** and **'NLTK'**, which will help us extract the most used words from fake and real news articles. Text column contain English sentences that we think will be adequate for our project as NLTK and Wordcloud will be efficient in detecting any structural thematic deviation.

The data was gathered from real-world sources, with actual news samples acquired by crawling Reuters.com and false news pieces picked from other sources. The dataset contains 2 CSV files named "True.csv" and "Fake.csv", containing more than 35,000 samples collectively. Each article contains the article title, text, type, and date on which the article is published. Samples in the dataset are from 2016-to 2017. The collected data is cleaned and processed. However, the fake news errors are kept in the text.

1) Preprocessing: For data preprocessing, we'll perform dimensionality reduction by dropping the columns we do not use, such as 'subject', 'title', and 'date'. Next, we'll be removing stopwords and punctuation from the data using NLTK and converting all text into lowercase for easy processing.

Next we will find out what are the most frequently used words in both fake and real news article.

2) Feature Extraction: For feature extraction we're using 'tokenize' library from NLTK to count the number of most frequent words in fake and real news. These words will act as features for our model.

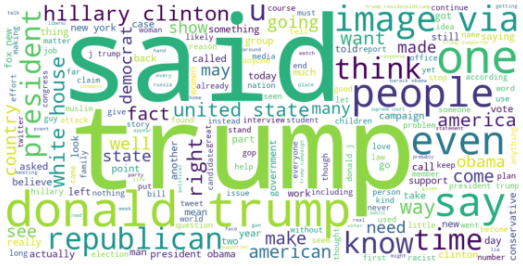

Fig. 2: Frequent words used in fake news article.

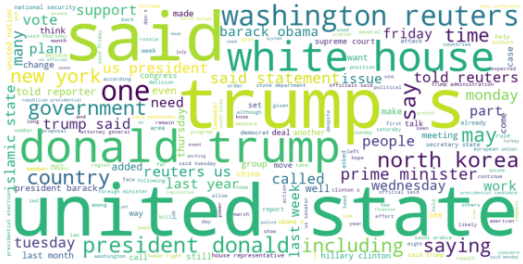

Fig. 3: Frequent words used in real news article.

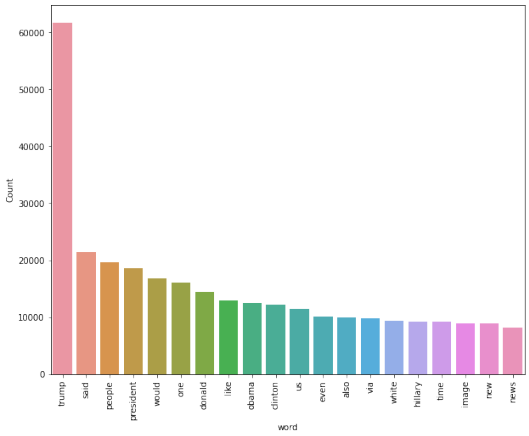

Fig. 4: Number of most frequent words in Fake articles

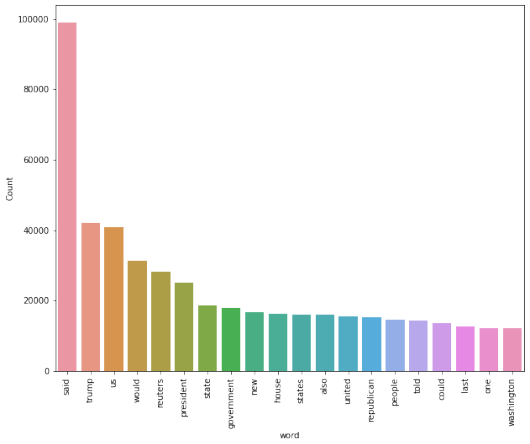

Fig. 5: Number of most frequent words in Real articles

Also, TF-IDF(Term frequency-inverse document frequency) algorithm is used for feature extraction. TF-IDF algorithm is a crucial part of our model as it tells us how important a word is in a given news article, whether fake or real. Along with that, CountVectorizer is used to convert the extracted words into tokens that further can be analyzed by our model.

B. Experiments Run

We have created 3 models to test our data.

- Logistic Regression
- Decision Tree
- Random Forest

C. Metrics

For metrics we are using:

- Precision
- Recall
- f1 score

1) Precision: Precision will tell us out of our total samples we're able to identify the True positives.

$$Precision = TP/(TP + FP) \tag{1}$$

2) Recall: Secondly, we will be using recall after the accuracy; therefore, our second most important metric will be recalled as recall will tell us that out of all 35000 plus samples, how many samples of fake news we can identify successfully.

$$Recall = TP/(TP + FP) \tag{2}$$

3) f1 Score: Our third most important metric will be f1-score as it'll give the harmonic mean of precision and recall. F1-score will tell us the performance of our model based on two factors that are precision and recall.

$$f1score = 2x(PrecisionxRecall)/(Precision + Recall) \tag{3}$$

IV. Results and Analysis

We have use 3 models and 3 metrics for each of the model and produced results as follow:

1) Logistic Regression:

- Precision = 98.39
- Recall = 99.33
- f1 score = 98.86

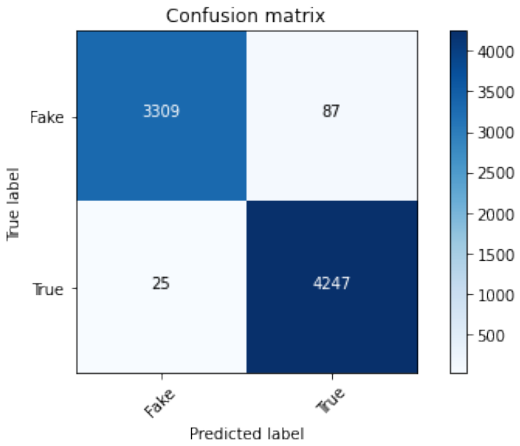

Fig. 6: Confusion Matrix for Logistic Regression

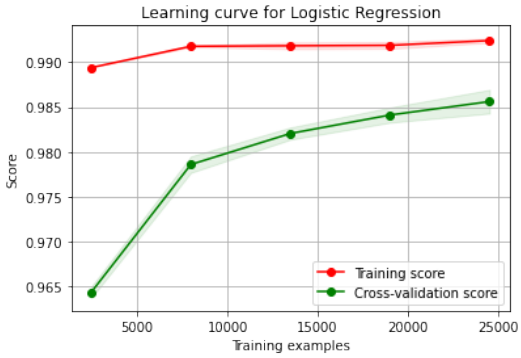

Fig. 7: Learning Curve for Logistic Regression

2) Decision Tree:

- Precision = 99.65
- Recall = 99.75
- f1 score = 99.7

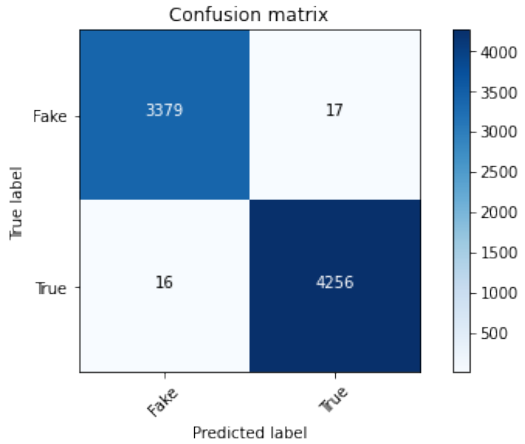

Fig. 8: Confusion Matrix for Decision Tree

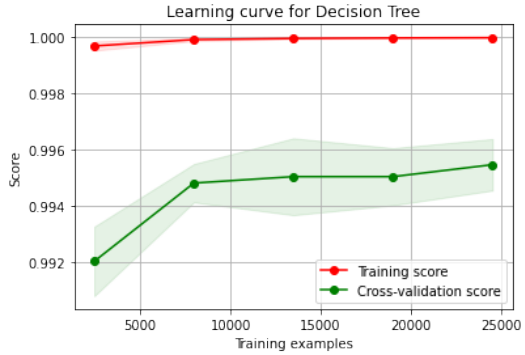

Fig. 9: Learning Curve for Decision Tree

3) Random Forest:

- Precision = 97.24
- Recall = 99.44
- f1 score = 98.33

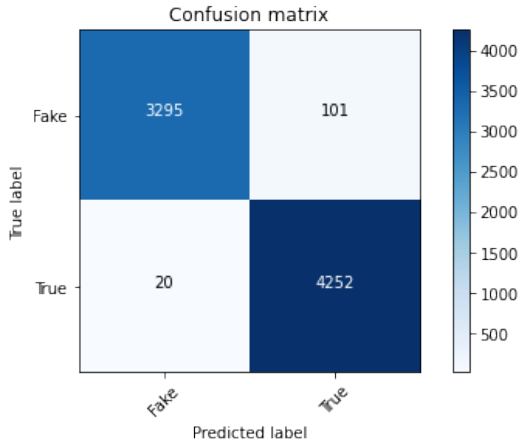

Fig. 10: Confusion Matrix for Random Forest

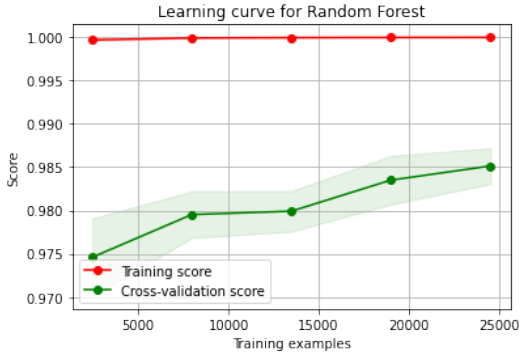

Fig. 11: Learning Curve for Random Forest

From the results displayed above, we can see that the Decision Tree classifier is performing the best with all three scores above 99 per cent, followed by the Logistic Regression with an average of 98.8 per cent and random forest with an average of 98.3 per cent.

We believe that produced results are promising as the models are able to identify the fake news article with great precision every time. However we still have some room for progress, if we use several other techniques to improve our result.

The limitation that come wrapped up with our work is that data is inconsistent, that means our model can make mistakes and have anomalies.

In future, we can take advantage of technology like word2vec or Topic modelling, which will provide an edge to our model in feature extraction and classification.

V. Conclusion

The problem of fake news in the world is dangerous and spreads like wildfire. A recent example is what happened in the US during the last presidential elections. According to reports, false news may have a major impact on political propaganda and, eventually, on individuals, much like a ripple effect. In this study, we present three methods for dealing with the real-world problem of fake news. In this digital age, we can combat the problem and regulate the spread of fake news with the aid of sophisticated AI.

Among the several attempts in the field, a convincing one has yet to be observed. Every day, massive amounts of data are acquired from many sources, and models develop. Future work in this sector with the assistance of a deep neural network appears promise.

References

[1] Shao, C., Ciampaglia, G. L., Varol, O., Flammini, A., Menczer, F. (2017). The spread of fake news by social bots. arXiv preprint arXiv:1707.07592, 96-104.

[2] Shu, Kai, et al. "Fake news detection on social media: A data mining perspective." ACM SIGKDD explorations newsletter 19.1 (2017): 22-36.

[3] Ruchansky, Natali, Sungyong Seo, and Yan Liu. "Csi: A hybrid deep model for fake news detection." Proceedings of the 2017 ACM on Conference on Information and Knowledge Management. 2017.

[4] Volkova, Svitlana, et al. ”Separating facts from fiction: Linguistic models to classify suspicious and trusted news posts on twitter.” Proceedings of the 55th annual meeting of the association for computational linguistics (volume 2: Short papers). 2017.
[5] Ahmed, Hadeer, Issa Traore, and Sherif Saad. ”Detecting opinion spams and fake news using text classification.” Security and Privacy 1.1 (2018): e9.
[6] Ahmed, Hadeer, Issa Traore, and Sherif Saad. ”Detection of online fake news using n-gram analysis and machine learning techniques.” International conference on intelligent, secure, and dependable systems in distributed and cloud environments. Springer, Cham, 2017.
[7] Pal, Subhabaha, TK Senthil Kumar, and Sampa Pal. ”Applying Machine Learning to Detect Fake News.” Indian Journal of Computer Science 4.1 (2019): 7-12.
[8] Waldman, Ari Ezra. ”The marketplace of fake news.” U. Pa. J. Const. L. 20 (2017): 845.
[9] Zhou, Xinyi, and Reza Zafarani. ”Fake news: A survey of research, detection methods, and opportunities.” arXiv preprint arXiv:1812.00315 2 (2018).
[10] Karimi, Hamid, and Jiliang Tang. ”Learning hierarchical discourse-level structure for fake news detection.” arXiv preprint arXiv:1903.07389 (2019).
[11] Anspach, Nicolas M., Jay T. Jennings, and Kevin Arceneaux. ”A little bit of knowledge: Facebook’s News Feed and self-perceptions of knowledge.” Research Politics 6.1 (2019): 2053168018816189.
[12] Khanam, Z., et al. ”Fake news detection using machine learning approaches.” IOP Conference Series: Materials Science and Engineering. Vol. 1099. No. 1. IOP Publishing, 2021.