Fake News Detection on Indian Sources

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Abstract. Everyone relies on many online resources for news in today's world, where the internet is pervasive. As the use of social media platforms such as Twitter, Facebook, and others has grown, news has traveled quickly among millions of users in a short amount of time. Fake news has far-reaching effects, ranging from the formation of biased opinions to manipulating election outcomes in favor of specific politicians. Furthermore, spammers profit from click-bait ads by utilizing appealing news headlines. Sometimes, humans find it more difficult to determine the article's authenticity without additional verification. In this paper, we developed a classification model with the help of Deep Learning and Natural Language Processing Techniques, that classifies the article as real or fake news. The model has been tested on Indian news source - Times Of India along with other sources such as Politifact and was able to give decent accuracy in verifying the authenticity of the news.

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Keywords: NLP · Word2Vec · LSTM · Artificial neural networks · N-gram analysis

1 Introduction

Information sharing has become a simple undertaking in today's world of continuously developing technology. We link ourselves so much to news but sometimes fail to verify its authenticity. As we spend more time interacting online through social media platforms, more people are seeking out and consuming news from social media rather than traditional news organizations. It was also discovered that, as a key news source, social media currently exceeds television. Despite the advantages of social media, the quality of social media stories is lower than that of traditional news organizations.

Large volumes of fake news, i.e. news pieces with purposely incorrect material, are created online for a variety of reasons, including financial and political gain because it is inexpensive to supply news online and significantly faster and easier to distribute through social media. Many people were harmed by this, and their trust in online social networks was eroded (a platform where news is easily spread worldwide). This deception creates importance and necessity for a system that verifies the authenticity of a news article and detects fake news. Many scientists believe that artificial intelligence and machine learning can assist solve the problem of fake news.

J. I.-Z. Chen et al. (Eds.): ICIPCN 2022, LNNS 514, pp. 1–13, 2023.
https://doi.org/10.1007/978-3-031-12413-6_3

Various models are employed to achieve a 60–75% accuracy range. Naive bayes classifier, Linguistic characteristics based, PCA and Chi-Square in feature extraction followed by CNN-LSTM model, Support Vector Machines, and others are included. The parameters that are taken into account do not provide a high level of precision.

This project tries to solve this real-world problem, which is challenging since the bots are improving and deceiving humans. It is not simple to check the article's authenticity; hence we need better systems that help us understand fake news patterns and prevent confusion in the world. We have utilized an available dataset for training our model and performed analysis on the text data along with sentiment analysis to understand the polarity of data. Feature extraction techniques like Word2Vec are employed to generate sentence features and a model built with LSTM and dropout layers for training and validation of data. To test the data on real time data, web scraping has been done on websites like Politifact and Times of India to test systems accuracy.

This paper is prepared as follows. Section 2 highlights the different models, unique techniques and also different types of datasets used for training. Section 3 gives a clear view on methodology and makes up for shortcomings. Section 4 helps you in visualizing the model architecture. Sections 5 and 6 talks about usage of our model and the future works that can be done respectively. The final section consists of the results obtained on testing our model with real time data.

2 Related Works

Following a wave of widespread fake news in recent years, several measures have been developed to detect it. Social bots, trolls, and cyborg users are the three sorts of contributors to fake news. According to the definition of a social bot, a social media account that is managed by a computer algorithm. Content can be generated by the social bot automatically. Second trolls are genuine people who seek to disrupt online communities in order to elicit an emotional response from social media users. Cyborg is the other one. Automated actions with human input are what cyborg users are. To engage in social media activities, people create accounts and use programs.

Some of them propose a general natural language way of performing fake news detection using traditional NLP techniques, some propose novel techniques using deep learning methods.

We began our investigation by learning the basic methodology for developing a fake news detector, which includes news aggregation (gathering of news), authentication (training a model to detect the authenticity of news), and recommendation (assistance in determining the authenticity of news).

We started our research by comparing different word to numeric transformation techniques starting from Traditional methods like Tf-Idf, followed by word2vec and doc2vec embedding algorithms and deep learning approaches. We were also introduced to new concepts namely LSTM and GRU, which helps in overcoming the shortcomings of RNN i.e. long-term dependence [1] and also we were able to figure out the metrics used for finding the accuracy of models.

We went through different approaches of feature extraction [2–4]. These papers used PCA and Chi-Square for dimensionality reduction. And in some papers they used N-gram and sequence model for the text transformations along with the conversion they used regularization techniques to make sure data is not being overfitted. Some papers used a traditional method tf-idf we need to threshold the vocabulary so that we won't get a sparse matrix. From the research we concluded that Word2Vec is a suitable method, since it converts human readable language to system readable language and can also maintain semantics.

A brief research on classification methods have made clear the significance of SVM, KNN in fake news detection. Based on the research done we were able to figure out SVM is one of the better approaches for classification [5]. On further exploring we were able to figure out some of the neural networks consisting of LSTM layers [6] gave better results for the classification. By this, we concluded to use simple neural networks for the classification.

For data scraping from web sources, this paper [12] helped us to understand the process of scraping data from web sources.

3 Proposed Solution

Figure 1 depicts the Pipeline/Workflow for the implementation of the fake news detector.

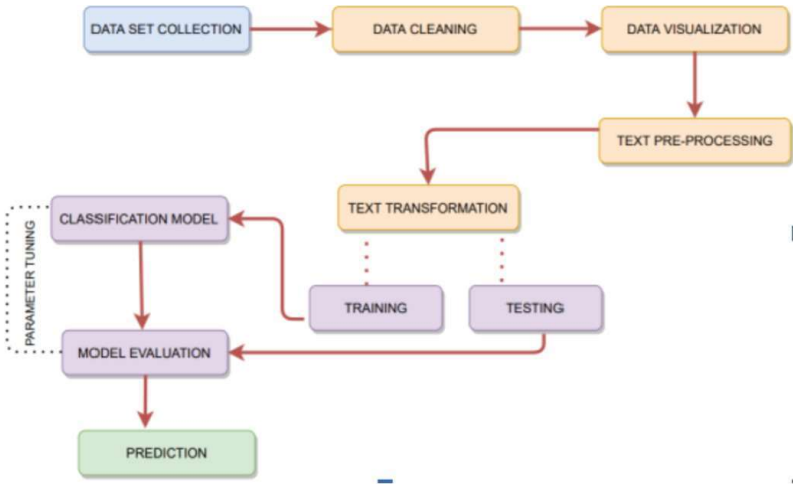

Fig. 1. Model pipeline

3.1 Dataset

The training of our fake news detection model has been done on ISOT fake news dataset [9, 10]. The dataset consists of Two Comma separated files, Fake.csv, Real.csv. Refer to Fig. 2 for a sample of the dataset. Each of the files has the title of the news, text data, topic/category, date published and whether the news is Fake or Not.

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

Fig. 2. Sample dataset

3.2 Data Cleaning

The data we choose consists of two CSV's, each for real and fake data. While the data was mostly clean, In order to increase the usability of data for training the following steps have been used:

1. Cleaned the empty (NA) values in the data.
2. The titles without a publisher name have been removed in both the data files.
3. A new column, "*isfake*", is created which represents whether the data is fake or real, i.e. token 0 for real data and 1 for fake data.
4. Both the data files have been merged to create a single data file for easy processing.

3.3 Data Analysis

We have performed data analysis with the goal of getting a deeper understanding of the data. The bar graph (Fig. 3) is displayed to understand the categorical distribution from which the majority of fake news is generated. We were able to deduce from charting that authentic data has only two categories, whereas bogus news has seven. Following the basic text cleaning, a word cloud (Fig. 4) is generated to determine the most commonly used words. The final N-gram analysis was completed. In computational linguistics, an N-gram is explained as an adjoining sequence of n elements in a sample of text or speech. N-gram analysis can be a major asset in deciding the best possible tool for text analysis (Table 1).

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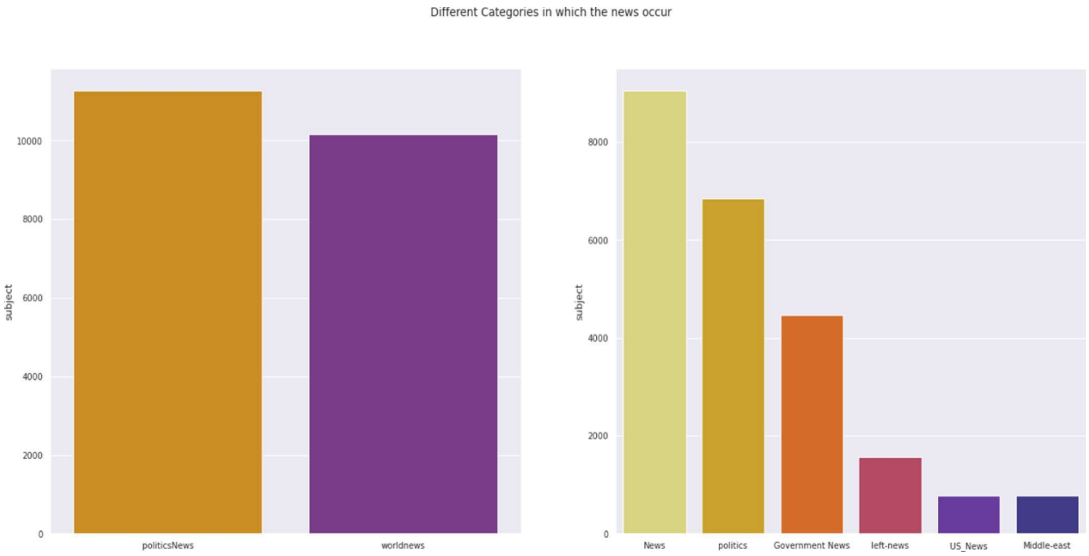


Fig. 3. Plot depicting categorical distribution of data

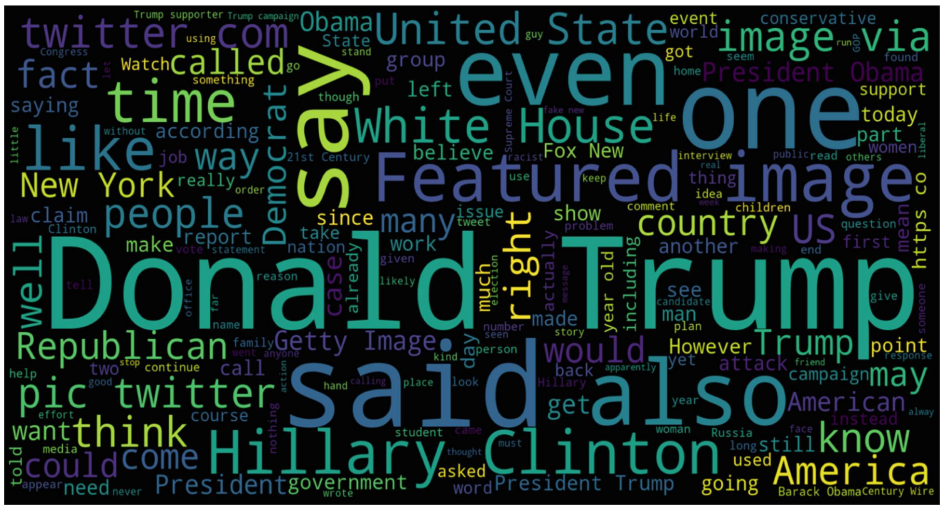


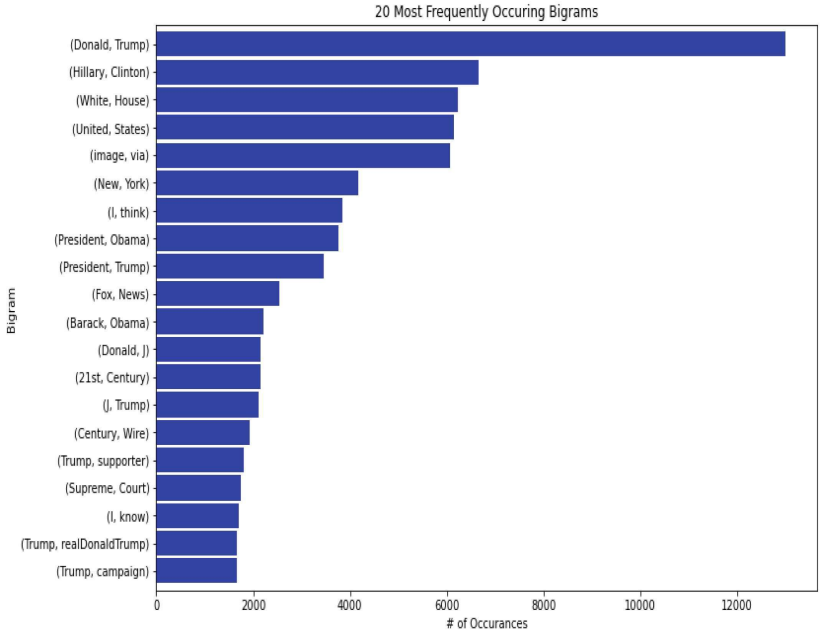
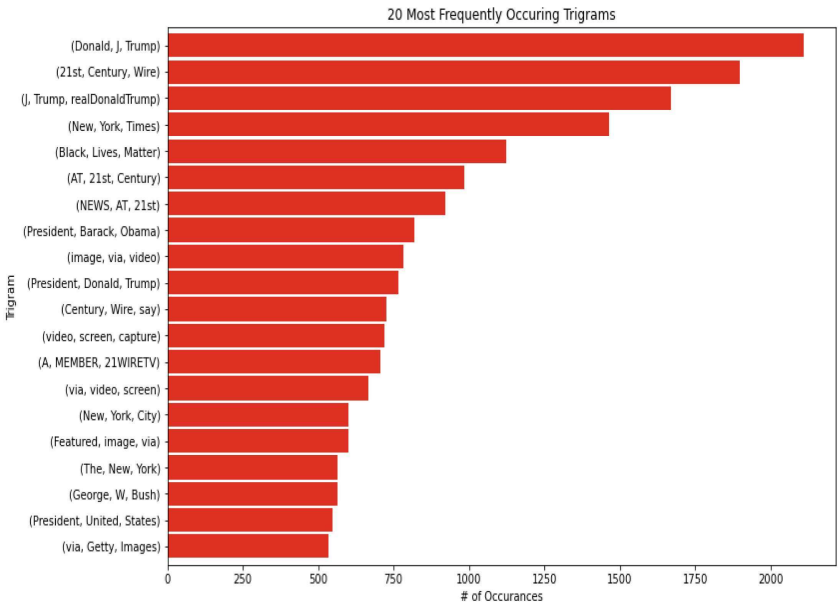
Fig. 4. Word cloud with most famous words

3.4 Text Preprocessing and Text Transformation

As a part of text preprocessing, the title and text parts of the data have been merged for faster processing and better understanding. With the use of the NLTK library various preprocessing steps were implemented. They include:

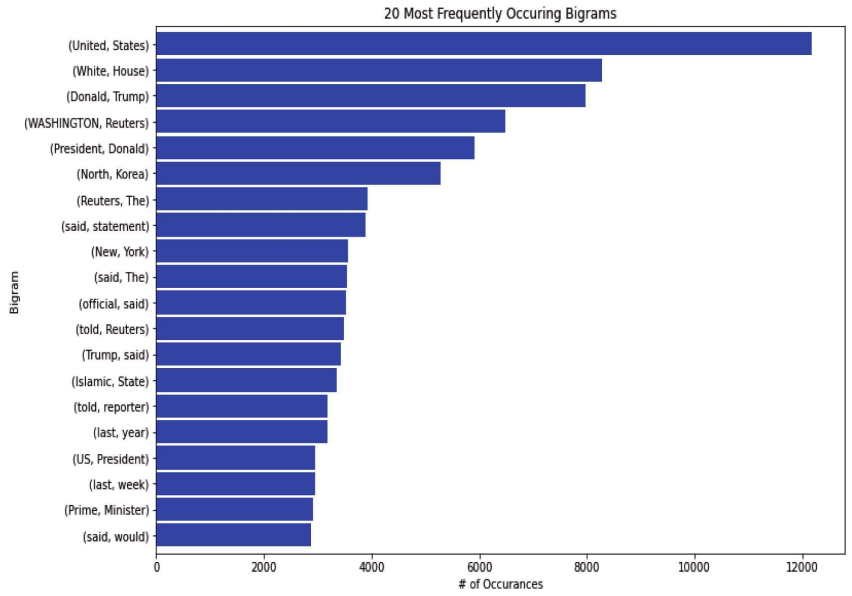
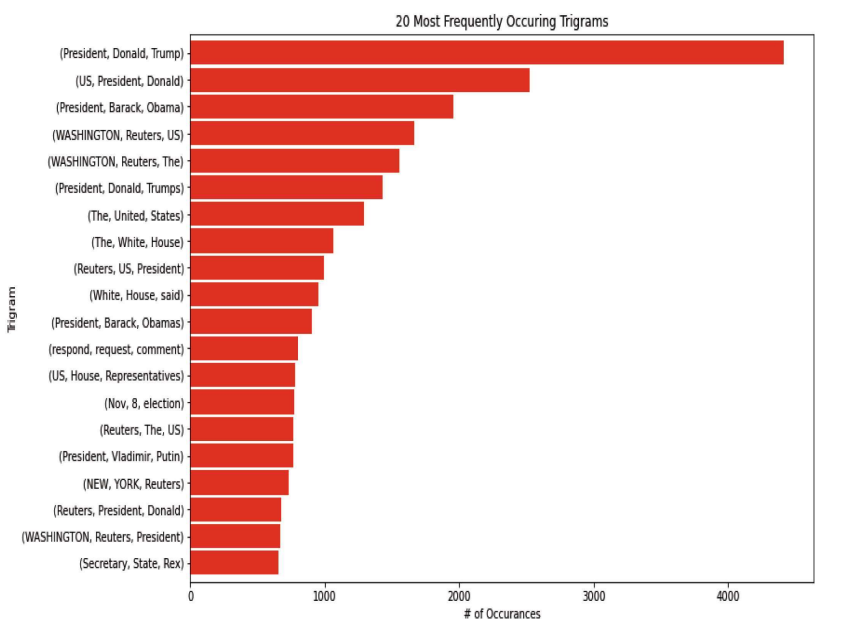
1. Removing stop words
2. Removing punctuations
3. Utilizing regex to remove single characters.
4. Tokenization of sentences.

Table 1. Plots of ngram analysis.

Bi gram - Fake news	
Tri gram- Fake news	

(*continued*)

Table 1. (*continued*)

Bi gram - real news	
Tri gram - real news	

For text transformation, Word2Vec is used to convert text in human readable form to embeddings that can be understood by the model. It is a two-layered neural network which is used to reconstruct the linguistics of words. It has weights, much like all neural networks, and the purpose of training is to lower the loss function by adjusting the weights. However, we will not utilize Word2Vec for the job for which it was trained; instead, we will use its hidden weights as our word embeddings and discard the rest of the model.

It takes a large corpus of words as its input and produces a vector space of several hundred dimensions, with each unique word being assigned a corresponding vector in the multi dimensional vector space. Word vectors are positioned in the vector space in such a way that words with similar contexts in the corpus are close together in the space. For learning word embeddings from raw text, Word2Vec is a computationally efficient predictive model. The Continuous Bag-of-Words (CBOW) model and the Skip-gram model are also available.

Word2vec builds the vocabulary and also extracts the sentence features which are later used to train the system. The size of the input is capped at 700 words as most of the sentences fall in this category thus removing any outliers. Refer to Fig. 5 for the same.

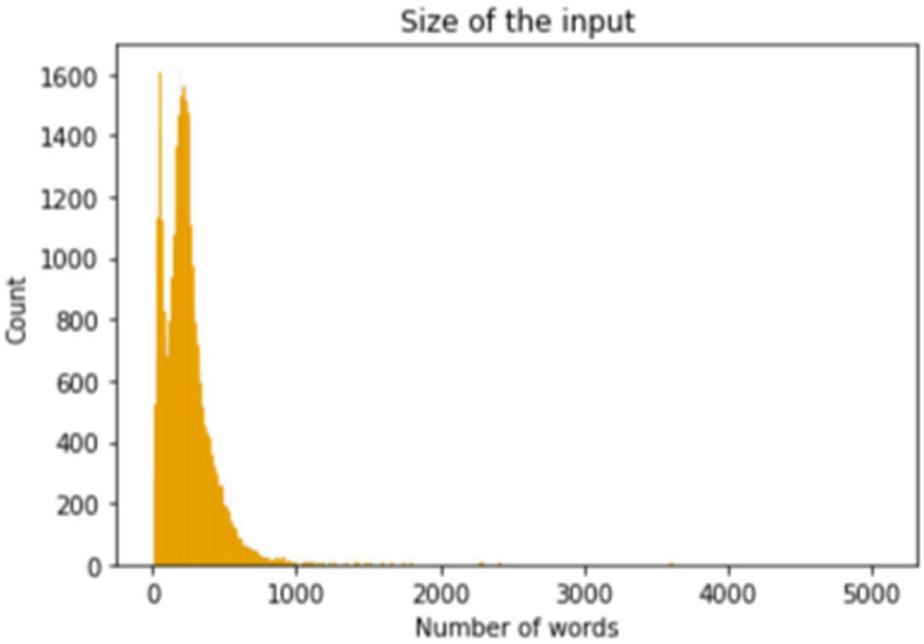


Fig. 5. Input outlier detection

3.5 Model

To train the data we relied on a custom neural network. Figure 6 displays the architecture of the Neural Network. The Neural network consists of many layers and the most important of them is the LSTM layer.

3.5.1 Long Short Term Memory

Long short term memory, i.e., LSTM [11] is an improved variant of recurrent neural networks(RNN). The issue with RNN is that they take a long time to back-propagate, majorly caused due to the decay of error and its backflow which makes it futile in situations where we need to store the memory. LSTM, which can hold short term memories longer than RNN can be used in these situations and they are very capable. LSTM maintains different cell states and gates (input gate, output gate and forget gate) (Fig. 7).

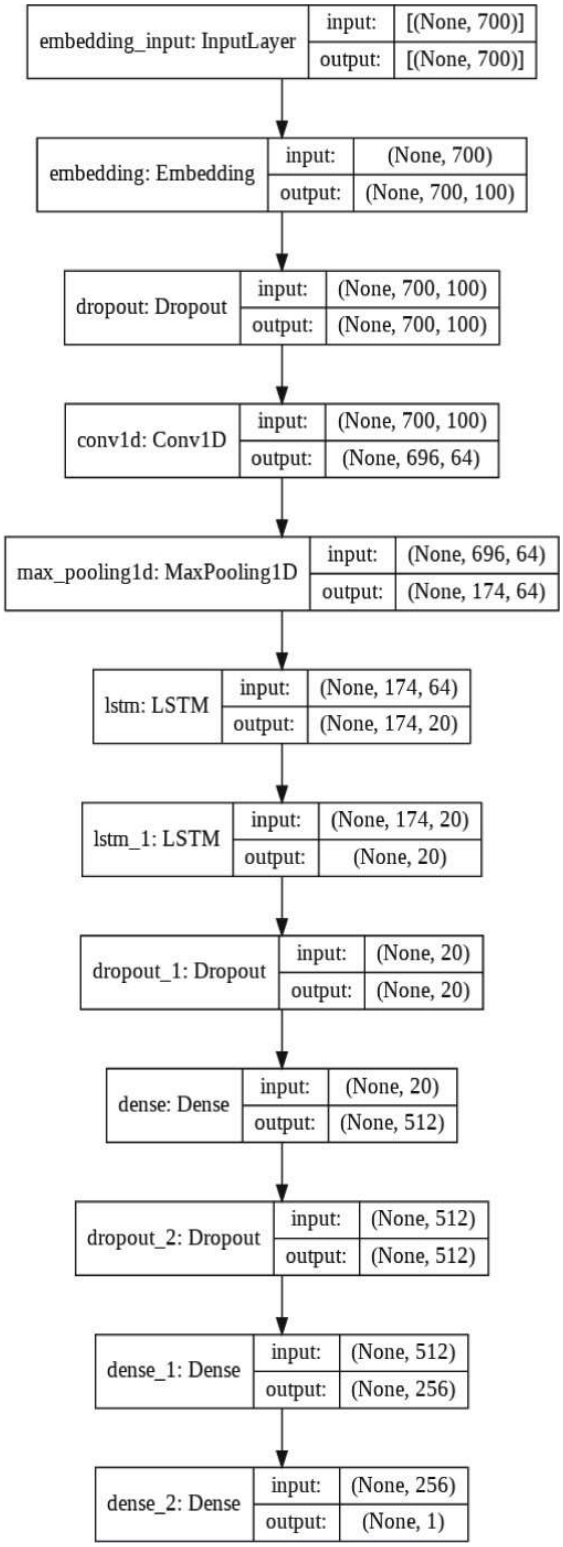
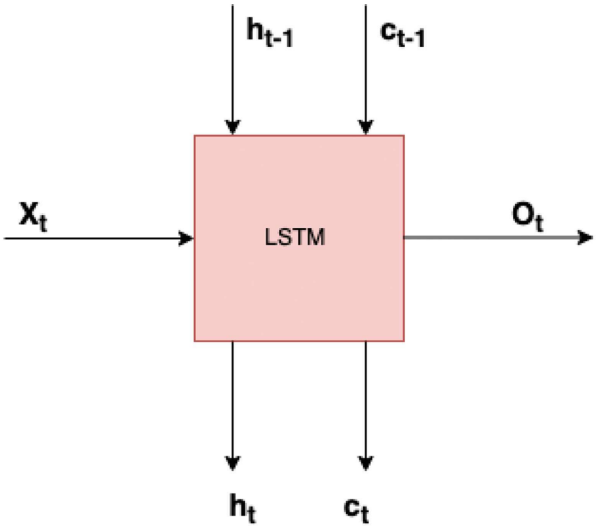


Fig. 6. Model architecture



$$
\begin{aligned}
f_t &= \sigma_g(W_f \times x_t + U_f \times h_{t-1} + b_f) \\
i_t &= \sigma_g(W_i \times x_t + U_i \times h_{t-1} + b_i) \\
o_t &= \sigma_g(W_o \times x_t + U_o \times h_{t-1} + b_o) \\
c'_t &= \sigma_c(W_c \times x_t + U_c \times h_{t-1} + b_c) \\
c_t &= f_t \cdot c_{t-1} + i_t \cdot c'_t \\
h_t &= o_t \cdot \sigma_c(c_t)
\end{aligned}
$$

f_t is the forget gate , i_t is the input gate , o_t is the output gate , c_t is the cell state , h_t is the hidden state

Fig. 7. LSTM at a timestamp t and equations

3.5.2 Training and Validation

To avoid overfitting, dropout layers were used. The training and validation accuracies were impressive with the model validating fake news 99% on test data (Fig. 8 and Table 2).

3.6 Testing

The testing was done on Indian news websites. We tested on real time news by scraping the website named 'Times of India' by using beautiful soap (To read the html file) and

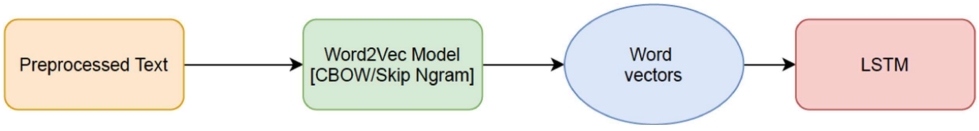


Fig. 8. Training procedure

Table 2. Confusion matrix of training

	Precision	**Recall**	**f1-score**	**support**
Fake (1)	0.99	1.00	0.99	5713
Real (0)	1.00	0.99	0.99	5354
Accuracy			0.99	11067
Macro avg	0.99	0.99	0.99	11067
Weighted avg	0.99	0.99	0.99	11067

request libraries. After scraping the text from the site, it is pre processed and passed to our model. And our model is able to give an accuracy around 67%, 75% in the detection of fake news respectively.

4 Results

We have scraped data from websites like "Times Of India" and "Politifcat". After pre-processing, the text and extracted text features are passed to the Model. The results in terms of accuracy are represented in Table 3.

Table 3. Results in terms of accuracy of predictions

	Accuracy when tested on		
Data	Title + Description	Only description	Only title
Training data	98.96	98.5	86.14
Times Of India	75.01	68.18	71.3
Politifact (American)	66.67	61.66	63.34

5 Use Cases

When people try to impersonate someone else or a trusted source to spread false information, this can also be considered as false news. In most of the cases, the people who

spread false news have an agenda that can be political, economic, or to change behavior or thinking about a topic. And there are also countless scenarios where fake news is also spread from automated bots. Our application can be used to detect and filter these fake news sources, which can help to report them, thus helping to provide reliable news.

6 Future Works

1. The model can be incorporated in social media websites which can check the content of the message and refrain them from sharing or posting fake news itself by avoiding the spreading of fake news initially.
2. It can also be integrated with UI which lets users give their piece of text and check for its authenticity.
3. This approach can be further extended to testing on various other news of other languages and nations.
4. In real time, the availability of data in a clear format is minimal, hence more concentration can be given to work with unformatted data in an unsupervised manner to make users life's simpler.

7 Conclusion

In this paper, we focused on detecting the fake news using neural networks on Indian news. We used word2vec for the text transformations followed by neural networks for the classification of fake and real news. Testing the model against real data and attaining an acceptable accuracy of 75% has further reinforced our research work. In conclusion, this is a simple yet yielding deep learning approach for the classification of real and fake news using traditional NLP methods.

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