Fake News Detection on Social Media

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Abstract- Fake news has been there since before the advent of the Internet. It can be defined as "fictitious articles deliberately fabricated to deceive readers". Some news may have a nugget of truth, but lack any contextualizing details. They may not include any verifiable facts or sources. Some stories may include basic verifiable facts, but are written using language that is deliberately inflammatory, leaves out pertinent details or only presents one viewpoint. In this paper we try to understand these nuances in fake news by it's language. Initially the data set was preprocessed, the article's content was pre-processed using techniques like Lemmatization and TF-IDF. The data was then classified using a Stacking Classifier, using Naïve Bayes, SVM, Decision Tree as base models and Logistic Regression as meta model.

Index Terms- Fake News, Classification, Social Media, SVM, Naïve Bayes, NLP

I. INTRODUCTION

In modern era where the internet is ubiquitous, everyone relies on various online resources for news. Along with the increase in the use of social media platforms like Facebook, Twitter etc. News spread rapidly among millions of users within a very short span of time. Fake news encapsulates pieces of news that may be hoaxes and is generally spread through social media and other online media. Such news items may contain false and/or exaggerated claims, and may end up being made viral by algorithms, and users may end up in a filter bubble. The spread of fake news has far-reaching consequences like the creation of biased opinions to swaying election outcomes for the benefit of certain candidates.

With the current usage of social media platforms, consumers are creating and sharing more information than ever before, some of which are misleading with no relevance to reality. Social media and news outlets publish fake news to increase readership or as part of psychological manipulation. In general, the goal is profiting through click baits to lure users and entice curiosity with flashy headlines or designs to click links to increase advertisements revenues.

A regular examination of the news articles would give us an understanding of what articles are fake and which ones are real. This classification can help in identifying fraud accounts spreading the news and the respective authorities can be alerted to take necessary action.

II. LITERATURE SURVEY

Efeosasere Okoro et al., (2018) in their paper titled "A Hybrid Approach To Fake News Detection On Social Media" stated that there have been a wide range of solutions developed to help humans distinguish between fake and real news however, the solutions rely on either a machine-based approach or a human-based approach to detection. Research in the fields of computer science, artificial intelligence and psychology research has shown the limitations in both approaches. Based on these research findings, this paper proposes a hybrid model for detecting fake news on social media using a combination of both the human-based and machine-based detection approaches.

Ray Oshikawa et al., (2018) in their paper titled "A Survey on Natural Language Processing for Fake News Detection" stated that given the massive amount of Web content, automatic fake news detection is a practical NLP problem useful to all online content providers, in order to reduce the human time and effort to detect and prevent the spread of fake news. In their paper, we describe the challenges involved in fake news detection and they describe related tasks. We systematically review and compare the task formulations, datasets and NLP solutions that have been developed for this task, and also discussed the potentials and limitations of them. Based on their insights, they outline promising research directions, including more fine-grained, detailed, fair, and practical detection models.

MontherAldwairi et al., (2018) in their paper titled "Detecting Fake News in Social Media Networks" stated that clickbaits lure users and entice curiosity with flashy headlines or designs to click links to increase advertisements revenues. This exposition analyzes the prevalence of fake news in light of the advances in communication made possible by the emergence of social networking sites. The purpose of their work is to come up with a solution that can be utilized by users to detect and filter out sites containing false and misleading information. They used simple and carefully selected features of the title and post to accurately identify fake posts. The experimental results showed a 99.4% accuracy using logistic classifier.

Kai Shu et al., (2017) in their paper titled "Fake News Detection on Social Media: A Data Mining Perspective" started that first, news is intentionally written to mislead readers to believe false information, which makes it difficult and nontrivial to detect based on news content; therefore, we need to include auxiliary

information, such as user social engagements on social media, to help make a determination. Second, exploiting this auxiliary information is challenging in and of itself as users' social engagements with fake news produce data that is big, incomplete, unstructured, and noisy. In this survey, they present a comprehensive review of detecting fake news on social media, including fake news characterizations on psychology and social theories, existing algorithms from a data mining perspective, evaluation metrics and representative datasets. They also discuss related research areas, open problems, and future research directions for fake news detection on social media.

M. F. Mridha et al., (2021) in their paper titled "A Comprehensive Review on Fake News Detection With Deep Learning" stated that a protuberant issue of the present time is that, organizations from different domains are struggling to obtain effective solutions for detecting online-based fake news. It is quite thought-provoking to distinguish fake information on the internet as it is often written to deceive users. Compared with many machine learning techniques, deep learning-based techniques are capable of detecting fake news more accurately. Previous review papers were based on data mining and machine learning techniques, scarcely exploring the deep learning techniques for fake news detection. However, emerging deep learning-based approaches such as Attention, Generative Adversarial Networks, and Bidirectional Encoder Representations for Transformers are absent from previous surveys. This study attempts to investigate advanced and state-of-the-art fake news detection mechanisms pensively The prominent evaluation metrics in fake news detection are also discussed. Nevertheless, they suggest further recommendations to improve fake news detection mechanisms in future research directions.

Iftikhar Ahmad et al., (2020) in their paper titled "Fake News Detection Using Machine Learning Ensemble Methods" stated that even an expert in a particular domain has to explore multiple aspects before giving a verdict on the truthfulness of an article. In this work, we propose to use machine learning ensemble approach for automated classification of news articles. Their study explores different textual properties that can be used to distinguish fake contents from real. By using those properties, they train a combination of different machine learning algorithms using various ensemble methods and evaluate their performance on 4 real world datasets. Experimental evaluation confirms the superior performance of our proposed ensemble learner approach in comparison to individual learners.

Syed Ishfaq at al., in their paper titled "Fake News Detection Using Machine Learning approaches: A systematic Review" state that the easy dissemination of information by way of sharing has added to exponential growth of its falsification. The credibility of social media networks is also at stake where the spreading of fake information is prevalent. Thus, it has become a research challenge to automatically check the information viz a viz its source, content and publisher for categorizing it as false or true. Machine learning has played a vital role in classification of the information although with some limitations. This paper reviews various Machine learning approaches in detection of fake and fabricated news. The limitation of such and approaches and improvisation by way of implementing deep learning is also reviewed.

GihwanKim et al., (2020) in their paper titled "Effective fake news detection using graph and summarization techniques" stated that there is an increasing need to accurately detect fake news to prevent such damage. In this paper, they propose a novel method that uses graph and summarization techniques for fake news detection. Their proposed method represents the relationship of all sentences in a graph structure to accurately understand the context information of the document. Accordingly, the relationship between sentences in the graph is calculated as a score through the attention mechanism. Then, the summarization technique is used to reflect the sentence subject information in the graph update process. Our proposed method shows better performance than Karimi's and BERT based models by approximately 10.34%p and 3.72%p, respectively.

III. PROPOSED METHODOLOGY

Due to the complexity of fake news detection in social media, it is evident that a feasible method must contain several aspects to accurately tackle the issue. This is why the proposed method is a combination of Naïve Bayes classifier, Support Vector Machines, Logistic Regression and Lemmatization. This method is a combination between Machine Learning algorithms that subdivide into supervised learning techniques, and natural language processing methods. Although each of these algorithms can be separately used to classify and detect fake news, in order to increase the accuracy they have been combined into an integrated algorithm as a method for fake news detection.

A. Lemmatization

The NLP technique find the relationships among the word, Lemmatization is the process where we take individual tokens from a sentence and we try to reduce them to their base form. The process that makes this possible is having a vocabulary and performing morphological analysis to remove inflectional endings. The output of the lemmatization process is the lemma or the base form of the word. Lemmatization was preferred over stemming to take into account the sentence context.

B. TF-IDF

TF-IDF is the importance of a term is inversely related to its frequency across documents.TF gives us information on how often a term appears in a document and IDF gives us information about the relative rarity of a term in the collection of documents. Combining these with supervised learning algorithms with the concept of Ensemble Learning will yield us more accuracy than the algorithms working individually.

C. Classification Models

The SVM and Naïve Bayes classifier and Decision Tree tend to "rival" each other due to the fact they are supervised learning algorithms that are efficient at classifying data. Three techniques are moderately accurate at categorizing fake news in experiments, which is why this proposed method focuses on combining SVM and Naïve Bayes classifier and Decision Tree to get even more accurate results. The biggest drawback of Decision Tree, Naïve Bayes classifier is that it deems all features of a document, or whichever textual format being used, to be independent even though most of the time that is not the situation. This is a problem due to lowered accuracy and the fact that relationships are not being learned if everything is assumed to be unrelated.

IV. RESULTS

Explorative data analysis was performed on the Fake News Classification data set. It was analyzed by means of Histogram, Box plots, Bar plots, and Word Clouds. The mean length, min length and max length of the news article titles in terms of number of characters are as shown in Table. 1. It is indicating that fake articles tend to have titles that are either too long or too short compared to articles that contain real or legitimate news.

Table 1: Article Title Lengths

Label	Mean Length	Min Length	Max Length
All	74.7023	3	456
Real	79.6142	22	175
Fake	68.2798	3	456

Upon analyzing the title lengths via a bar plot as show in Fig. 1, we observe that most articles tend to have a length between 50-100 characters. We observe that there seem to be outliers for the length of the articles, so we have plotted a box plot as Fig. 2, which plots the article title lengths. Outliers tend to lie more on the greater side to the median in this particular data set.

Fig. 1: Article Title Lengths vs Frequency

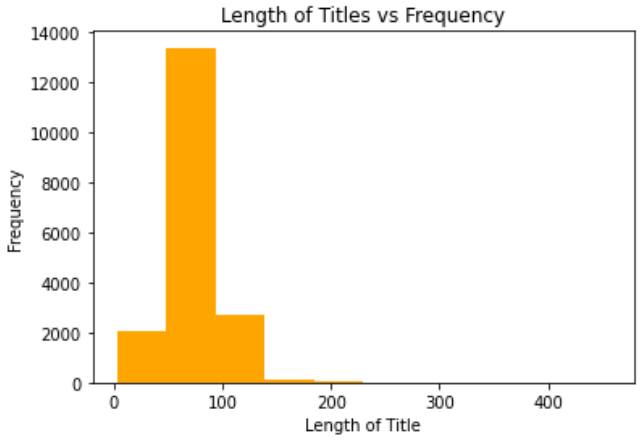
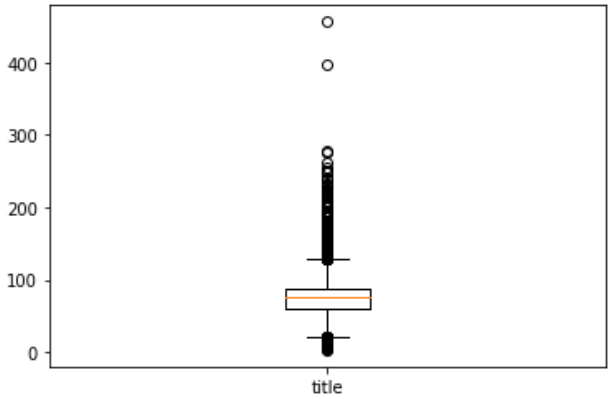


Fig. 2: Box plot for article lengths



In order to understand what words could be probable indicators to fake news and real news, a Word Cloud was plotted as shown in Fig. 3. Words like Trump, Hillary, VIDEO, New, Comment, Russia, Election are some of the frequent words among fake articles Fig.3(a). Where as words like New York, Times, Breitbart, Donald, Trump are some of the frequent words among real articles Fig.3(b).

Fig. 3(a): Fake News Title Word Cloud

Fig. 3(b): Real News Title Word Cloud

Fig.4 indicates that most of the fake articles comes from authors with names, admin, Pakalert, Eddy Lavine, Starkman, Alex Ansary, Gillian, Editor, noreaply@blogger.com (Alexander Light). Since Trump is one of the most frequent words, on plotting a bar graph as shown in Fig.5, we observe that there are equal number of texts with the word Trump.

Fig. 4: Authors with most fake articles

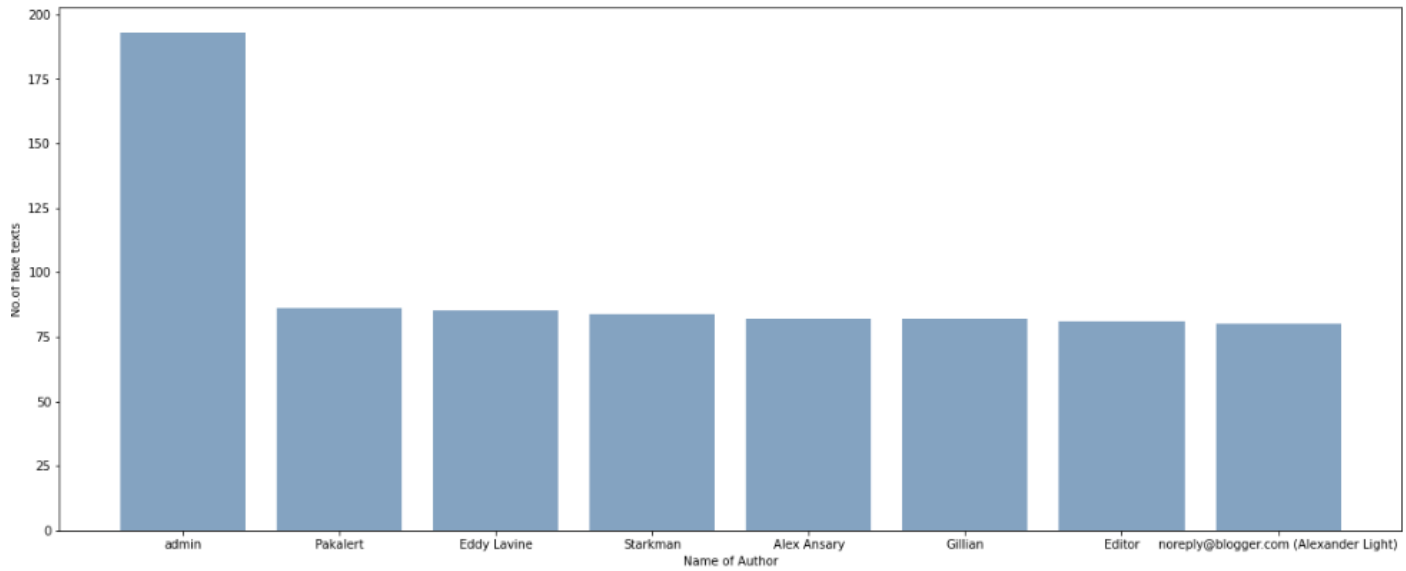


Fig. 5: Articles with word Trump

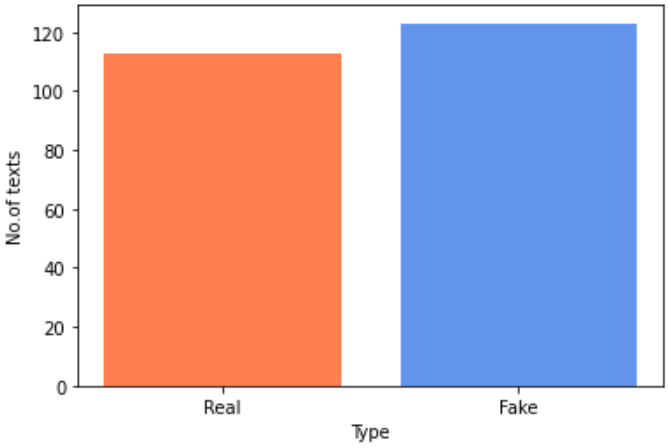


Table. 2: Accuracy Scores

DataType	Naïve Bayes	SVM	Decision Tree	Stacked Model
Train	92.5307	99.1562	56.8873	99.7734
Test	91.0682	96.9559	56.1429	97.8855

Table. 2 shows the classification accuracy scores for the different models. We observe that SVM has the most accurate classification whereas Decision Tree is the least accurate. Stacked Model which uses Naïve Bayes, SVM, Decision Tree as base models and Logistic Regression as the Meta model always has an accuracy greater than the individual models.

V. CONCLUSION

Due to an increased usage of internet in these modern days, it is now very easy to spread any kind of news. Many people are connected regularly with the internet and the social media platforms and there is no restriction while using posting or sharing something on these kind of platforms. Therefore, some people takes this as an advantage to share the news that is fake which may affect an individual or an organization.There is a need for a way to detect these fake news. Machine learning classifiers are using for different purposes and these can also be used for detecting the fake news. The classifiers are first trained with a data set called training data set. After that, these classifiers can automatically detect fake news.The classifers used in the project are Naive Bayes, SVM and Decision Tree. And, while combining all the models, Logistic Regression is used for stacking them all together. In this systematic literature review, the supervised machine learning classifiers are discussed that requires the labeled data for training. Labeled data is not easily available that can be used for training the classifiers for detecting the fake news. In future a research can be on the use of the unsupervised machine learning classifiers for the detection of fake news.

VI. FUTURE SCOPE

The proposed methodology can be extended to combine machine learning algorithms with advantages of blockchain peer-to-peer networking concepts. It can also be extended to detect the abusive words used in social media with our ML algorithms. An ambitious work would be to search the news on the internet and compare the search results with the original news. The project can be improvised by using the unsupervised machine learning classifiers for the detection of fake news.

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