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Fake News Detection

Using ML

A Report for the Evaluation 3 of Project 2

Submitted by-

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(16SCSE101350)

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

Computer Science and Engineering

Under the Supervision of

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APRIL / MAY - 2020

ABSTRACT:

In recent years, due to the booming development of online social networks, fake news for various commercial and political purposes has been appearing in large numbers and widespread in the online world. With deceptive words, online social network users can get infected by these online fake news easily, which has brought about tremendous effects on the offline society already. An important goal in improving the trustworthiness of information in online social networks is to identify the fake news timely. This paper aims at investigating the principles, methodologies and algorithms for detecting fake news articles, creators and subjects from online social networks and evaluating the corresponding performance. This paper addresses the challenges introduced by the unknown characteristics of fake news and diverse connections among news articles, creators and subjects. This paper introduces a novel automatic fake news credibility inference model, namely FAKEDETECTOR. Based on a set of explicit and latent features extracted from the textual information, FAKEDETECTOR builds a deep diffusive network model to learn the representations of news articles, creators and subjects simultaneously. Extensive experiments have been done on a real-world fake news dataset to compare FAKEDETECTOR with several state-of-the-art models, and the experimental results have demonstrated the effectiveness of the proposed model. Index Terms—Fake News Detection; Diffusive Network; Text Mining; Data Mining.

In this paper, we explore the application of Natural Language Processing techniques to identify when a news source may be producing fake news.

INTRODUCTION:

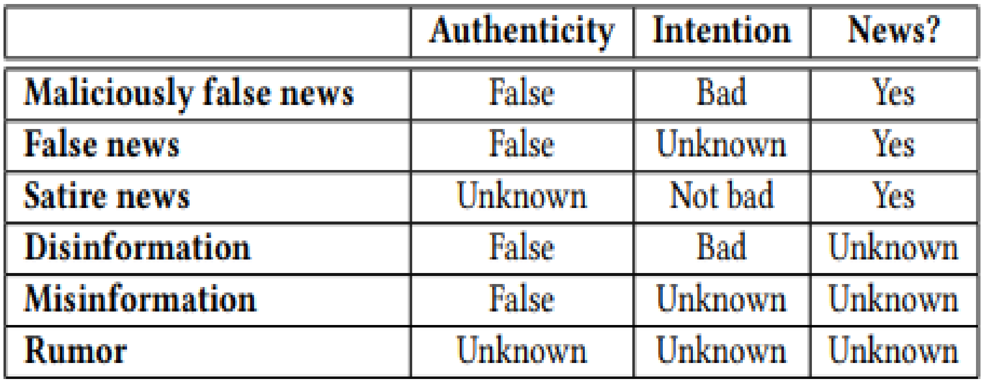
Fake news denotes a type of yellow press which intentionally presents misinformation or hoaxes spreading through both traditional print news media and recent online social media. Fake news has been existing for a long time, since the “Great moon hoax” published in 1835 [1]. In recent years, due to the booming developments of online social networks, fake news for various commercial and political purposes has been appearing in large numbers and widespread in the online world. With deceptive words, online social network users can get infected by these online fake news easily, which has brought about tremendous effects on the offline society already. During the 2016 US president election, various kinds of fake news about the candidates widely spread in the online social networks, which may have a significant effect on the election results. According to a post-election statistical report [4], online social networks account for more than 41.8% of the fake news data traffic in the election, which is much greater than the data traffic shares of both traditional TV/radio/print medium and online search engines respectively. An important goal in improving the trustworthiness of information in online social networks is to identify the fake news timely, which will be the main tasks studied in this paper. Fake news has significant differences compared with traditional suspicious information, like spams [70], [71], [20], [3], in various aspects: (1) impact on society: spams usually exist in personal emails or specific review websites and merely have a local impact on a small number of audiences, while the impact fake news in online social networks can be tremendous due to the massive user numbers globally, which is further boosted by the extensive information sharing and propagation among these users [39], [61], [72]; (2)

audiences’ initiative: instead of receiving spam emails passively, users in online social networks may seek for, receive and share news information actively with no sense about its correctness; and (3) identification difficulty: via comparisons with abundant regular messages (in emails or review websites), spams are usually easier to be distinguished; meanwhile, identifying fake news with erroneous information is incredibly challenging, since it requires both tedious evidence-collecting and careful factchecking due to the lack of other comparative news articles available. These characteristics aforementioned of fake news pose new challenges on the detection task. Besides detecting fake news articles, identifying the fake news creators and subjects will actually be more important, which will help completely eradicate a large number of fake news from the origins in online social networks. Generally, for the news creators, besides the articles written by them, we are also able to retrieve his/her profile information from either the social network website or external knowledge libraries, e.g., Wikipedia or government-internal database, which will provide fundamental complementary information for his/her background check. Meanwhile, for the news subjects, we can also obtain its textual descriptions or other related information, which can be used as the foundations for news subject credibility inference. From a higher-level perspective, the tasks of fake news article, creator and subject detection are highly correlated, since the articles written from a trustworthy person should have a higher credibility, while the person who frequently posting unauthentic information will have a lower credibility on the other hand. Similar correlations can also be observed between news articles and news subjects. In the following part of this paper, without clear specifications, we will use the general fake news term to denote the fake news articles, creators and subjects by default.

What is Fake News?

There has been no universal definition for fake news, even in journalism. A clear and accurate definition helps lay a solid foundation for fake news analysis and evaluating related studies. Here we (I) theoretically distinguish between several concepts that frequently co-occur or have overlaps with fake news, (II) present a broad and a narrow definition for the term fake news, providing a justification for each definition, and (III) further highlight the potential research problems raised by such definitions.

Table 1. A Comparison between Concepts related to Fake News



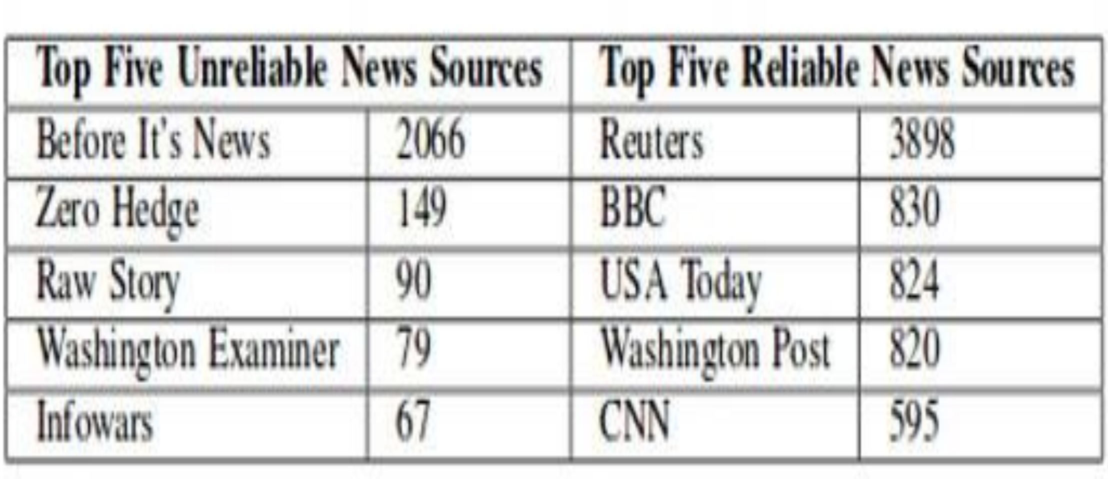
	Authenticity	**Intention**	**News?**
Maliciously false news	False	Bad	Yes
False news	False	Unknown	Yes
Satire news	Unknown	Not bad	Yes
Disinformation	False	Bad	Unknown
Misinformation	False	Unknown	Unknown
Rumor	Unknown	Unknown	Unknown

EXISTING SYSTEM :

There exists a large body of research on the topic of machine learning methods for deception detection, most of it has been focusing on classifying online reviews and publicly available social media posts. Particularly since late 2016 during the American Presidential election, the question of determining 'fake news' has also been the subject of particular attention within the literature.

Conroy, Rubin, and Chen [1] outlines several approaches that seem promising towards the aim of perfectly classify the misleading articles. They note that simple content-related n-grams and shallow parts-of-speech (POS) tagging have proven insufficient for the classification task, often failing to account for important context information. Rather, these methods have been shown useful only in tandem with more complex methods of analysis. Deep Syntax analysis using Probabilistic Context Free Grammars (PCFG) have been shown to be particularly valuable in combination with n-gram methods. Feng, Banerjee, and Choi [2] are able to achieve 85%-91% accuracy in deception related classification tasks using online review corpora.

Feng and Hirst implemented a semantic analysis looking at 'object:descriptor' pairs for contradictions with the text on top of Feng's initial deep syntax model for additional improvement. Rubin, Lukoianova and Tatiana analyze rhetorical structure using a vector space model with similar success. Ciampaglia et al. employ language pattern similarity networks requiring a pre-existing knowledge base.



Top Five Unreliable News Sources		Top Five Reliable News Sources	
Before It's News	2066	Reuters	3898
Zero Hedge	149	BBC	830
Raw Story	90	USA Today	824
Washington Examiner	79	Washington Post	820
Infowars	67	CNN	595

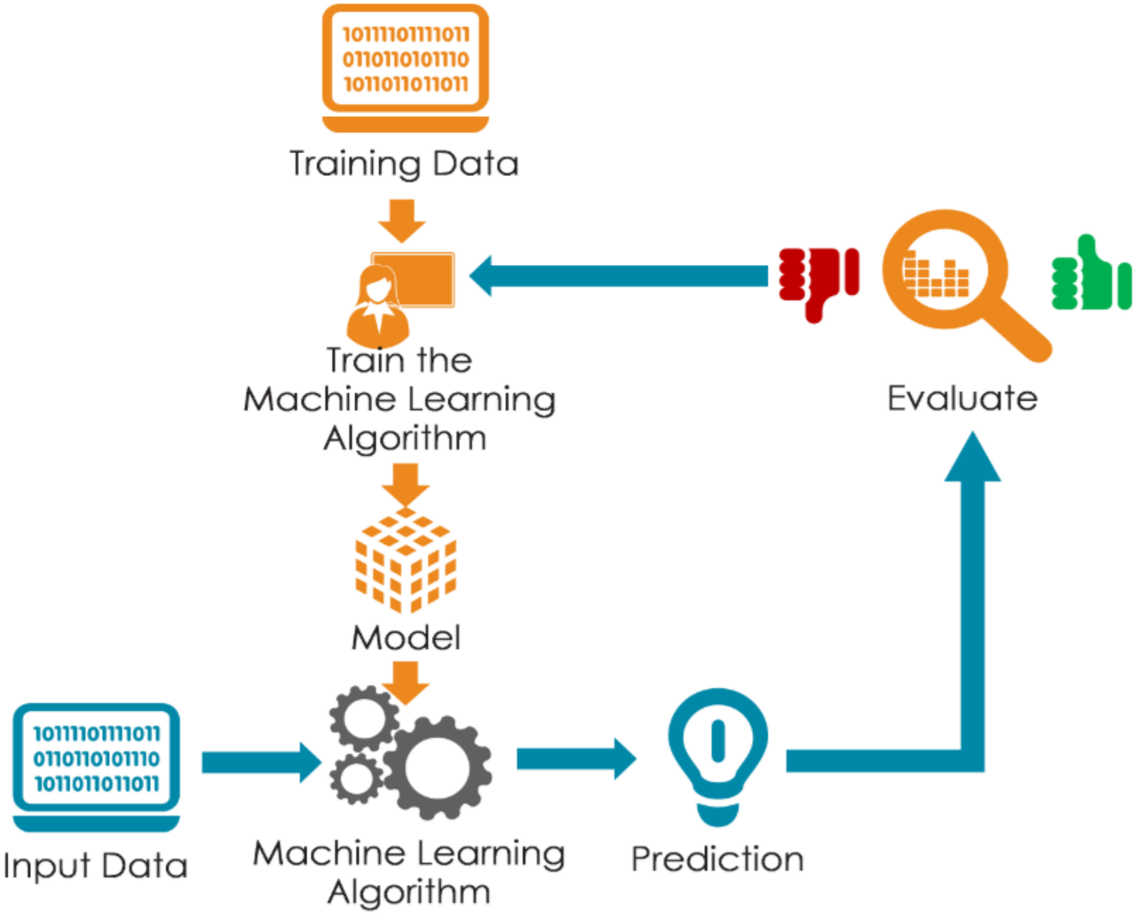
PROPOSED SYSTEM:

In this section, we will provide the detailed information about the FAKEDETECTOR framework in this section. Framework FAKEDETECTOR covers two main components: representation feature learning, and credibility label inference, which together will compose the deep diffusive network model FAKEDETECTOR.

Training a Model

⧫ Models used-

- Naive Bayes
- Support Vector Machine (SVM)
- Neural Network
- Long Short-Term Memory (LSTM)



Naive Bayes classifier:

Naive Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. There is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable. For example, a fruit may be considered to be an apple if it is red, round, and about 10 cm in diameter. A naive Bayes classifier considers each of these features to contribute independently to the probability that this fruit is an apple, regardless of any possible correlations between the color, roundness, and diameter features.

Likelihood

Class Prior Probability

$$P(c \mid x) = \frac{P(x \mid c)\,P(c)}{P(x)}$$

Posterior Probability

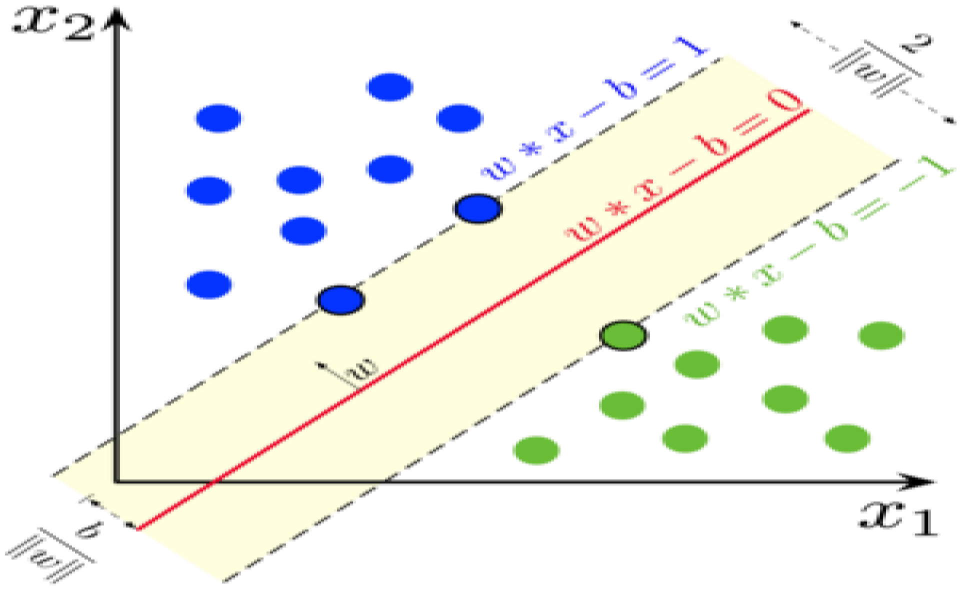
Predictor Prior Probability

$$P(c \mid X) = P(x_1 \mid c) \times P(x_2 \mid c) \times \cdots \times P(x_n \mid c) \times P(c)$$

Support Vector Machine (SVM):

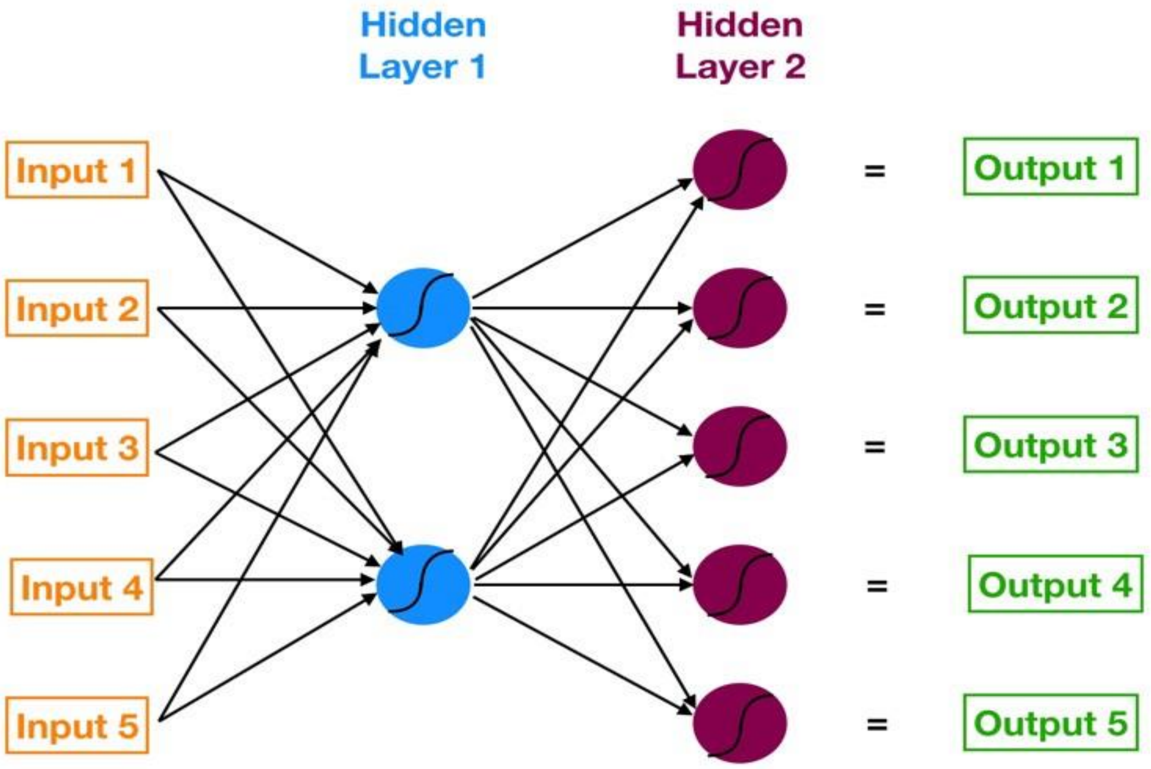
a support-vector machine constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks like outliers detection.[3] Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class (so-called functional margin), since in general the larger the margin, the lower the generalization error of the classifier

Whereas the original problem may be stated in a finite-dimensional space, it often happens that the sets to discriminate are not linearly separable in that space.



Neural Network:

A neural network is a network or circuit of neurons, or in a modern sense, an artificial neural network composed of artificial neurons or nodes.



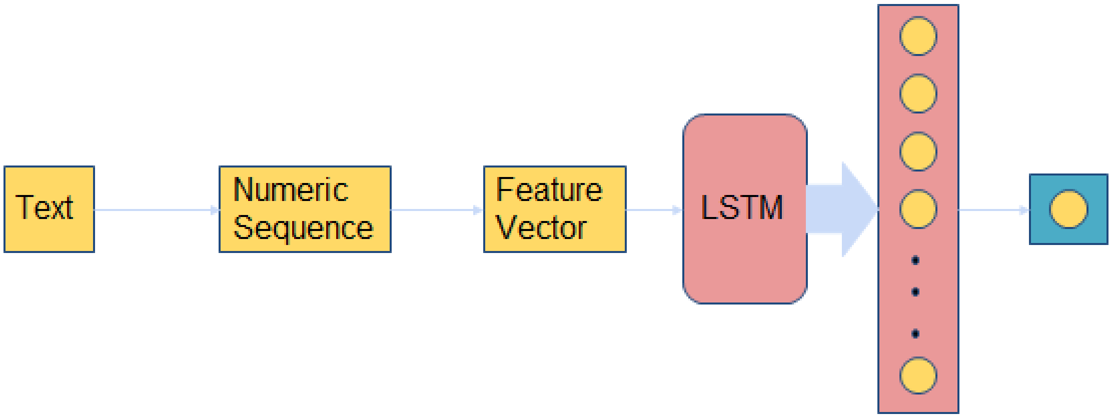
LONG SHORT TERM MEMORY:

Long Short Term Memory networks – usually just called "LSTMs" – are a special kind of RNN, capable of learning long-term dependencies. They were introduced by Hochreiter & Schmidhuber (1997), and were refined and popularized by many people in following work.[1] They work tremendously well on a large variety of problems, and are now widely used.

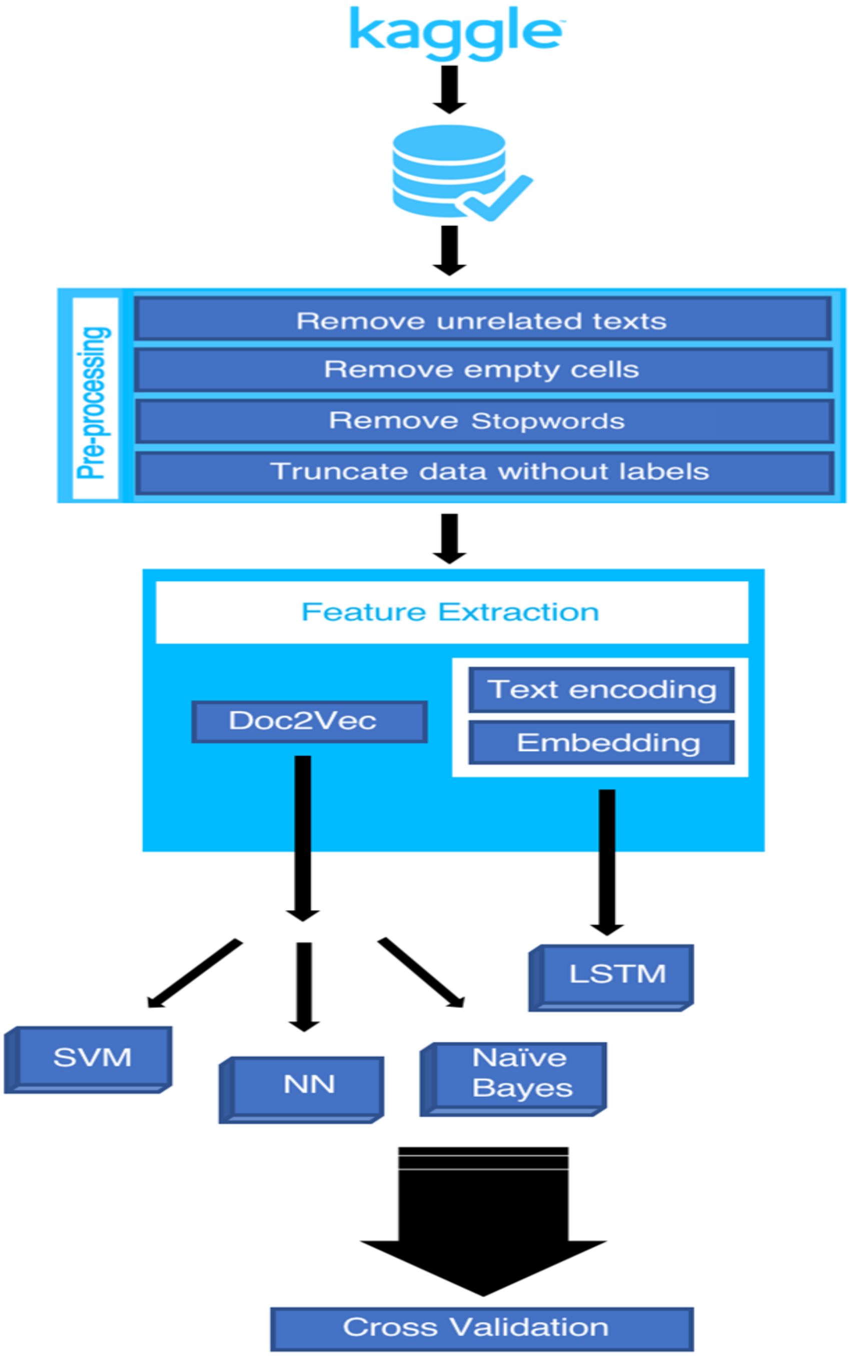
LSTMs are explicitly designed to avoid the long-term dependency problem. Remembering information for long periods of time is practically their default behavior, not something they struggle to learn!

All recurrent neural networks have the form of a chain of repeating modules of neural network. In standard RNNs, this repeating module will have a very simple structure, such as a single tanh layer.

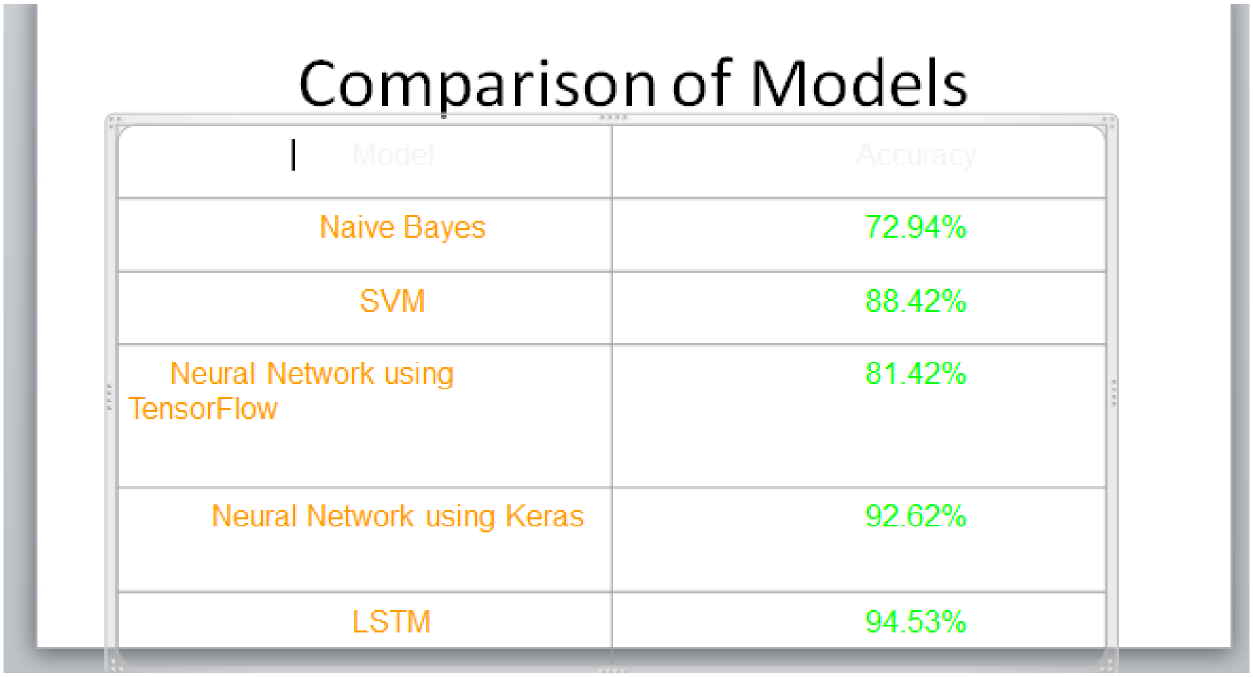
LSTM



ARCHITECTURE :



RESULT:



Comparison of Models

Model	Accuracy
Naive Bayes	72.94%
SVM	88.42%
Neural Network using TensorFlow	81.42%
Neural Network using Keras	92.62%
LSTM	94.53%

We observed that LSTM gave us the best results. We had to use a different set of embeddings for preprocessing the data to be fed to our LSTM model. It uses ordered set of Word2Vec representations. The LSTM achieves the highest F1 score in comparison to all the other models, followed by the Neural Network model using Keras. One of the reasons that LSTM performs so well is because the text is inherently a serialized object. All theothermodelsusetheDoc2Vectoget their feature vectors and hence, they rely on the Doc2Vec to extract the order in formation and perform a classification on it. On the other hand, the LSTM model preserves the order using a different pre-processing method and makes prediction based on both the words and their order. This is how it outperforms others.

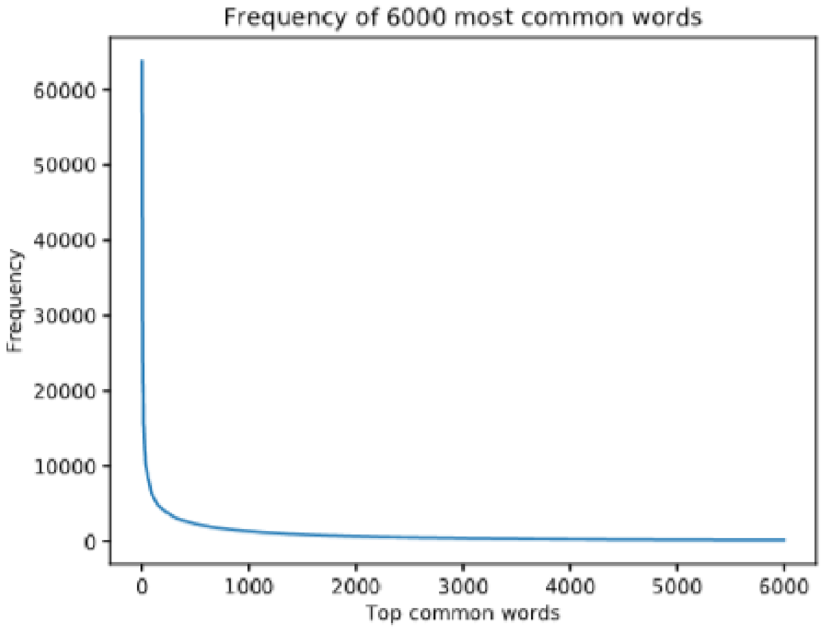


Figure 1: Frequency of Top Common Words

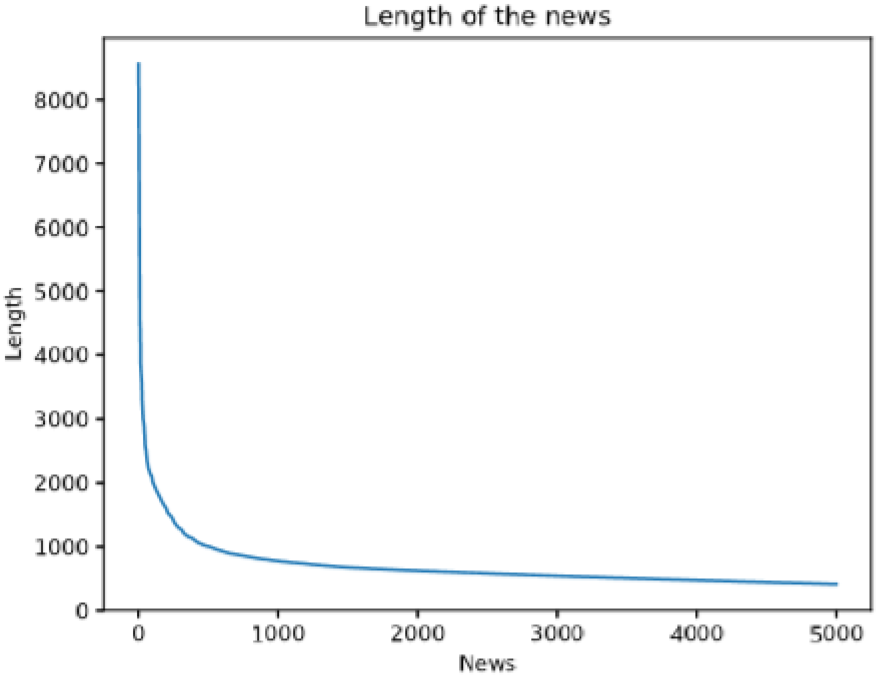


Figure 2: Length of the News

CONCLUSION:

With the increasing popularity of social media, more and more people consume news from social media instead of traditional news media. However, social media has also been used to spread fake news, which has strong negative impacts on individual users and broader society. In this article, we explored the fake news problem by reviewing existing literature in two phases: characterization and detection. In the characterization phase, we introduced the basic concepts and principles of fake news in both traditional media and social media. In the detection phase, we reviewed existing fake news detection approaches from a data mining perspective, including feature extraction and model construction. We also further discussed the datasets, evaluation metrics, and promising future directions in fake news detection research and expand the field to other applications.

FUTURE ENHANCEMENT:

Acomplete,production-quality classifier will incorporate many different features beyond the vectors corresponding to the words in the text For fake news detection,we can add as features the source of the news, including any associated URLs, the topic (e.g., science, politics, sports, etc.), publishing medium(blog,print,socialmedia),countryorgeographicregionoforigin,publicationyear,aswell as linguistic features not exploited in this exerciseuse of capitalization, fraction of words that are proper nouns (using gazetteers), and others. Besides, we can also aggregate the well-performed classifiers to achieve better accuracy. For example, using bootstrap aggregating for the Neural Netwrok, LSTM and SVM models to get better prediction result. An ambitious work would be to search the news on the Internet and compare the search results with the original news. Since the search result is usually reliable, this method should be more accurate, but also involves natural language understanding because the search results will not be exactly the same as the original news. So we will need to compare the meaning of two contents and decide whether they mean the same thing.