

# Fake News Detection using Deep Learning

Vaishnavi R, Anitha Kumari S

**Abstract:** News is a routine in everyone's life. It helps in enhancing the knowledge on what happens around the world. Fake news is a fictional information made up with the intention to delude and hence the knowledge acquired becomes of no use. As fake news spreads extensively it has a negative impact in the society and so fake news detection has become an emerging research area. The paper deals with a solution to fake news detection using the methods, deep learning and Natural Language Processing. The dataset is trained using deep neural network. The dataset needs to be well formatted before given to the network which is made possible using the technique of Natural Language Processing and thus predicts whether a news is fake or not.

**Keywords :** Deep Learning, Fake news, Long Short Term Memory, Natural language Processing.

## I. INTRODUCTION

Fake news is a fallacious piece of information. Since fake news spread much faster it has become desideratum to categorize a news into real and fake. It has become a major factor in creating social disturbances and can be spread by anyone as social media is an open platform for everyone to express their ideas on any topic. Spreading of fake news can cause loss of trust in the society and also has the ability to exploit public's thoughts into a different manner[6]. As they are interwoven it is difficult to simply identify between real and fake news. Therefore it can be said that news act as a bonus to the society whereas deceptive news is a bane. There are many instances where fake news has caused so much of instabilities and religious clashes in the cultural aspects of the society. However the distinction between fake and real news is a difficult task as the idea of identification is full of dependencies and disparities. The large amount of information that gets spread are most of the times unverified and considered truth. In 2017, a German official stated that spreading of fake news is a huge phenomenon of dimension one could never see before [8]. Therefore recognizing the rightness of a news is an engrossing topic and can be consummated using different philosophies.

In this work, a framework to distinguish between real and fake news is done. The deep neural network used to serve the purpose is the LSTM model. Data is taken from trusted sites and is pre-processed before transferring to the

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network. Natural Language Tool Kit (NLTK) packages are used for the purpose of preprocessing of the data. Basic loss was calculated using categorical loss entropy and optimised using adam optimizer.

## II. CURRENT STATE OF ART

Samir Bajaj in his paper approached fake news detection purely on Natural Language Processing. The paper includes the results of many model implementations and analysis on the findings. Here a convolution Network includes an attention-like mechanism that led to the increase in the number of parameters to be learned. An assumption was made that max pooled input will be a good benchmark for the classifier but it did not go that well. CNN did not work well because of certain resource constraint[1]. Shlok Gilda in the paper collected articles and have tested the framework on multiple models and have obtained an accuracy of 77.2%. He used the term frequency inverse document frequency i.e. the TF-IDF and the other method is probabilistic CFG. It was observed that the PCFG do not provide any predictive value but was able to balance the recall[2]. Singhanian et.al. in the paper has mentioned fake news as a serious problem that would need an AI solution. They have developed an automated detector which has a three level attention network one each for word, sentence, headline and finally develops a news vector. The model was named 3HAN meaning three level hierarchical attention network. The author has managed to make sure that the attention layers are well visualized[3]. Reis et al. use machine learning techniques on buzzfeed article related to US election. The evaluated algorithm are k-Nearest Neighbours, Naive-Bayes, Random Forests, SVM with RBF kernel and XGBoost. They also show that XGBoost is good for selecting texts that need to be hand-verified, this means that the texts classified as reliable are indeed reliable, and thus reducing the amount of texts to be checked manually. This model is limited by the fact they do use metadata that is not always available [7].

## III. METHODOLOGY

### A. Natural Language Processing

If a text which is in human language needs to be understood by a machine it must be made into an understandable format for the machines, which is made possible using Natural Language Processing method. The text needs to be cleaned and further converted into a machine readable format. And thus one could say Natural Language Processing is one in which there exists some sort of interactions between the computers and humans to process the natural language data.



# Fake News Detection using Deep Learning

It has progressed to automatically detect the sentiments and mine opinions from text. A good range of techniques have been developed in this area of interest [4]. Collobert et. al. in the paper [5] describes on how to learn word representations and sentence representations and introduce them to the neural networks to apply various NLP tasks. This led the researchers to make the words and sentences to be represented as vectors [5]. This way of representing the words into vectors are called word vectors or word embeddings.

## B. Deep Learning

Deep Learning comes under the category of Machine Learning in which there exists greater flexibility by learning the way of representing the concepts with relation to much simpler concepts that need not be programmed explicitly. Working of deep learning can be summarized as follows:

- Identifying the real problem to find the right solution.
- Identifying the relevant data that corresponds to the actual problem and needs to be prepared accordingly.
- Choose the deep learning method accordingly.
- Train the model with the data.
- Test the model with the data [9].

## C. Long Short Term Memory

The RNN (recurrent neural network) that has the ability to learn continuing dependencies are known to be LSTM. LSTM is found suitable in classification and also in making predictions. They helps in connecting the previous information to the present task and avoids long term dependency problems. They have the default behaviour of remembering an information for an aeon. The network consists of cells that helps in retaining the memory and gates (input,output, forget) to control the flow of information into and out of the cells. They solves vanishing and exploding gradient problem fixed by gradient clipping. The problem occurs due to the multiple weight updation of RNN layers which forgets the earliest memory. There exists no such issues in the case of LSTM as they are resolved in this method.

## IV. PROPOSED APPROACH

The dataset is collected using the webscraping technique using the newspaper3k python package and it needs to be made acceptable for the algorithms, which is made possible with the help of python's NLTK. The dataset was collected from sites [10],[11]. The stopword corpus contains NLTK library's stopwords and word tokenization is performed which returns the number of unique tokens in the text. The word embedding is done using an embedding layer which is found in the front end of the neural network. In this case the size of the vector space is 100 dimensions. Keras's pre-processing text's tokenizer is used for tokenizing the text. The word index of the tokenized word are used as the default weights for the network. The dataset was padded to make each of the article to be in the same length which is then given to the network. The input needs to be integer encoded and hence it is passed through the embedding layer. The other layers include dense layer, dropout 1D layer, LSTM layer, sigmoid layer with Adam optimizer etc. Basic loss is calculated using categorical cross entropy. Basically the proposed method contains the following step:

## A. Training

1. Collection of dataset, performed using web scraping
2. Read the dataset
3. Pre-processing the data.
  - Remove the symbols by replacing it with space
  - Removal of stop words.
  - Tokenize the words.
  - Assign word index.
  - Pad the sequences.
4. Split the dataset into train and test data.
5. Training the model.
6. Save the model.

## B. Running the main code

1. Enter the news to the GUI.
2. Pre-process the data.
3. Load the model.
4. The result will be either fake or real based on the prediction value.

## V. EXPERIMENTS AND RESULTS

The texts needs to be pre-processed to implement the model. There exists many techniques for the purpose. The process starts with removing the stopwords from the text. Stopwords are usually the connecting part of the text i.e, the conjunctions, which are of least importance. Therefore its removal is one among the step followed in data pre-processing which is done using the Natural Language Tool Kit library. Punctuations represent the grammatical context of a sentence, which are to be removed from text. The dataset is split into train and test set. On running the code for training, the result obtained is mentioned below:

```
Epoch 1/5
8220/8220 [=====] -
127s 15ms/step - loss: 0.3917 - acc: 0.7867 - val_loss:
0.2164 - val_acc: 0.8972
Epoch 2/5
8220/8220 [=====] -
157s 19ms/step - loss: 0.1497 -
acc: 0.9408 - val_loss: 0.2136 - val_acc: 0.8961
Epoch 3/5
8220/8220 [=====] -
163s 20ms/step - loss: 0.0867 - acc: 0.9686 - val_loss:
0.1993 - val_acc: 0.9103
Epoch 4/5
8220/8220 [=====] -
155s 19ms/step - loss: 0.0542 - acc: 0.9819 - val_loss:
0.2330 - val_acc: 0.9114
Epoch 5/5
8220/8220 [=====] -
160s 19ms/step - loss: 0.0293 - acc: 0.9915 - val_loss:
0.2650 - val_acc: 0.9147
1015/1015 [=====] -
3s 3ms/step
Test set
Loss: 0.260
Accuracy: 0.920
```

After running the main code the text given is predicted and classified as per the maximum prediction value. The hardware specifications include: Processor- Intel® Core™ i3-6006U CPU@ 2.00 GHz 1.99 GHz, RAM- 4.00 GB, System Type- 64 bit operating system, x64-based processor.

## VI. CONCLUSION

The spread of fake news can adversely affect our lives. Hence, in order to detect fake news we have proposed a computational model. A dataset was gathered by scraping some trusted sites. Data is pre-processed and NLP is applied consisting of methods such as stop word removal, replacing symbols with spaces and making embeddings. Word Index of the tokenized dataset is initialized as weights for the ANN. RNN with LSTM unit was used for creating and updating this neural network. Adam is used for optimization instead of classical stochastic gradient descent to update weights and categorical cross-entropy loss. The model gives an average accuracy of 85% and above, was able to predict whether the news is fake or real as per the prediction value.

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