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SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY (SCIT)

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PROJECT TITLE: FAKE NEWS DETECTION USING MACHINE LEARNING

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DATE SUBMITTED: ……

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Abstract

The invention of the world wide web and the rapid adoption of social media platforms such as Facebook and Twitter has paved way for dissemination of information. Some of the information in social media platforms shared in form of posts on various social media platforms are just misleading without any relevance of reality.

Classifying this posts as either fake or true is a challenging task that even an expert in the field of Information Technology needs to explore multiple aspects before making a conclusion on the truthfulness of the post. In this project I propose to use machine learning algorithm to automatically classify news as either false or true and the main aim therefore is to detect fake news. By using those properties, we are going to train the machine learning models and evaluate their performance on the real world dataset. The evaluation of the model will help confirm the superior performance of the proposed fake news detection system.

Problem statement

Develop a machine learning program to identify fake/unreliable news based on content acquired.

Objectives

The aim of this project is to create a system or machine learning model that can use the data of past news reports and predict the chances of a news report being fake or not in order to;

- Be aware of such article while forwarding to others.
- Reveal true stories.
- Prevent from false crisis events.
- Be informative.
  Acknowledgement

Algorithm used

Random Forest Classifier

Methodology used

In order for me to achieve the objectives of my project I used methodologies such as; Logistic Regression, Gradient Boosting Classifier, Decision Tree Classification, and Random Forest Classifier.

Conclusion.

With the help of Machine Learning I have created 4 Prediction models with each prediction model providing an accuracy of above 95% and it covers a wide range of the latest economic situation news across the globe. Also with some pre-trained models, I have covered news related to politics.

My intention is to build my own dataset which will be kept up to date according to the latest news in future.

1. INTRODUCTION

1.1 Introduction

Information is crucial for human's decision-making and has impact on life behaviors. Early information exchanges happened in interactive communications through daily conversations, or come from traditional media (e.g., books, newspapers, radio and television). Such information is more trustful as it is either self-vetted or controlled by authorities. Nowadays, people are exposed to massive information through a variety of sources (e.g., web pages, blogs, posts), especially with the popularity of Internet and social media platforms. The easiness of Internet access has caused the explosive growth of all sorts of misinformation, e.g., rumor, deception, hoaxes, fake news, spam opinion, which diffuses rapidly and uncontrollably in the human society. The erosion of misinformation to democracy, justice, and public trust becomes a global problem, which has gained an increasing number of research interests in its detection as well as the combat toward its propagation among a wide range of communities.

The inhibition of misinformation dissemination is never easy. One essential problem for anti-misinformation is the identification of information credibility. In the conventional journalism time, information credibility is established through esteemed publishers and the refereeing process. Nowadays, the credibility of information varies enormously, which can be true, false or has different degrees of reliability. Users of any kinds, prestigious or notorious, can freely post almost any information online and spread it without any cost. This should be alerted that rampant misinformation, especially maliciously fabricated news, poses great risks to the society, harms the public trust, misleads people's decision-making and may even lead to global tragedies. An example is the salt panic in China in 2011 which was caused by the rumor about salt radiation due to the Fukushima nuclear disaster. More examples include the recent consecutive cases of telecommunications scams, the medical scandal on the web, and the spread of false information about candidates of presidential election.

Various approaches, including human-crafted rules, traditional machine learning models, and neural networks, have been exploited to detect misinformation in an automatic way. With a broad definition, misinformation

detection is the task of assessing the appropriateness (truthfulness/credibility/veracity/authenticity) of claims in a piece of information using a multidisciplinary approach. It could be investigated from various perspectives, such as Data Mining, Social Media Pragmatics, Linguistic Analysis, Psychological Experiments and Natural Language Processing (NLP). Although efforts have been made for decades, misinformation detection remains a challenging problem due to limited datasets and lack of standard assessment of the diversified nature of misinformation. In this paper, we survey automated misinformation detection from the perspective of NLP with a comprehensive review of misinformation analysis, detection and inhibition by introducing the key methods, features, models and datasets for standard reference. It also elicits the challenges and opportunities with implications for future NLP research on this subject area.

As an increasing amount of our lives is spent interacting online through social media
platforms, more and more people tend to hunt out and consume news from social media instead of traditional news organizations. The explanations for this alteration in consumption behaviors are inherent within the nature of those social media platforms:

(i) it's often more timely and fewer expensive to consume news on social media compared with traditional journalism, like newspapers or television.
(ii) it's easier to further share and discuss the news with friends or other readers on social media. For instance, 62% of U.S. adults get news on social media in 2016, while in 2012; only 49% reported seeing news on social media. It had been also found that social media now outperforms television because the major news source. Despite the benefits provided by social media, the standard of stories on social media is less than traditional news organizations. However, because it's inexpensive to supply news online and far faster and

easier to propagate through social media, large volumes of faux news, i.e., those news articles with intentionally false information, are produced online for a spread of purposes, like financial and political gain. it had been estimated that over 1 million tweets are associated with fake news “Pizzagate" by the top of the presidential election. Given the prevalence of this new phenomenon, “Fake news" was even named the word of the year by the Macquarie dictionary in 2016.

The extensive spread of faux news can have a significant negative impact on individuals and society. First, fake news can shatter the authenticity equilibrium of the news ecosystem for instance; it's evident that the most popular fake news was even more outspread on Facebook than the most accepted genuine mainstream news during the U.S. 2016 presidential election. Second, fake news intentionally persuades consumers to simply accept biased or false beliefs. Fake news is typically manipulated by propagandists to convey political messages or influence for instance, some report shows that Russia has created fake accounts and social bots to spread false stories. Third, fake news changes the way people interpret and answer real news, for instance, some fake news was just created to trigger people's distrust and make them confused; impeding their abilities to differentiate what's true from what's not. To assist mitigate the negative effects caused by fake news (both to profit the general public and therefore the news ecosystem). It's crucial that we build up methods to automatically detect fake news broadcast on social media.

Internet and social media have made the access to the news information much easier and comfortable. Often Internet users can pursue the events of their concern in online form, and increased number of the mobile devices makes this process even easier. But with great possibilities come great challenges. Mass media have an enormous influence on the society, and because it often happens, there's someone who wants to require advantage of this fact. Sometimes to realize some goals mass-media may manipulate the knowledge in several ways. This result in producing of the news articles that isn't completely true or maybe completely false. There even exist many websites that produce fake news almost exclusively. All this happen because the world is indeed changing rapidly and we're so quick moving into the so called "digital world" each and every day through any bit of technological task that we perform each and every day some of which we even perform without knowing. . No doubt we have a number of advantages of this digital world but it also has its disadvantages as well. There are different issues in the digital world. One of such issues is fake news. Someone can easily spread a fake news. Fake news is spread to harm the reputation of a person or an organization. It can be a propaganda against someone that can be a political party or an organization. On the positive side however, there are a number of computational techniques that can be used to mark certain articles as fake on the basis of their textual content. Majority of these techniques use fact checking websites such as "PolitiFact" and "Snopes." There are a number of repositories maintained by researchers that contain lists of websites that are identified as

ambiguous and fake. However, this only gives us limited hopes because the problem with these resources is that human expertise is required to identify articles/websites as fake. More importantly, the fact checking websites contain articles from particular domains such as politics and are not generalized to identify fake news articles from multiple domains such as entertainment, sports, and technology.

The World Wide Web contains data in diverse formats such as documents, videos, and audios. News published online in an unstructured format (such as news, articles, videos, and audios) is relatively difficult to detect and classify as this strictly requires human expertise. However, computational techniques such as machine learning can be used to detect anomalies that separate a text article that is deceptive in nature from articles that are based on facts. Other techniques involve the analysis of propagation of fake news in contrast with real news. More specifically, the approach analyzes how a fake news article propagates differently on a network relative to a true article.

A large number of people are connected with internet and social media platforms. Since there is no any restriction while posting news on these platforms some people take advantage and start posting fake news against other individuals or organizations which can be very dangerous since it is very difficult for people to differentiate between fake and original news. Researchers across the globe are working for the detection of fake news, and the use of machine learning is proving helpful in this regard. The classifiers that are used by different researchers are the K-Nearest Neighbor, Support Vector

Machine, Logistic Regression, Linear Support Vector Machine, Decision tree, Stochastic Gradient Descent. According to results, linear support vector machine provided the good accuracy in detecting the fake news. Accuracy of the classifier must be considered because if it failed in detecting the fake news then it can be harmful to different persons. There are different machine learning classifiers that can help in detecting the news is true or false. The dataset can easily be collected to train these classifiers. The accuracy of the classifier depends on the training of this classifier. A model that is trained in a good way can give more accuracy.

1.1.1 Elaboration on similar concepts

Misinformation refers to misrepresented information in a macro aspect, including a series of fabricated, misleading, false, fake, deceptive or distorted information. It is usually created by information creators with malicious intentions for achieving certain purposes. As such, the credibility of the information is usually undermined. Under the common umbrella of conveying misrepresented information, it closely relates to several similar concepts, such as **fake news**, **rumor**, **deception**, **hoaxes**, **spam opinion** etc. Despite being similar, there exists salient differences among them in terms of the degrees of wrongness, the contexts of usage and the functions of serving for different propagation purposes. Below will address the main concepts of the several varieties of misinformation.

Deception is generally defined as an intentionally misleading statement, as a means of conceptualizing deceptive communication both implicitly and explicitly. A deceptive behavior normally shows the following two characteristics:

(a) the deceiver transmitting a false message (while hiding the true information)

(b) the act being intentional. Notably, unintentional behavior that leads to an untrue belief, such as honest mistakes, or misremembering, is not considered as deception.

Fake news is differentiated by the content that mimics news media in form but not in editorial processes. This definition emphasizes two main characteristics of fake news: the false content of the news and the lack of editorial norms and processes for credibility control. Fake news may be misleading or even harmful, especially when they are disconnected from their original sources and contexts. Fake news detection has been investigated for decades and remains a popular issue in NLP, but there is still no congruent definition of "fake news," which is sometimes interchangeably used with phony press releases, hoaxes, rumor and opinion spam.

Opinion spam, also called review spam, are fabricated reviews that range from self-promotions to false announcements of the reviewed product, to deliberately mislead consumers to buy or avoid the product. According to Shu *et al*. deceptive opinion spam has two distinct variations: *hyper spam*, where unwarranted positive reviews are given to products in order to unfairly promote them, and *defaming spam*, which gives unjustified negative reviews to competing products in order to damage their reputations.

A **rumor** is defined as a piece of circulating information whose veracity status is yet to be verified at the time of spreading. The function of a rumor is to make sense of an ambiguous situation, and the truthfulness value could be true, false or unverified. Different from fake news, which usually refers to public news events that can be verified as true or false, rumors may include long-term rumors, such as conspiracy theories, as well as short-term emerging rumors.

Although misinformation is usually created and propagated intentionally, it is difficult to detect the intention of information creators due to the insufficient information of such metadata in most publicly available datasets. The research scope will be focused on the measurement and detection of the veracity/credibility of information with license to existing NLP technologies

and released datasets which can help verify the information as true or false or partially true in a certain scale.

1.1.2 Acknowledgement

I would like to take this opportunity to express my sincere gratitude to Dr. Isaiah Mulang' for his valuable guidance in this PROJECT REPORT without which the PROJECT REPORT would not have been completed. I am very much grateful to him for his untiring assistance in this report and he has been encouraging us in eliminating the errors. The report has been developed as a result of his valuable advice. I am also grateful for the guidance from my friends for their valuable suggestion as a head of computer department and all other teaching staff of the computer department. for coordinating keen interest and providing necessary facilities in completing the PROJECT REPORT. I am thankful to my classmates and friends for their support and being such a good company. I extend our gratitude to researches and scholars whose papers and thesis have been utilized in my project report.

1.2 Motivation

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. The extensive spread of faux news can have a significant negative impact on individuals and society. First, fake news can shatter the authenticity equilibrium of the news ecosystem for instance. Understanding the truth of new and message with news detection can create positive impact on the society.

1.3 Hypothesis

The methodology chosen for this paper, and which is suitable for the type of question which the paper aims to answer, is a systematic literature review. Wee and Banister (2016) describe a literature review as something which should add *value*,

unlike a mere literature *overview*. This thesis will, as previously mentioned, fulfil this criteria by providing an analysis of the current research in fake news detection, and thus contributing to the development of protection against fake news for regular users online.

To perform a systematic literature review, relevant literature is needed from trusted and highquality sources, such as academic databases. A variety of sources is necessary to yield a wide enough selection of papers, and since a single database is unlikely to contain all relevant material. Brereton et al. (2007) recommends the following online databases for literature reviews in the area of software engineering, making them suitable for this thesis.

- *IEEExplore*
- *SpringerLink*
- *ACM Digital Library*

Google Scholar is also suggested to be useful for when one wants to examine more or less all main literature on a topic (Wee & Banister, 2016). The three databases suggested and listed above will therefore be the main sources of literature in this review, with Google Scholar being used as a secondary source for literature not already found in the main databases.

The search term used in all the above-mentioned databases, with the publications year limited to 2015 and later (to get the most recent results and due to the explosion in the popularity and discussion of the term since that time as a result of the US presidential election) was:

- *Automatic Fake News Detection*

These search parameters proved adequate and provided a vast amount of results in the aforementioned databases. Exclusion measures were then applied to the search results, this was the process of excluding articles in the results not related to fake news detection or which were not directly focused on it, for example articles that mentioned the concept but did not present automatic detection methods. Papers presenting developed detection methods in regards to news pieces or articles were

the ones collected from the databases. They were then sorted out of duplicates, which resulted in 47 relevant papers to be used.

Thematic coding was chosen to be the analysis method for the review of the literature. This method creates a descriptive presentation of qualitative data where themes of the data are identified and implications from across several pieces of analysed content can be identified and noted (Anderson, 2007; Smith et al., 1992). The collected material will be placed into different fake news detection categories based on the method-types which researchers have focused on. This will result in a good overview of how similar models relate to other models of the same method-type and, as mentioned above, how implications can be seen and conclusions drawn from the identified themes.

1.4 Scope

The usage of this system is to greatly reduce the time spent in social media to make a decision on which news and posts are false and which news is true.

The usage of this system greatly reduces the time required to search for a place leading to quicker decision making with respect to places to visit. Used to view the location view (the user can even zoom in and zoom out to get a better view) as well as 360 degree image embedded in the application. The System makes use of weather underground API for fetching the details of weather at accuracy.

The user can also find the paths to follow to reach the final destination in map which gives a better view to the users. It becomes convenient for users to book their tour via website instead of visiting agency ultimately saves time and money.

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1.4 Limitations

In this paper, we argue that this approach does not fully solve the detection of fake news created by neural language models. Specifically, it fails in two important instances:

1. Discriminating between truthful and fake information that are both machine-generated. Neural language models are increasingly used to produce any text. Applications such as auto-completion, text modification, question answering, text simplification, summarization, and others, are growing in popularity. Those might be used both for producing legitimate2 (Logan et al., 2019) and malicious text, resulting in “fake” and “real” text sources that are almost identical.3 To illustrate this problem, we consider machine-generated text that is true or false in the context of a given article.

2. Detecting an attacker that uses text from a legitimate human source, but automatically corrupts it to alter its meaning by making only subtle, relatively small changes. Unfortunately, powerful language models designed for text generation, can also easily be used to corrupt existing text. To demonstrate this, we consider an attacker that inverts the negation

of statements in a human-written article, guided by a language model's output probabilities on the attacker's modification.

The failure of the provenance-based approach is not surprising since both cases are similar in the distributional features that it relies on. In the first case, both real and fake texts are of an artificial source, as they were directly generated by a language model. In the second, both real and fake texts originate from a human author (though the attacker locally and subtly modifies text by an automated procedure). Figure 1 illustrates this. Our work highlights the need to consider a much broader landscape of how fake news is generated, when designing automatic detectors. There are many different ways in which machines and humans can collaborate for writing true and false text pieces. Therefore, we recommend an approach that defines fake news based on text truthfulness rather than provenance.

Under this approach, detector benchmarks would incorporates truthfulness as a primary indicator for fake-ness.

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Under this approach, detector benchmarks would incorporates truthfulness as a primary indicator for fake-ness.

In Chapter 2 of this paper, I will be describing the literature survey giving fine details concerning the project and then chapter 3 will be talking about the analysis and design of the project will be discussed in chapter 4 of this paper before diving into the actual implementation in chapter 5 and Conclusion in Chapter 6 of the paper.

2. LITERATURE REVIEW

2.1 Literature Review

World is changing rapidly. No doubt we have a number of advantages of this digital world but it also has its disadvantages as well. There are different issues in this digital world. One of them is fake news. Someone can easily spread a fake news. Fake news is spread to harm the reputation of a person or an organization. It can be a propaganda against someone that can be a political party or an organization. There are different online platforms where the person can spread the fake news. This includes the Facebook, Twitter etc. Machine learning is the part of artificial intelligence that helps in making the systems that can learn and perform different

actions (Donepudi, 2019). A variety of machine learning algorithms are available that include the supervised, unsupervised, reinforcement machine learning algorithms. The algorithms first have to be trained with a data set called train data set. After the training, these algorithms can be used to perform different tasks. Machine learning is using in different sectors to perform different tasks. Most of the time machine learning algorithms are used for prediction purpose or to detect something that is hidden.

Online platforms are helpful for the users because they can easily access a news. But the problem is this gives the opportunity to the cyber criminals to spread a fake news through these platforms. This news can be proved harmful to a person or society. Readers read the news and start believing it without its verification. Detecting the fake news is a big challenge because it is not an easy task (Shu et al., 2017). If the fake news is not detected early then the people can spread it to others and all the people will start believing it. Individuals, organizations or political parties can be effected through the fake news. People opinions and their decisions are affected by the fake news in the US election of 2016 (Dewey, 2016).

Different researchers are working for the detection of fake news. The use of Machine learning is proving helpful in this regard. Researchers are using different algorithms to detect the false news. Researchers in (Wang, 2017) said that fake news detection is big challenge. They have used the machine learning for detecting fake news. Researchers of (Zhou et al., 2019) found that the fake news are increasing with the passage of time. That is why

there is a need to detect fake news. The algorithms of machine learning are trained to fulfill this purpose. Machine learning algorithms will detect the fake news automatically once they have trained.

This literature review will answer the different research questions. The importance of machine learning to detect fake news will be proved in this literature review. It will also be discussed how machine learning can be used for detecting the false news. Machine learning algorithms that are used to detect false news will be discussed in the literature review. The structure of the rest of paper is as Methodology in section two, section three shows the research questions, section four is showing the search process model that is followed for this literature review, result and discussion is given in section five, the conclusion is presented in section six. In the last, references are given for the papers that are discussed in this literature review.

My project is a system which gives you the guidance of the day to day rountine of fake news, spam message in daily news chanel , Facebook, Twitter, Instagram and other social media. I have shown some data analysis from our dataset which have retrive from many online social media and display the main source till now fake news and true news are engaged. My project is tangled with multiple model trained by my own and also some pretrained model extracted from Felipe Adachi. The accuracy of the model is around 95% for all the selfmade model and 97% for this pretrained

model. This model can detect all news and message which are related to covid-19, political news, geology ,etc.

2.2 Existing System

We can get online news from different sources like social media websites, search engine, homepage of news agency websites or the fact checking websites. On the Internet, there are a few publicly available datasets for Fake news classification like Buzz feed News, LIAR [15], BS Detector etc. These datasets have been widely used in different research papers for determining the veracity of news. In the following sections, I have discussed in brief about the sources of the dataset used in this work. This Existing system can help us to trained our model using machine learning technique.

2.3 Need of New System

Currently, many people are using the internet as a central platform to find the information about reality in world and need to be continue. Hence I has mention above we will create fake news and message detection model which detect the reality of the news and message. 8 Also whose use our website can see the upto date about main source or keyword are getting most fake news and message and mapped up with chart. After and all everyone want to know how to prevent this hence we are giving some important tips to avoid this fake news of spreading rumor in the world.

2.4 Problems Definition

The system will help user to detect the fake news. We have given the text box where the user has the option to paste the message or paste the url link of the

news and other message link and after that it gives the reality of it. All the user gives data to detector may save for further use in order to update the statue of model, data analysis in future. We also help user by giving some guidance of how to prevent from such false event and how to stop with such event from spreading it.

2.5 Related works

1. Nguyen Vo student of Ho Chi Minh City University of Technology (HCMUT) Cambodi did his research on fake news detection and implemented in 2017. He used Bi-directional

GRU with Attention mechanism in his project fake news detection; Yang et al. originally proposed this mechanism. He also used some Deep learning algorithms and tried to implement other deep learning models such that Auto-
Encoders, GAN, CNN.

2. Researchers (Reis et al., 2019) have used the machine-learning classifiers for the detection of fake news. They have used different features to train these classifiers. Training of the classifiers is an important task because a trained classifier can give the more accurate results. According to the researchers of (Granik & Mesyura, 2017), artificial intelligence is better to detect the fake news. They have used Naïve Bayes classifier to detect fake news from Facebook posts. This classifier has given them the accuracy of 74% but they said the accuracy can be improved. To improve the accuracy different ways are also described by these researchers in that paper. There are classifiers of machine learning that are used for detecting fake news.

3. According to the researchers of (Ahmed et al., 2017), false news has major impact on the political situation of a society. False news on the social media

platforms can change opinions of peoples. People change their point of view according to a fake news without verifying it. There is a need for a way that can detect such news. The researchers have used classifiers of machine learning for this purpose. The classifiers that are used by different researchers are the K-Nearest Neighbor, Support Vector Machine, Logistic Regression, Linear Support Vector Machine, Decision tree, Stochastic Gradient Descent. According to results, linear support vector machine provided the good accuracy in detecting the false news.

4. Researchers in (Aphiwongsophon & Chongstitvatana, 2018) said that the social media produce a large number of posts. Anyone can register on these platforms can do any post. This post can contain false information against a person or business entity. Detecting such false news is an important and also a challenging task. For performing this task the researchers have used the three machine learning methods. These are the Naïve Bayes, Neural network and the SVM. The accuracy provided by the Naïve Bayes was 96.08%. On the other hand, the other two methods that are neural network and SVM provided the accuracy of 90.90%.

5. Researchers in (Kudarvalli & Fiaidhi, 2020) said that detection of false news is necessary because many persons spread the fake news of social media to mislead the people. To safe the individuals or organizations from losing their reputation because of false news it is necessary to detect it (Rahman et al., 2020). They have said that the machine learning is very helpful in this regard. They used the different machine-learning algorithms and they also found that the Logistic regression is a better classifier because it gives more accuracy.

6. Researchers in (Abdullah-All-Tanvir et al., 2019) used the machine learning classifiers for detecting the fake news. According to the experiments of the researchers the SVM and Naïve Bayes classifiers are best for detecting fake news. These two are better than other classifiers on the basis of accuracy they provide. A classifier with more accuracy is considered as a better classifier. The major thing is the accuracy that is provided by any classifier. Classifier with more accuracy will help in detecting more fake news.

7. Combination approaches were also proposed by Fernández-Reyes & Shinde (2018), who utilized machine learning classifiers and demonstrated the importance of combining statements with the overall “credibility patterns” of politicians. Similarly, Zhang et al. (2019) created a diffusive network model that relies on explicit and latent features extracted from a text which achieved very good performance in not only identifying fake news article, but also striking at the origin of such news by likewise identifying the news creators and types of news subjects, where a record of credibility can be seen and assessed. The latter two categories being considered more important than the news itself in the contribution to eradicate fake news spread on social media.

8. Ruchansky et al. (2017) also propose a model that looks at features like the group behaviour of users who spread fake news, and from who and where they spread it from. This would be done through a combined text analysis and network analysis model which combines the three fake news characteristics of: the article text, the user response it receives, and the user source promoting it. A combined approach like this is argued to increase accuracy and generality, managing to achieve this as well as a meaningful representation of users and articles.

9. Another approach which further focuses on the user engagement uses a combination of both the text-analysis in addition to a social-based method which takes into account the amount of times content is shared or “liked”, as well as by who. It has been shown that content of Facebook can be classified as fake news with very high accuracy based on the users who “like” them, a result of the tendency of users to aggregate into “bubbles” which selectively share content that fits their narrative of things. A downside to this is of course that the content needs to have a certain amount of “social interaction” in order to produce worthwhile results, which is why a combined approach was used (Della Vedova et al., 2018; Hamdi et al., 2020)

10. Zhou & Zafarani (2019) propose a network-based approach which studies the patterns of how the news are being spread, who spreads them, and what the relation between these spreaders are. Such patterns are then used at various network levels to detect fake news. The authors show how fake news spreads

farther than real news, and has more and stronger spreader engagement, which is denser for networks of similar interests and behaviour. A downside is that the news needs to be propagated on social media before it can be detected, although here as well only a small amount of network information is needed.

3. SYSTEM ANALYSIS

System analysis is a method of enquiring and understanding an existing problem system, defining requirements and analysing the best possible solution is the best way to increase the efficiency of the existing system. It is also considered to be a great problem solving methodology that will break the existing system into different component modules and evaluate each module to determine the efficiency of the system individually, by doing module wise analysis we will be able to individually increase the speed of each module.

Documentation plays a very important role in analysis of any system as it provides the target for design and development. Since it is impossible to stop the spread of fake news at once for all, we need to consider the ways in which we can prevent them. Detection and prevention of fake news exists as long as people tend to believe the fake news or the rumors. Fake news issue is being addressed by most of them within the previous number of years, especially when it was an outbreak among the people of US when the general election took place in 2016. It is hard to figure out the fake news among the bundle of real news since the fake news are generated as a shadow of real news.

However, fake news can be prevented from spreading only by showing keen knowledge toward real news. The foremost form of spreading this fake news or rumors are social media websites such as Google Plus, Facebook, Twitter and many others. Most of the people just have a habit of forwarding anything which they receive over the internet, they don’t even verify whether it is fake or real.

3.1 System Requirements Specification

The software requirements specification gives the overall description of the software system that is to be developed. It displays both the functional and non-functional requirements of the system and it includes certain set of use cases that describes the user interactions. Software requirement specification is the root foundation of the software development process. At the basic level, it is an organization's perspective of understanding of a client's expectations and dependencies. It is the basis for any organization to create a system requirement specification. Plus, Facebook, Twitter and many others. At the basic level, it is an organization's perspective of understanding of a client's expectations and dependencies. It is the base for any organization to create a system requirement specification. fake news can be prevented from spreading only by showing keen knowledge toward real news. The foremost form of spreading this fake news or rumors are social media websites such as Google Plus, Facebook, Twitter and many others.

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Fake news can be prevented from spreading only by showing keen knowledge toward real news. The foremost form of spreading this fake news or rumors are social media websites such as Google Plus, Facebook, Twitter and many others.

3.2 Functional Requirements

A function is a set of all inputs, structure and output. A functional requirement is a function that defines the function of the concerned system. It includes specific functionality such as technical detail and data manipulation etc. documentation of the operation and the activities that a system should perform.

It contains the information about the implementation phase and the functional requirement.

Data Collection- The dataset used I this project is UCI, which is known as UCI SMS span and the dataset has 5575 SMS classified into spam and ham.

Data Pre-processing- Pre-processing is done before training and testing the data so that the data scientist finds it easy to understand the dataset and feed it into the Doc2Vec model. By doing this, we are able to obtain a result that is more precise.

Dataset Splitting- The data should to split into three sub division that are Training, testing and validation.

Model Training- After the pre-processing done by the data scientist, which he has processed into train and test the data is ready for model training. This process starts with feeding the algorithm with the training data, an algorithm will process the data and will display an output through which we can be able to determine the accuracy of the project.

Model evaluation and testing- The goal of this process is to develop a simple model that would be able to target a value fast and with high accuracy rate. This can be achieved by model tuning.

3.3 Non-functional Requirements

While the functional requirement specifies the behavior of the system, non-functional requirements are concerned with how the system is supposed to be. It contains the details of how to implement these non-functional requirements. Documentation plays a very important role in analysis of any system as it provides the target for design and development. Since it is impossible to stop the spread of fake news at once for all, we need to consider the ways in which we can prevent them. Detection and prevention of fake news exists as long as people tend to believe the fake news or the rumors.

It also tells the details about the criteria that are used to evaluate the operation of the system, instead of a specific behavior. In other words they are also called as quality attributes and non-behavioral requirements.

Since it is impossible to stop the spread of fake news at once for all, we need to consider the ways in which we can prevent them. Detection and prevention of fake news exists as long as people tend to believe the fake news or the rumors. Fake news issue is being addressed by most of them within the previous number of years, especially when it was an outbreak among the people of US when the general election took place in 2016.

It is hard to figure out the fake news among the bundle of real news since the fake news are generated as a shadow of real news. However, fake news can be prevented from spreading only by showing keen knowledge toward real news. The foremost form of spreading this fake news or rumors are social media websites such as Google Plus, Facebook, Twitter and many others.

Most of the people just have a habit of forwarding anything which they receive over the internet, they don't even verify whether it is fake or real.

The following is the details of non-functional requirements.

- Response time: A function is a set of all inputs, structure and output. A functional requirement is a function that defines the function of the concerned system. It includes specific functionality such as technical detail and data manipulation etc. documentation

of the operation and the activities that a system should perform. In a view to acquire a standard accuracy rate for our data, we applied a Naive Bayes classifier.

- Maintainability: After the pre-processing done by the data scientist, which he has processed into train and test the data is ready for model training. This process starts with feeding the algorithm with the training data, an algorithm will process the data and will display an output through which we can be able to determine the accuracy of the project.
- Usability: After the pre-processing done by the data scientist, which he has processed into train and test the data is ready for model training. This process starts with feeding the algorithm with the training data, an algorithm will process the data and will display an output through which we can be able to determine the accuracy of the project.
- Availability: It also tells the details about the criteria that are used to evaluate the operation of the system, instead of a specific behavior. In other words they are also called as quality attributes and non-behavioral requirements. Since it is impossible to stop the spread of fake news at once for all, we need to consider the ways in which we can prevent them. Detection and prevention of fake news exists as long as people tend to believe the fake news or the rumors.
- Stability: It is hard to figure out the fake news among the bundle of real news since the fake news are generated as a shadow of real news. However, fake news can be prevented from spreading only by showing keen knowledge toward real news. The foremost form of spreading this fake news or rumors are social media websites such as Google Plus, Facebook, Twitter and many others.

3.4 Hardware Requirements

The hardware requirements include the requirements specification of the physical computer resources for a system to work efficiently. The hardware requirements serve as the basis for a contract and for the implementation of the system

- Processor - Any Processor above 500 MHz
- Ram - 4 GB
- Hard Disk - 4 GB
- Input device - Standard Keyboard and Mouse.
- Output device - VGA and High Resolution Monitor.

3.4 Software Requirements

4.4.1 Operating System: Windows 7 or higher

4.4.2 Programming : Python 3.6 and related libraries – Keras, Numpy, Gensim

4.4.3 Software Description: Python

Python is an interpreted high-level programming language for all-purpose programming. Created by Guido Van Rossum and first released in 1991, created by Guido Van Rossum. It provides constructs that alter clear programming on each tiny and huge scales. Python is a dynamic type system and automatic memory management. It can support multiple programming parameters, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library. Python interpreters are available for many OS.

3.5 Feasibility Study

Feasibility study can be understood as the assessment of the practical concept of

proposed system. It is a key to evaluate the strength of any success of the project. There are two most important thing that is to measure the feasibility of the project that includes the total cost involved in completing the project and the value or the actual output obtained by doing such feasibility. It includes the technical development and implementation.

Risk analysis is very closely related to feasibility study. Hence, by doing the feasibility study, the risk of the project can be minimized.

Going to the depth study of this topic, we need to consider the three primary area of interest in this context:

3.5.1 Technical Analysis

3.5.2 Performance Analysis

3.5.3 Economic Analysis

All the above-mentioned feasibility tests are useful in determining the overall performance and economic condition of the project. Thus, it is important to perform these tests individually.

3.6.1 Performance Analysis

As the name suggests this process deals with the performance analysis of the project. The main aim of this analysis is to provide the end user with the required functionality of the system. User must obtain the predicted output in accurate manner and time-efficient manner. The goal process is to achieve requirement satisfaction and carry out performance as soon as possible.

- The user should obtain relevant results as per the situation demand.
- The user should get accurate prediction of the SMS messages
- The user should get these results in a limited time period, so there is enough time for conducting analysis

- The output of the system should give the user a clear idea of whether the message is spam or ham
- The system should benefit the user to make consequent important decisions regarding the messages.

3.6.2 Technical Analysis

The main aim of this analysis is to provide the end user with the required functionality of the system. User must obtain the predicted output in a accurate manner and time-efficient manner. The goal process is to achieve requirement satisfaction and carry out performance as soon as possible.

The project is implemented using python and other machine learning algorithms, since the resources are available, it can be concluded that our system is technically feasible.

3.6.3 Economic Analysis

The economic analysis is mainly done to analyze the development cost weighted against the benefits, which will be derived from the developed system. Considering our project that we only used dataset for processing so only a computer is enough to complete this process. Therefore, I conclude that the system that we implemented is economically feasible.

User must obtain the predicted output in accurate manner and time-efficient manner. The goal process is to achieve requirement satisfaction and carry out performance as soon as possible.

3.6.3.1 The user should get these results in a limited time period, so there is enough time for conducting analysis

3.6.3.2 The output of the system should give the user a clear idea of whether the message is spam or ham

3.6.3.3 The system should benefit the user to make consequent important decisions regarding the messages.

4. SYSTEM DESIGN

System design is mechanism or the flow of outlining the structural design, sections, interfaces, and data for a system to fulfill its definite requirements. The System design plays an important role in developing the outline and to product development. The main aim of this analysis is to provide the end user with the required functionality of the system. User must obtain the predicted output in accurate manner and time-efficient manner.

4.1 System Architecture

The Proposed system's architecture is shown I the below. In this, I am introducing a new tool Doc2Vec to predict fake news and tell us the accuracy. . User must obtain the predicted output in a accurate manner and time-efficient manner. The project is implemented using python and other machine learning algorithms, since the resources are available

There are three modules namely

- Extracting the data
- Data pre-processing
- Prediction.

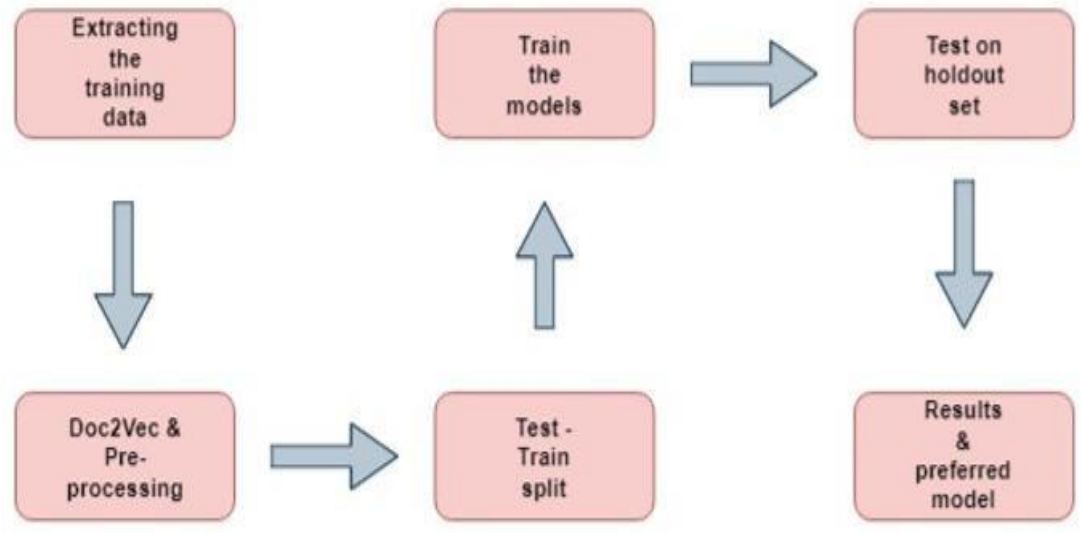


Figure 5.1 Architecture of FDM

FDM

5.2 Class Diagram

The Class diagram has the ability to make the developer to understand the workflow in a better conceptual manner. It is also one of the essential block of the OOPS (Object-Oriented Modelling) concept. It is widely used for the common conceptual modelling of designing and system architecture or making a systematic approach for development of applications. It is also useful for briefing and modelling the translation of the study design model to the code. Class diagrams are also used for the data modeling. The main elements, interactions in the application, and the classes to be programmed are defined and represented in the class diagram by different classes. In the below design, the classes are represented with boxes they contain three sections:

The Top section	Name of the class	Bold and centered and, first letter is capitalized.
The Middle section	Attributes of the class	Left aligned and the first letter is lowercase.
The Bottom section	Operations the class can execute	Left aligned and the first letter is lowercase.

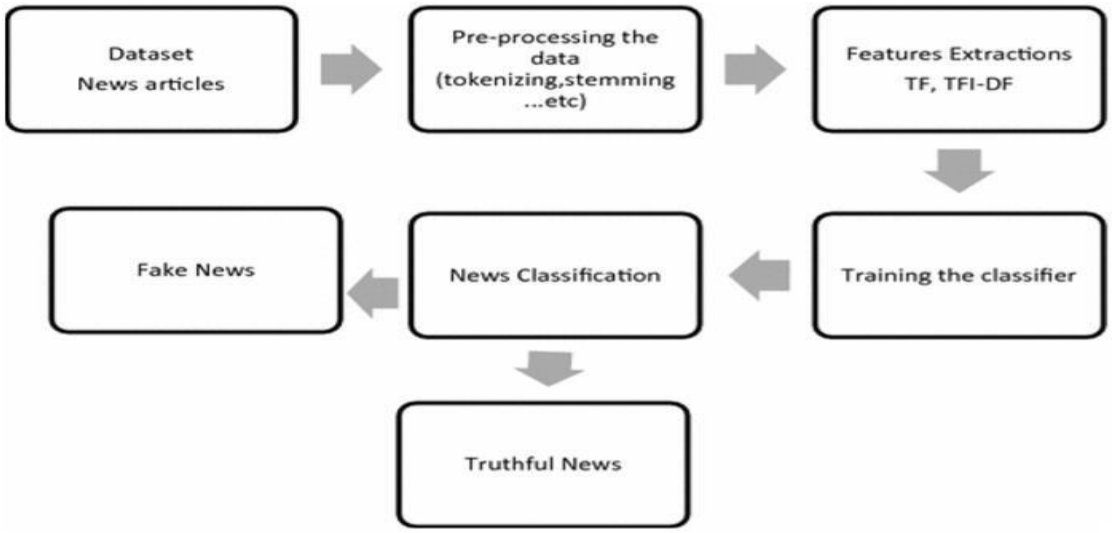


Figure 5.2 Class Diagram of FDM

5.3 Use Case Diagram

The Use Case diagram is one of the best and the simple diagram or a design to show to relationship between the user's interactions. It also tells about the relationship between the user and the various use cases. The Use Case diagram can find the different types of the users in the system and the cases, which are used in the other structure diagrams. With the help of Use Case diagram higher-level view of the proposed system can be depicted.

They represent us the workflow of what system does in a simple graphical representation. Because of their simple design, it is serving as good communication tool for stakeholders.

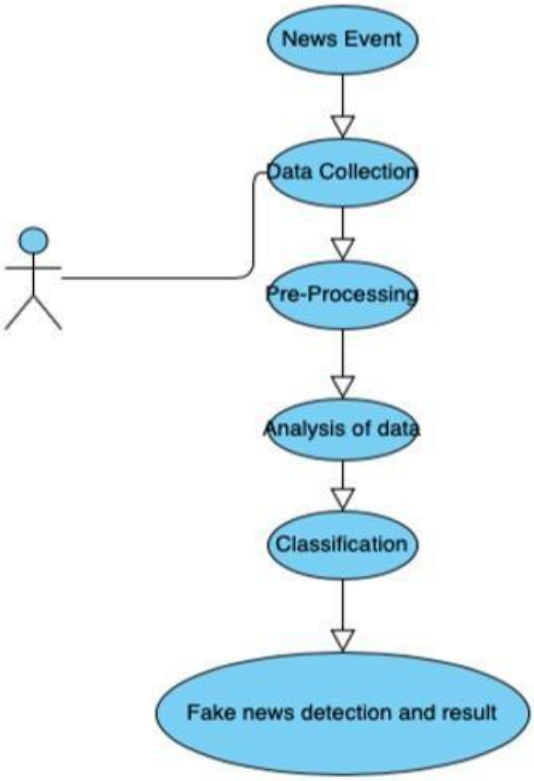
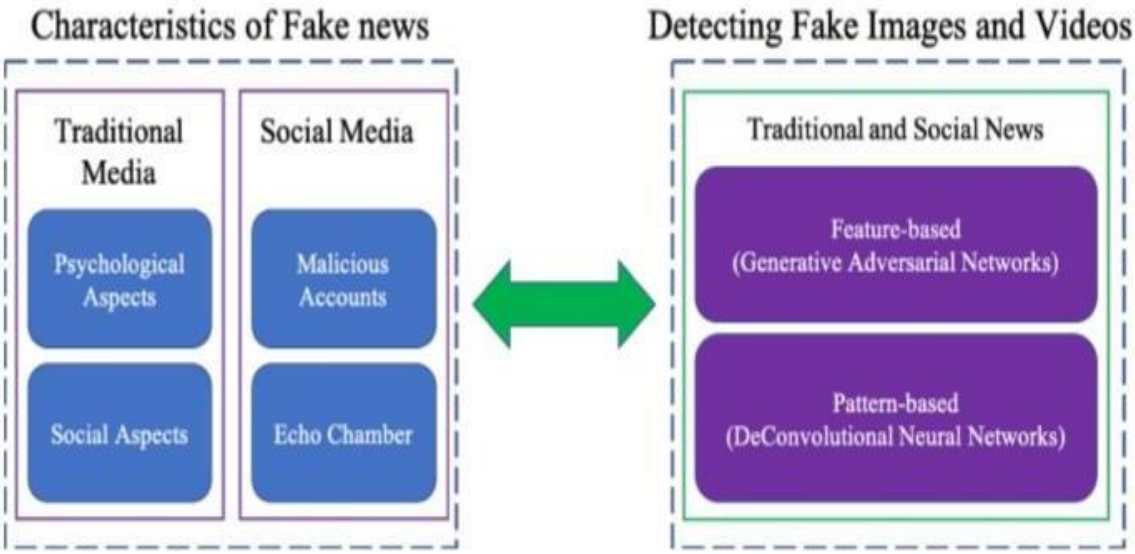


Figure 5.3 Use case Diagram of FDM

5.4 Sequence Diagram

Sequence diagrams are made usually to make the user and stakeholders to understand the interaction of objects and how they are arranged in the sequence manner. The Objects and the classes are involved it and plays the important role. The sequence of the news collected by the object and defined in various classes which carry the functionality feature of the scenario are depicted here in the sequence diagram. The Use Case realization are shown in the Logical view of the system model development and are associated with the sequence diagrams. They are also called as Event diagrams or Event scenarios.

A sequence diagram illustrates, that the parallel vertical lines (lifelines), various processes or objects that tend to live at the same time, and the horizontal arrows illustrates whether the news replaced are fake or real, In the order in which they are placed or flown. This allows the simple run time scenarios in graphical manner by



providing the specifications.

Figure 5.4 Sequence Diagram of FDM

4.6 Deployment Diagram

In the deployment diagram, which is shown below, the physical deployment of the artifact on nodes, are made by the UML models. The nodes are represented as boxes, and the artifacts assigned to separate node are shown as rectangles contained by the boxes. The nodes contains sub nodes, which are represented as nested boxes. One particular node in a deployment diagram conceptually represents the multiple physical nodes, such as a cluster of databank servers.

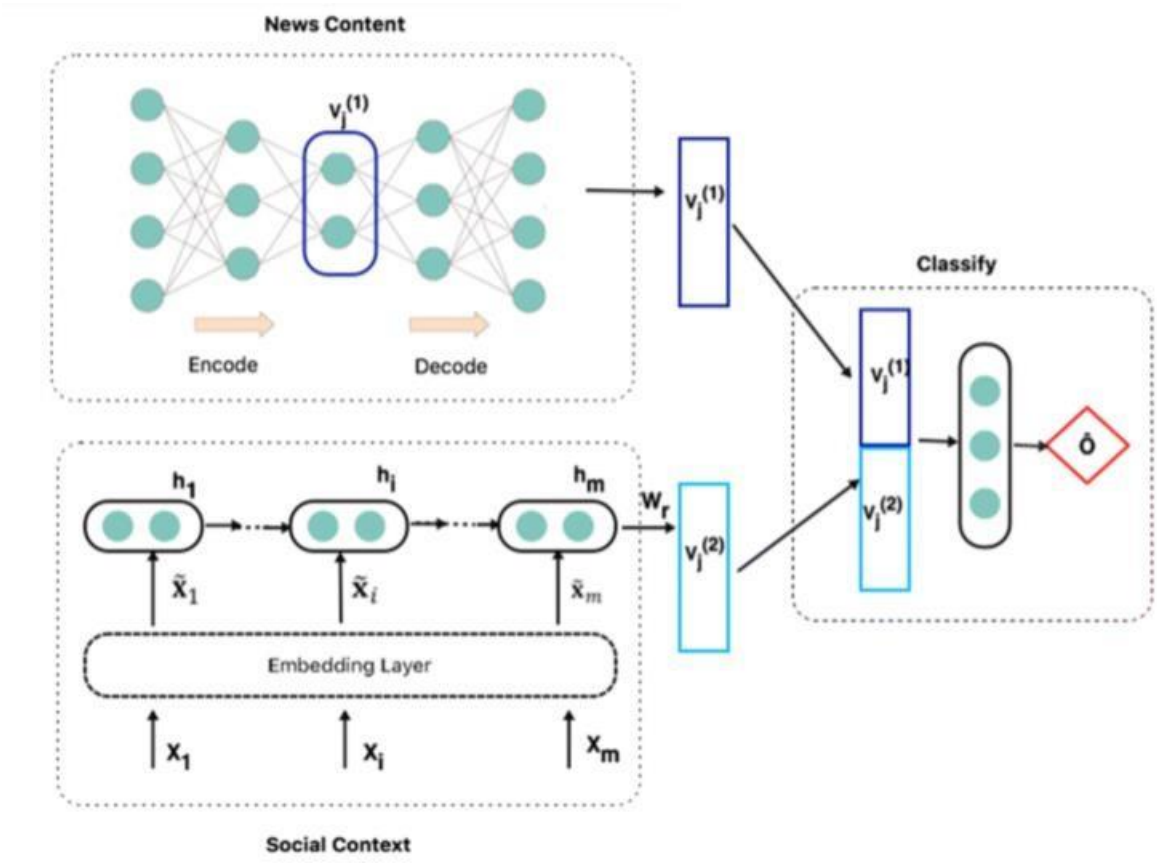


Figure 5.5 Deployment Diagram of FDM

5. IMPLEMENTATION

5.1 Implementation

I implemented my fake news detection system using Python since it supports a large number of efficient packages helping to deal with any type of data (images, text, audio, etc.) and to achieve any target he wants (machine learning, deep learning, web development, etc.). To implement my system I used the following libraries: Scikit-learn, Pandas, PyQT5 (used for implementing the application's graphical user interface)

For my system which is on fake news detection, the actual implementation was an improvement of a system that already exists on Github.

I used different software tools and hardware to achieve the objectives earlier stated.

5.2 Software tools used

We used the machine learning library Scikit-learn (http://scikit-learn.org) in Python since it has built-in methods that implement different classification approaches. We have used probabilistic (Naive Bayes) and linear (Support Vector Machine). As text representation models, we used Bag-of Words, Term Frequency-Inverse Document Frequency (TFIDF) and Bi-gram frequency. By combining these approaches, we built a fake news detection tool.

5.3 Methodology used

In our proposed framework, we are expanding on the current literature by introducing ensemble techniques with various linguistic feature sets to classify news articles from multiple domains as true or fake. The ensemble techniques along with Linguistic Inquiry and Word Count (LIWC) feature set used in this research are the novelty of our proposed approach.

There are numerous reputed websites that post legitimate news contents, and a few other websites such as PolitiFact and Snopes which are used for fact checking. In addition, there are open repositories which are maintained by researchers to keep an up-to-date list of currently available datasets and hyperlinks to potential fact checking sites that may help in countering false news spread. However, we selected three datasets for our experiments which contain news from multiple domains (such as politics, entertainment, technology, and sports) and contain a mix of both truthful and fake articles. The datasets are available online and are extracted from the World Wide Web. The first dataset is ISOT Fake News Dataset the second and third datasets are publicly available at Kaggle. A detailed description of the datasets is provided in Section.

The corpus collected from the World Wide Web is preprocessed before being used as an input for training the models. The articles' unwanted variables such as authors, date posted, URL, and category are filtered out. Articles with no body text or having less than 20 words in the article body are also removed. Multicolumn articles are transformed into single column articles for uniformity of format and structure. These operations are performed on all the datasets to achieve consistency of format and structure.

Once the relevant attributes are selected after the data cleaning and exploration phase, the next step involves extraction of the linguistic features. Linguistic features involved certain textual characteristics converted into a numerical form such that

they can be used as an input for the training models. These features include percentage of words implying positive or negative emotions; percentage of stop words; punctuation; function words; informal language; and percentage of certain grammar used in sentences such as adjectives, preposition, and verbs. To accomplish the extraction of features from the corpus, we used the LIWC2015 tool which classifies the text into different discrete and continuous variables, some of which are mentioned above. LIWC tool extracts 93 different features from any given text. As all of the features extracted using the tool are numerical values, no encoding is required for categorical variables. However, scaling is employed to ensure that various feature's values lie in the range of (0, 1). This is necessary as some values are in the range of 0 to 100 (such as percentage values), whereas other values have arbitrary range (such as word counts). The input features are then used to train the different machine learning models. Each dataset is divided into training and testing set with a 70/30 split, respectively. The articles are shuffled to ensure a fair allocation of fake and true articles in training and tests instances.

The learning algorithms are trained with different hyperparameters to achieve maximum accuracy for a given dataset, with an optimal balance between variance and bias. Each model is trained multiple times with a set of different parameters using a grid search to optimize the model for the best outcome. Using a grid search to find the best parameters is computationally expensive however, the measure is taken to ensure the models do not overfit or underfit the data.

Novel to this research, various ensemble techniques such as bagging, boosting, and voting classifier are explored to evaluate the performance over the multiple datasets. We used two different voting classifiers composed of three learning models: the first voting classifier is an ensemble of logistic regression, random forest, and KNN, whereas the second voting classifier consists of logistic regression, linear SVM, and classification and regression trees (CART). The criteria used for training the voting classifiers is to train individual models with the best parameters and then test the model based on the selection of the output label on the basis of major votes by all three models. We have trained a bagging ensemble consisting of 100 decision trees, whereas two boosting ensemble algorithms are used, XGBoost and AdaBoost. A *k*-fold ($k = 10$) cross validation model is employed for all ensemble learners. The learning models used are described in detail in Section 2.2. To evaluate the performance of each model, we used accuracy, precision, recall, and F1 score metrics as discussed in Section

The methodology chosen for this paper, and which is suitable for the type of question which the paper aims to answer, is a systematic literature review. Wee and Banister (2016) describe a literature review as something which should add *value*, unlike a mere literature *overview*. This thesis will, as previously mentioned, fulfil this criteria by providing an analysis of the current research in fake news detection, and thus contributing to the development of protection against fake news for regular users online.

To perform a systematic literature review, relevant literature is needed from trusted and highquality sources, such as academic databases. A variety of sources is necessary to yield a wide enough selection of papers, and since a single database is unlikely to contain all relevant material. Brereton et al. (2007) recommends the following online databases for literature reviews in the area of software engineering, making them suitable for this thesis.

- *IEEExplore*
- *SpringerLink*
- *ACM Digital Library*

Google Scholar is also suggested to be useful for when one wants to examine more or less all main literature on a topic (Wee & Banister, 2016). The three databases suggested and listed above will therefore be the main sources of literature in this review, with Google Scholar being used as a secondary source for literature not already found in the main databases.

The search term used in all the above-mentioned databases, with the publications year limited to 2015 and later (to get the most recent results and due to the explosion in the popularity and discussion of the term since that time as a result of the US presidential election) was:

- *Automatic Fake News Detection*

These search parameters proved adequate and provided a vast amount of results in the aforementioned databases. Exclusion measures were then applied to the search results, this was the process of excluding articles in the results not related to fake news detection or which were not directly focused on it, for example

articles that mentioned the concept but did not present automatic detection methods. Papers presenting developed detection methods in regards to news pieces or articles were the ones collected from the databases. They were then sorted out of duplicates, which resulted in 47 relevant papers to be used.

Thematic coding was chosen to be the analysis method for the review of the literature. This method creates a descriptive presentation of qualitative data where themes of the data are identified and implications from across several pieces of analysed content can be identified and noted (Anderson, 2007; Smith et al., 1992). The collected material will be placed into different fake news detection categories based on the method-types which researchers have focused on. This will result in a good overview of how similar models relate to other models of the same method-type and, as mentioned above, how implications can be seen and conclusions drawn from the identified themes.

5.4 Algorithms

We used the following learning algorithms in conjunction with our proposed methodology to evaluate the performance of fake news detection classifiers.

1 Logistic Regression

As we are classifying text on the basis of a wide feature set, with a binary output (true/false or true article/fake article), a logistic regression (LR) model is used, since it provides the intuitive equation to classify problems into binary or multiple classes. We performed hyperparameters tuning to get the best result for all individual datasets, while multiple parameters are tested before acquiring the maximum accuracies from LR model. Mathematically, the logistic regression hypothesis function can be defined as follows
Logistic regression uses a sigmoid function to transform the output to a probability value; the objective is to minimize the cost function to achieve an optimal probability. The cost function is calculated as shown in

2 Support Vector Machine

Support vector machine (SVM) is another model for binary classification problem and is available in various kernels functions. The objective of an SVM model is to

estimate a hyperplane (or decision boundary) on the basis of feature set to classify data points. The dimension of hyperplane varies according to the number of features. As there could be multiple possibilities for a hyperplane to exist in an *N*-dimensional space, the task is to identify the plane that separates the data points of two classes with maximum margin. A mathematical representation of the cost function for the SVM model is defined as given in and shown insuch that

The function above uses a linear kernel. Kernels are usually used to fit data points that cannot be easily separable or data points that are multidimensional. In our case, we have used sigmoid SVM, kernel SVM (polynomial SVM), Gaussian SVM, and basic linear SVM models.

3 Ensemble Learners

We proposed using existing ensemble techniques along with textual characteristics as feature input to improve the overall accuracy for the purpose of classification between a truthful and a false article. Ensemble learners tend to have higher accuracies, as more than one model is trained using a particular technique to reduce the overall error rate and improve the performance of the model. The intuition behind the ensemble modeling is synonymous to the one we are already used to in our daily life such as requesting opinions of multiple experts before taking a particular decision in order to minimize the chance of a bad decision or an undesirable outcome. For example, a classification algorithm can be trained on a particular dataset with a unique set of parameters that can produce a decision boundary which fits the data to some extent. The outcome of that particular algorithm depends not only on the parameters that were provided to train the model, but also on the type of training data. If the training data contains less variance or uniform data, then the model might overfit and produce biased results over unseen data. Therefore, approaches like cross validation are used to minimize the risk of overfitting. A number of models can be trained on different set of parameters to create multiple decision boundaries on randomly chosen data points as training data. Hence, using ensemble learning techniques, these problems can be addressed and mitigated by training multiple algorithms, and their results can be combined for near optimum outcome. One such technique is using voting classifiers where the final classification depends on the major votes provided by all algorithms. However, there are other ensemble techniques as well that can be used in different scenarios such as the following.

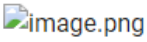
4 Random Forest (RF)

Random forest (RF) is an advanced form of decision trees (DT) which is also a supervised learning model. RF consists of large number of decision trees working individually to predict an outcome of a class where the final prediction is based on a class that received majority votes. The error rate is low in random forest as compared to other models, due to low correlation among trees [33]. Our random forest model was trained using different parameters; i.e., different numbers of estimators were used in a grid search to produce the best model that can predict the outcome with high accuracy. There are multiple algorithms to decide a split in a decision tree based on the problem of regression or classification. For the classification problem, we have used the Gini index as a cost function to estimate a split in the dataset. The Gini index is calculated by subtracting the sum of the squared probabilities of each class from one.

5 Boosting Ensemble Classifiers

boosting is another widely used ensemble method to train weak models to become strong learners. For that purpose, a forest of randomized trees is trained, and the final prediction is based on the majority vote outcome from each tree. This method allows weak learners to correctly classify data points in an incremental approach that are usually misclassified. Initially equal weighted coefficients are used for all data points to classify a given problem. In the successive rounds, the weighted coefficients are decreased for data points that are correctly classified and are increased for data points that are misclassified. Each subsequent tree formed in each round learns to reduce the errors from the preceding round and to increase the overall accuracy by correctly classifying data points that were misclassified in previous rounds. One major problem with boosting ensemble is that it might overfit to the training data which may lead to incorrect predictions for unseen instances There are multiple boosting algorithms available that can be used for both the purposes of classification and regression. In our experiments we used XGBoost and AdaBoost algorithms for classification purpose.

Fake News Detection



Importing Libraries

```
[ ]  import pandas as pd
     import numpy as np
     import seaborn as sns
     import matplotlib.pyplot as plt
     from sklearn.model_selection import train_test_split
     from sklearn.metrics import accuracy_score
     from sklearn.metrics import classification_report
     import re
     import string
```

Importing Dataset

```
[ ]  from google.colab import drive
     drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
[ ]  df_fake = pd.read_csv(F"/content/drive/MyDrive/Colab Notebooks/fake news.csv/Fake.csv")
     df_true = pd.read_csv(F"/content/drive/MyDrive/Colab Notebooks/true news.csv/True.csv")
```

```
[ ]  df_fake.head()
```

```
[ ]  df_fake.head()
```

	title	text	subject	date
0	Donald Trump Sends Out Embarrassing New Year'...	Donald Trump just couldn t wish all Americans ...	News	December 31, 2017
1	Drunk Bragging Trump Staffer Started Russian ...	House Intelligence Committee Chairman Devin Nu...	News	December 31, 2017
2	Sheriff David Clarke Becomes An Internet Joke...	On Friday, it was revealed that former Milwauk...	News	December 30, 2017
3	Trump Is So Obsessed He Even Has Obama's Name...	On Christmas day, Donald Trump announced that ...	News	December 29, 2017
4	Pope Francis Just Called Out Donald Trump Dur...	Pope Francis used his annual Christmas Day mes...	News	December 25, 2017

```
[ ] df_true.head(5)
```

	title	text	subject	date
0	As U.S. budget fight looms, Republicans flip t...	WASHINGTON (Reuters) - The head of a conservat...	politicsNews	December 31, 2017
1	U.S. military to accept transgender recruits o...	WASHINGTON (Reuters) - Transgender people will...	politicsNews	December 29, 2017
2	Senior U.S. Republican senator: 'Let Mr. Muell...	WASHINGTON (Reuters) - The special counsel inv...	politicsNews	December 31, 2017
3	FBI Russia probe helped by Australian diplomat...	WASHINGTON (Reuters) - Trump campaign adviser ...	politicsNews	December 30, 2017
4	Trump wants Postal Service to charge 'much mor...	SEATTLE/WASHINGTON (Reuters) - President Donal...	politicsNews	December 29, 2017

Inserting a column "class" as target feature

```
[ ] df_fake["class"] = 0
    df_true["class"] = 1
```

```
[ ] df_fake.shape, df_true.shape
```

```
((23481, 5), (21417, 5))
```

```
[ ] # Removing last 10 rows for manual testing
    df_fake_manual_testing = df_fake.tail(10)
    for i in range(23480,23470,-1):
        df_fake.drop([i], axis = 0, inplace = True)


    df_true_manual_testing = df_true.tail(10)
    for i in range(21416,21406,-1):
        df_true.drop([i], axis = 0, inplace = True)
```

```
[ ] df_fake.shape, df_true.shape
```

```
((23471, 5), (21407, 5))
```

```
[ ] df_fake_manual_testing["class"] = 0
    df_true_manual_testing["class"] = 1
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

```
[ ] df_fake_manual_testing.head(10)
```

	title	text	subject	date	class
23471	Seven Iranians freed in the prisoner swap have...	21st Century Wire says This week, the historic...	Middle-east	January 20, 2016	0
23472	#Hashtag Hell & The Fake Left	By Dady Chery and Gilbert MercierAll writers ...	Middle-east	January 19, 2016	0
23473	Astroturfing: Journalist Reveals Brainwashing ...	Vic Bishop Waking TimesOur reality is carefull...	Middle-east	January 19, 2016	0
23474	The New American Century: An Era of Fraud	Paul Craig RobertsIn the last years of the 20t...	Middle-east	January 19, 2016	0
23475	Hillary Clinton: 'Israel First' (and no peace ...	Robert Fantina CounterpunchAlthough the United...	Middle-east	January 18, 2016	0
23476	McPain: John McCain Furious That Iran Treated ...	21st Century Wire says As 21WIRE reported earl...	Middle-east	January 16, 2016	0
23477	JUSTICE? Yahoo Settles E-mail Privacy Class-ac...	21st Century Wire says It s a familiar theme. ...	Middle-east	January 16, 2016	0
23478	Sunnistan: US and Allied 'Safe Zone' Plan to T...	Patrick Henningsen 21st Century WireRemember ...	Middle-east	January 15, 2016	0
23479	How to Blow $700 Million: Al Jazeera America F...	21st Century Wire says Al Jazeera America will...	Middle-east	January 14, 2016	0
23480	10 U.S. Navy Sailors Held by Iranian Military ...	21st Century Wire says As 21WIRE predicted in ...	Middle-east	January 12, 2016	0

```
[ ] df_true_manual_testing.head(10)
```

	title	text	subject	date	class
21407	Mata Pires, owner of embattled Brazil builder ...	SAO PAULO (Reuters) - Cesar Mata Pires, the ow...	worldnews	August 22, 2017	1
21408	U.S., North Korea clash at U.N. forum over nuc...	GENEVA (Reuters) - North Korea and the United ...	worldnews	August 22, 2017	1
21409	U.S., North Korea clash at U.N. arms forum on ...	GENEVA (Reuters) - North Korea and the United ...	worldnews	August 22, 2017	1
21410	Headless torso could belong to submarine journ...	COPENHAGEN (Reuters) - Danish police said on T...	worldnews	August 22, 2017	1
21411	North Korea shipments to Syria chemical arms a...	UNITED NATIONS (Reuters) - Two North Korean sh...	worldnews	August 21, 2017	1
21412	'Fully committed' NATO backs new U.S. approach...	BRUSSELS (Reuters) - NATO allies on Tuesday we...	worldnews	August 22, 2017	1
21413	LexisNexis withdrew two products from Chinese ...	LONDON (Reuters) - LexisNexis, a provider of l...	worldnews	August 22, 2017	1
21414	Minsk cultural hub becomes haven from authorities	MINSK (Reuters) - In the shadow of disused Sov...	worldnews	August 22, 2017	1
21415	Vatican upbeat on possibility of Pope Francis ...	MOSCOW (Reuters) - Vatican Secretary of State ...	worldnews	August 22, 2017	1
21416	Indonesia to buy $1.14 billion worth of Russia...	JAKARTA (Reuters) - Indonesia will buy 11 Sukh...	worldnews	August 22, 2017	1

```
[ ] df_manual_testing = pd.concat([df_fake_manual_testing,df_true_manual_testing], axis = 0)
    df_manual_testing.to_csv("manual_testing.csv")
```

Merging True and Fake Dataframes

```
[ ] df_merge = pd.concat([df_fake, df_true], axis =0 )
    df_merge.head(10)
```

	title	text	subject	date	class
0	Donald Trump Sends Out Embarrassing New Year'...	Donald Trump just couldn t wish all Americans ...	News	December 31, 2017	0
1	Drunk Bragging Trump Staffer Started Russian ...	House Intelligence Committee Chairman Devin Nu...	News	December 31, 2017	0
2	Sheriff David Clarke Becomes An Internet Joke...	On Friday, it was revealed that former Milwauk...	News	December 30, 2017	0
3	Trump Is So Obsessed He Even Has Obama's Name...	On Christmas day, Donald Trump announced that ...	News	December 29, 2017	0
4	Pope Francis Just Called Out Donald Trump Dur...	Pope Francis used his annual Christmas Day mes...	News	December 25, 2017	0
5	Racist Alabama Cops Brutalize Black Boy While...	The number of cases of cops brutalizing and ki...	News	December 25, 2017	0
6	Fresh Off The Golf Course, Trump Lashes Out A...	Donald Trump spent a good portion of his day a...	News	December 23, 2017	0
7	Trump Said Some INSANELY Racist Stuff Inside ...	In the wake of yet another court decision that...	News	December 23, 2017	0
8	Former CIA Director Slams Trump Over UN Bully...	Many people have raised the alarm regarding th...	News	December 22, 2017	0
9	WATCH: Brand-New Pro-Trump Ad Features So Muc...	Just when you might have thought we d get a br...	News	December 21, 2017	0

```
[ ] df_merge.columns
```

```
Index(['title', 'text', 'subject', 'date', 'class'], dtype='object')
```

Removing columns which are not required

```
[ ] df = df_merge.drop(["title", "subject","date"], axis = 1)
```

```
[ ] df.isnull().sum()
```

```
text     0
class    0
dtype: int64
```

Random Shuffling the dataframe

```
[ ]  df = df.sample(frac = 1)
```

```
[ ]  df.head()
```

	text	class
27	The following statements were posted to the ve...	1
4721	Greta van Susteren left Fox News abruptly rece...	0
13639	BRUSSELS (Reuters) - North Korea s latest miss...	1
18263	Nice threat to POTUS: The intelligence commun...	0
611	After news broke that Kim Jong Un might be cap...	0

```
[ ]  df.reset_index(inplace = True)
     df.drop(["index"], axis = 1, inplace = True)
```

```
[ ]  df.columns
```

```
Index(['text', 'class'], dtype='object')
```

```
[ ]  df.head()
```

	text	class
0	The following statements were posted to the ve...	1
1	Greta van Susteren left Fox News abruptly rece...	0
2	BRUSSELS (Reuters) - North Korea s latest miss...	1
3	Nice threat to POTUS: The intelligence commun...	0
4	After news broke that Kim Jong Un might be cap...	0

Creating a function to process the texts

```
[ ]  def wordopt(text):
         text = text.lower()
         text = re.sub('\[.*?\]', '', text)
         text = re.sub("\\W"," ",text)
         text = re.sub('https?://\S+|www\.\S+', '', text)
         text = re.sub('<.*?>+', '', text)
         text = re.sub('[%s]' % re.escape(string.punctuation), '', text)
         text = re.sub('\n', '', text)
         text = re.sub('\w*\d\w*', '', text)
         return text
```

```
[ ]  df["text"] = df["text"].apply(wordopt)
```

Defining dependent and independent variables

```
[ ]  x = df["text"]
     y = df["class"]
```

Splitting Training and Testing

```
[ ]  x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25)
```

Convert text to vectors

```
[ ]  from sklearn.feature_extraction.text import TfidfVectorizer

     vectorization = TfidfVectorizer()
     xv_train = vectorization.fit_transform(x_train)
     xv_test = vectorization.transform(x_test)
```

Logistic Regression

```
[ ]  from sklearn.linear_model import LogisticRegression

     LR = LogisticRegression()
     LR.fit(xv_train,y_train)
```

```
     LogisticRegression()
```

```
[ ]  pred_lr=LR.predict(xv_test)
```

```
[ ]  LR.score(xv_test, y_test)
```

```
     0.9861853832442068
```

```
[ ]  print(classification_report(y_test, pred_lr))
```

```
                  precision    recall  f1-score   support

               0       0.99      0.99      0.99      5757
               1       0.98      0.99      0.99      5463

        accuracy                           0.99     11220
       macro avg       0.99      0.99      0.99     11220
    weighted avg       0.99      0.99      0.99     11220
```

Decision Tree Classification

```
[ ]  from sklearn.tree import DecisionTreeClassifier

     DT = DecisionTreeClassifier()
     DT.fit(xv_train, y_train)
```

```
     DecisionTreeClassifier()
```

```
[ ]  pred_dt = DT.predict(xv_test)
```

```
[ ]  DT.score(xv_test, y_test)
```

```
     0.995632798573975
```

```
[ ]  print(classification_report(y_test, pred_dt))
```

```
                  precision    recall  f1-score   support

               0       1.00      0.99      1.00      5757
               1       0.99      1.00      1.00      5463

        accuracy                           1.00     11220
       macro avg       1.00      1.00      1.00     11220
    weighted avg       1.00      1.00      1.00     11220
```

Gradient Boosting Classifier

```
[ ] from sklearn.ensemble import GradientBoostingClassifier

    GBC = GradientBoostingClassifier(random_state=0)
    GBC.fit(xv_train, y_train)
```

```
    GradientBoostingClassifier(random_state=0)
```

```
[ ] pred_gbc = GBC.predict(xv_test)
```

```
[ ] GBC.score(xv_test, y_test)
```

```
    0.9957219251336898
```

```
[ ] print(classification_report(y_test, pred_gbc))
```

```
                  precision    recall  f1-score   support

               0       1.00      0.99      1.00      5757
               1       0.99      1.00      1.00      5463

        accuracy                           1.00     11220
       macro avg       1.00      1.00      1.00     11220
    weighted avg       1.00      1.00      1.00     11220
```

Random Forest Classifier

```
[ ]  from sklearn.ensemble import RandomForestClassifier

     RFC = RandomForestClassifier(random_state=0)
     RFC.fit(xv_train, y_train)
```

```
RandomForestClassifier(random_state=0)
```

```
[ ]  pred_rfc = RFC.predict(xv_test)
```

```
[ ]  RFC.score(xv_test, y_test)
```

```
0.9907308377896613
```

```
[ ]  print(classification_report(y_test, pred_rfc))
```

```
              precision    recall  f1-score   support

           0       0.99      0.99      0.99      5757
           1       0.99      0.99      0.99      5463

    accuracy                           0.99     11220
   macro avg       0.99      0.99      0.99     11220
weighted avg       0.99      0.99      0.99     11220
```

Model Testing

```
[ ]  def output_lable(n):
         if n == 0:
             return "Fake News"
         elif n == 1:
             return "Not A Fake News"

     def manual_testing(news):
         testing_news = {"text":[news]}
         new_def_test = pd.DataFrame(testing_news)
         new_def_test["text"] = new_def_test["text"].apply(wordopt)
         new_x_test = new_def_test["text"]
         new_xv_test = vectorization.transform(new_x_test)
         pred_LR = LR.predict(new_xv_test)
         pred_DT = DT.predict(new_xv_test)
         pred_GBC = GBC.predict(new_xv_test)
         pred_RFC = RFC.predict(new_xv_test)

         return print("\n\nLR Prediction: {} \nDT Prediction: {} \nGBC Prediction: {} \nRFC Prediction: {}".format(output_lable(pred_LR[0]),
                                                                                                                   output_lable(pred_GBC[0]),
                                                                                                                   output_lable(pred_RFC[0])))
```

```
[ ]  news = str(input())
     manual_testing(news)
```

```
[ ]

[ ]

[ ]  news = str(input())
     manual_testing(news)

     news = str(input())
     manual_testing(news)

     news = str(input())
     manual_testing(news)
```

6. CONCLUSION

What conclusions can be drawn and what wider implications can be seen now that the different types of methods in the field of automatic fake news detection have been examined? Many different detection models exist, and improvements seem to be happening constantly. Despite many manual fact-checking websites existing, automatization of this process has been a natural next step due to the poor scalability of purely human-based approaches (Rehm, 2017; Shabani & Sokhn, 2018; Zhou & Zafarani, 2019). Consensus which appears between authors reveal certain commonalities between the different approaches or even categories. These addresses challenges, where and how fake news spreads, and what the common elements which needs to be focused on to achieve effective fake news detection are. Trends that appear throughout much of the literature, signifying such common elements, should be useful to focus on in a detection model intended for widespread implementation.

For example, emotionally charged or “sensitive” words were often used, intended to invoke emotional responses to influence people’s opinions or to cause them to spread the “news” in outrage or shock, for example (Ajao et al., 2019; Giachanou

et al., 2019; Granik & Meysura, 2017; Janze & Risius, 2017; Li et al., 2019; Rehm, 2017). Such manipulation is often used in conjunction with eye-catching headlines, another hallmark of fake news. This also exploits the fact that many people only read the headline of articles online, compounded with the fact that social media feeds usually only show the headline unless a user clicks on it to read the full article. Models that analyse the article structure and its relation with its corresponding headline were therefore many (Abedalla et al., 2019; Qawasmeh et al., 2019; Rubin et al., 2016; Saikh et al., 2019; Singhania et al., 2017). Social media has of course shown to be the main area where fake news is spread, and user engagement in articles and their role in its spread was particularly focused on in the network category. This included the tendency of users to aggregate into social "bubbles" where content suiting a group's narrative of things achieves quick circulation (Della Vedova et al., 2018; Hamdi et al., 2020; Rehm, 2017; Ruchansky et al., 2017; Zhang et al., 2019; Zhou & Zafarani, 2019).

A challenge that many authors brought up was to separate the detection of fake news with satire or similar things. As both of these can be written in similar ways, combined with the fact that many people only read the article headlines, they can have a harmful effect and any eventual model should account for this using the methods presented in the literature focusing on this issue (Faustini & Covões, 2019; Giełczyk et al., 2019; Rubin et al., 2016; Shabani & Sokhn, 2018). Limited amounts of datasets, as well as the limitations of existing ones, presents another challenge due to the dependence of such datasets in the development of accurate detection models (Ahmed et al., 2017; Karidi et al., 2019). An interesting aspect of this is fake news detection in non-English languages, and how this can even cause successful models to become non-viable due to the lack of sufficient datasets in the right language to train and test them with (Giełczyk et al., 2019; Monteiro et al., 2018; Vogel & Jiang, 2019). Suggested solutions which could be useful here include automatic creation of large datasets, which can achieve high results despite a lot of noise, datasets created from fact-checking websites, or in the form of publically available linked-data datasets, which can help with checking up-to-date facts (Conroy et al., 2019; Helmstetter & Paulheim, 2018; Karidi et al., 2019).

What type of detection model should be used which includes these aforementioned considerations? The content classification approach, which focuses on the text of the article, was the most popular, with various authors showing classification algorithms achieving high results (Ahmed et al.,2017; Girgis et al., 2018; Kaur et al., 2019; Ksieniewicz et al, 2019; Pérez-Rosas et al., 2017; Waikhom & Goswami, 2019). But deficiencies and downsides were also brought up (Alam & Ravshanbekov, 2019; Manzoor & Singla, 2019), and by using the benefits of a network approach, a combination between the two was recommended to achieve the best results (Conroy et al., 2019; Della Vedova et al., 2018; Fernández-Reyes & Shinde, 2018; Hamdi et al., 2020; Janze & Risius; Ruchansky et al., 2017; Zhang et al., 2019). Such an approach would also consider the aspect of the spread itself. This could offset some weaknesses regarding early detection of text classification, since combined, or even pure network models, have shown to achieve good results with early or little information, despite needing a degree of initial spread to have something to analyse. (Della Vedova et al., 2018; Hamdi et al., 2020; Hu et al., 2019; Liu & Wu, 2018; Pan et al., 2018; Zhou & Zafarani, 2019).

A combined method of both text and network analysis is therefore the most strongly recommended approach. Some insights into how such a model, taking all the aforementioned points into account, could be practically implemented for widespread use among online users was given. Rehm (2017) proposes a concrete solution, but it would require a large collective undertaking by several international corporations and organizations. Bhattacharjee et al. (2017) proposed a “lighter” method suited towards short messages, such as for use on Twitter. An idea like that could be kept in mind in regards to detection models requiring little information, mentioned above.

Using an overlay on web browsers, similar to what has been suggested, would promote widespread usage, as it would be available to use at any time on any site. Based on the conclusions regarding the common elements across all categories, such a tool should use a combined approach of existing advanced text analysis, including linguistics, syntax, use of emotional words, and satire detection, as well as with network analysis, looking at the trustworthiness and credibility depending on the source and/or spreader. The development of quality

datasets, also in non-English languages, is a critical part of the development and accuracy of such a system. The network aspect and quality datasets would help ensure that detection functions well for fake news which are newly released or short. Possible additional human input could be used to augment this, but in such a case separation between machine detection and human input should be clearly highlighted to not have human bias be presented as machine-analysis.

The problems of fake news and disinformation play an important role on nowadays life. This is because the advanced level of technology and communication methods we have enabled information spreading among people without any verification. This is a reason why researchers started searching for solutions to stop fake news and disinformation from spreading easily. However, it is well known that controlling the flow of information online is impossible. In this paper, we performed an attempt to verify the news articles credibility depending on their characteristics. At this aim, we implemented an algorithm combining several classification methods with text models. It performed well, and the accuracy results were relatively satisfying. As future work, we plan to better study the combination between the feature extraction methods and the classifiers as we will be able to choose the text representation model that performs best with the classifier. Moreover, to achieve a higher accuracy, we will have to implement a more sophisticated algorithm which may use data mining technologies with big data, because creating a big dataset including more types of news articles with more class variables (labels) will help raising the accuracy score
As mentioned I earlier, the concept of deception detection in social media is particularly new and there is ongoing research in hopes that scholars can find more accurate ways to detect false information in this booming, fake-news-infested domain. For this reason, this research may be used to help other researchers discover which combination of methods should be used in order to accurately detect fake news in social media. The proposed method described in this paper is an idea for a more accurate fake news detection algorithm.
It is significant to find the accuracy of news which is available on internet. In the paper, the components for recognizing Fake news are discussed. A mindfulness that not all, the fake news will propagate via web-based networking

media. Currently, to test out the proposed method of Naïve Bayes classifier, SVM, and NLP are used. In future, ensuing algorithm may provide better results with hybrid approaches for the same purpose fulfilment. The mentioned system detects the fake news on the based on the models applied. Also it had provided some suggested news on that topic which is very useful for any user. In the future, the efficiency and accuracy of the prototype can be enhanced to a certain level, and also enhance the user interface of the proposed model.

The task of classifying news manually requires in-depth knowledge of the domain and expertise to identify anomalies in the text. In this research, we discussed the problem of classifying fake news articles using machine learning models and ensemble techniques. The data we used in our work is collected from the World Wide Web and contains news articles from various domains to cover most of the news rather than specifically classifying political news. The primary aim of the research is to identify patterns in text that differentiate fake articles from true news. We extracted different textual features from the articles using an LIWC tool and used the feature set as an input to the models. The learning models were trained and parameter-tuned to obtain optimal accuracy. Some models have achieved comparatively higher accuracy than others. We used multiple performance metrics to compare the results for each algorithm. The ensemble learners have shown an overall better score on all performance metrics as compared to the individual learners.

Fake news detection has many open issues that require attention of researchers. For instance, in order to reduce the spread of fake news, identifying key elements involved in the spread of news is an important step. Graph theory and machine learning techniques can be employed to identify the key sources involved in spread of fake news. Likewise, real time fake news identification in videos can be another possible future direction.

Due to increasing use of internet, it is now easy to spread fake news. A huge number of persons are regularly connected with internet and social

media platforms. There is no any restriction while posting any news on these platforms. So some of the people takes the advantage of these platforms and start spreading fake news against the individuals or organizations. This can destroy the repute of an individual or can affect a business. Through fake news, the opinions of the people can also be changed for a political party. 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. 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.

6.1 Discussion

The research question the introduction chapter asked what measures were being developed to protect online users against fake news, and how these could be automated. As have been seen, many different approaches of handling the problem of online fake news in automated ways exists, each with their own advantages and disadvantages. While certain methods were more common than others, the best results seem to come from combined approaches that identify fake news based on multiple factors. Such approaches manages to “cancel out” the disadvantages of each other, compared to if they had been used separately. Practical implementations of these detection models exist, but a well-developed “standard” seems to be necessary to achieve widespread use. In conclusion, there are many well-developed automatic detection methods which should be used in a widespread tool for online users.

Despite if a highly accurate tool achieving standardized implementation in the future, it should however not mean the end of efforts to education for people on how to identify fake news and detect bias in online news. Not adopting a critical view in regards to what can be read online and in the media, and thereby fully putting the judgment of “truth” in the hands of an (always imperfect) computer

algorithm, is not a good way for humans to view the world and process information. Any widespread fake news detection tool should always be used as assistance to a critical mind that thinks for itself.

The main scientific contribution of this paper was to provide an overview of the existing developments and models in the field of automatic fake news detection as of today. Due to the recent explosion in popularity regarding this topic since the time of the US presidential election period in 2015-16, the material analysed in this paper should present a comprehensive overview of the current situation in this area and present a picture of where development stands as of today.

Fake news have been shown to be one of the largest social problems (at least online) in the developed world, receiving much focus and research on how to combat its spread. Methods to detect fake news is therefore a valuable contribution to the online public. It can also help in less-developed areas; the importance of datasets used to train detection models to become accurate also became apparent, especially when looking at the situation from a global perspective, where some detection models sometimes struggled due to a lack of non-English datasets. Development of datasets in different languages could be especially important in countries were the internet is only recently becoming widespread, and where people as a result might be more susceptible to online disinformation. Assistance with identifying what's real and what's fake could be very valuable for the "social health" in such emerging online communities.

While this paper has looked at the current fake news detection methods, future work could make the suggestions and conclusions from this paper into a reality. It could focus on implementing the best of these models into a working tool which can be practically used by people online. Of note should be that even a widely used browser overlay would not include social media accessed on smartphones and similar devices, which is how a very large portion of people interact with social media. A way to implement any tool which is developed into that environment is very important if widespread usage is to be achieved.

6.2 Reference

Fake News Detection: A Data Mining Perspective

Fake News Identification - Stanford CS 229

BS Detector

Datasets from Kaggle

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Project Repository

*https://github.com/oliverotieno/Fake-News-Detection-Using-Machine-Learning_*