

# Fake News Detection using Multi Channel Convolution Neural Network

Yeleti Aarti

University College of Engineering, Kakinada

Yeleti Jyoti

University College of Engineering, Kakinada

**Abstract - Fake news refers to news articles that are not real and are generated to deceive or mislead users. With the increasing demand for social media and social networking sites, the distribution of fake news has become a major threat to various sectors. The process of obtaining news from social media is like a double-edged weapon[1]. On one side it is easy to access news from social media. And on the other hand, the news being obtained on social media is being manipulated for personal interests. So there is a great need to identify fake news and promote the spread of genuine information. In this paper, a novel model is developed for fake news classification that is the *Multi-Channel Convolution Neural Network* which is a modified form of Convolution Neural Network.**

**Keywords - Fake News, Multi-Channel Convolution Neural Network, Convolution Neural Network, Social Media**

## 1. Introduction

The evolution of information and communication technologies has dramatically increased the number of people with access to the Internet, which has changed the way the information is propagated or discharged. As a consequence of the above, fake news have become one of the greatest threat to society, individuals, organization, and government.

Fake news is defined as misinformation or manipulated news that is spread either on traditional media or social media with an intention to damage a person's agency or organization. In the past, fake news is propagated through traditional media like television news, newspapers, etc[2]. The term "Fake news" on social media gained popularity during the US electoral campaign of 2016.

There are two main sources of fake news propagation in social media. One is through the creation of malicious accounts. These malicious accounts are operated by social bots, cyborg, and trolls and become a powerful source of fake news transmission. Another way of propagation is through the echo chamber effect. In this, a group of people believes the news is true due to their psychological factors even though it is false and starts propagating this fake news across social media. The main problem with the identification of fake news is that it is focused on emerging events and there are very little shreds of evidence and knowledge base to claim its genuine.

The recent scenario of COVID-19 pandemic shows a huge increase in the fake news articles through social media misleading people and getting undue benefits. The adverse effects of these fake news made people believe that COVID only affects old age people, not children and young people. There are many other misinformations such as vaccines are developed, Masks do not prevent the virus spread, and many more.

Technologies such as Deep Learning, Natural Language Processing provide better results in efficiently classifying fake news from real news. In this paper, we propose a specialized Convolution Neural Network called the Multi- Channel Convolution Neural Network for efficiently detecting fake news. In this paper, three datasets are used of which one dataset contains information on *fake news related to COVID-19*. The dataset contains recent and up to date information about different types of fake news that prevailed during the COVID-19 period.

## 2. Related work

The work done by various researchers in detecting fake news are [3] In this for fake news detection the researcher proposed a novel Two Level Convolution Neural Network with user response generator(TCNN-URG).In this there are two convolution layers(TCNN).The first layer is used to convert word information to sentence information. The second layer is used for semantic classification. The user response generator (URG) is an auto encoder used to learn the responses of human on different news articles.

[4] Automatic fake news detection is extremely hard ,so the researcher provided the method Text and Image Information based Convolution Neural Network(TI-CNN).In this for text classification word embedding is performed first and then the data is passed to the convolution layer and then to the max pooling and to the fully connected layer of the convolution network. If it is image data the data is first passed to the convolution layer and to max polling and fully connected layer. Finally fake news is detected.

[5] In order to identify the fake news the researcher proposed the Fake Detector. The fake detector uses a Deep Diffusive Neural Network. The first step used in Fake Detector is Feature Learning. In this textual content is extracted by using hybrid feature extraction unit. The second step is the Deep Diffusive Model. In this a gated diffusive unit is used to identify the relationships between news articles.

[6] In order to classify if the news is true or false the researcher proposed a novel algorithm. This algorithm is to used Long Short Term Memory on LIAR dataset. This algorithm proved better then RNN , CNN and many others. The steps involved in the implementation of this algorithm are as follows .First preparing the LIAR dataset. Next performing word embedding. Third is taking word embedding as input to the LSTM and processing. Last we get the output if the news is fake or real. Finally output is compared with other algorithms.

[7] In this paper for detecting fake news the researcher developed a hybrid model for fake news detection. The model used is the CSI model which stands for Capture ,Score and Integrate. Capture is used to extract temporal representation using RNN. Score is used to apply weight and pass it to fully connected layer. Integrate is used concatenate two modules which can be used for classification.

### 3. Dataset

Fake news detection problem is a classification problem. If the news provided is true the classifier returns 0 and if the news is fake it returns 1. To efficiently identify fake news three datasets are used

#### *Dataset-1: Getting real about fake news [8]*

The getting real about fake news also popularly known as the misrdal dataset contains different instances of news articles such as bias, fake, conspiracy, hate, satire. The dataset contains a total of 12,990 different news articles. There are 20 different attributes used to correctly classify the fake news from the real. Some of the attributes are author, title, text, and context. Based on the information in these attributes the label 1 is assigned to fake news and label 0 to real news.

#### *Dataset-2: Fake news [9]*

Fake news dataset is one of the widely used dataset for fake news detection. The attributes used in the dataset are the id, title, author, text, and label. The data in the dataset is divided into three categories. This includes train set, test set, submit set. All the files are comma-separated. The label has values 0 and 1. 0 indicates real news and 1 indicates fake news. Based on the information in the text attribute the label is assigned. The dataset contains around 20800 rows, which indicates it has 20800 different samples which can be used for training the deep learning model.

#### *Dataset-3: COVID-19 fake news*

COVID-19 fake news dataset is a latest dataset. The dataset contains information from various sources such as Politifact, news checker regarding the different types of fake news that are propagated around the world regarding the COVID pandemic. .The dataset contains 50,000 different news articles. The attributes used to uniquely identify the fake from the real and labeling it with 1 or 0 respectively are Date, URL, Title, Body. The dataset contains many instances of fake and real news related to COVID-19 pandemic

### 4. Proposed Method

#### 4.1 Data Preprocessing

The datasets collected for fake news detection contains redundant, null, and empty data. The datasets to be implemented in the deep learning model should undergo data preprocessing. Data preprocessing involves removing redundant, null, and empty data and making the data complete and suitable to be implemented in deep learning models.

The following are the steps involved in the pre-processing of the dataset.

1. Loading the necessary libraries such as pandas, NumPy, matplotlib
2. Loading the dataset
3. Removing redundant data
4. Removing NULL data
5. Removing punctuations
6. Lower casing
7. Tokenizing the data

All the three datasets used after preprocessing becomes free of redundant, null data. The preprocessed data is passed as input to the word embedding layer.

#### 4.2 Word Embedding

Word embedding refers to creating a propped association between words. There are many types of word embeddings such as one-hot encoding, Word2Vec. In the model developed the embedding technique used is the GLoVe [10]. GLoVe also known as Global Vectors is developed by Stanford University. A GLoVe is an open-source tool used for word embedding. It takes word –word co-occurrence statistics from a corpus and reduces sparse matrix into dense one by matrix factorization. The GLoVe creates vectors that are passed as input to the special Convolution Neural Network Model.

The tokenized data of the three datasets are passed as an input to the GLoVe word embedding layer. The GLoVe word embedding creates around 4,00,000 different words.

#### 4.3 Method

The model developed for efficiently classifying fake news from real news is the Multi-Channel-Convolution Neural Network.

Multi-Channel Convolution Neural Network is a special type of Convolution Neural Network. Multi-Channel Convolution Neural Network is implemented by using standard Convolution Neural Network, with different kernel sizes. The Multi-Channel Convolution Neural Network used for classification of Fake news has the following layers as shown in Figure 1

1. **Input Layer:** Input Layer takes the input that are the different features from the dataset
2. **Embedding Layer:** Embedding Layer takes the features of GLoVe
3. **Convolution Layer:** The Convolution Layer takes input from the word embedding layer and convolves it and passes as input to Pooling.
4. **Pooling layer:** The pooling layer consolidates input from the convolution layer.
5. **Flatten Layer:** Flatten layer is used to maintain the dimensionality
6. **Dense Layer:** Dense Layer is used to produce output that's is Fake news or Real news

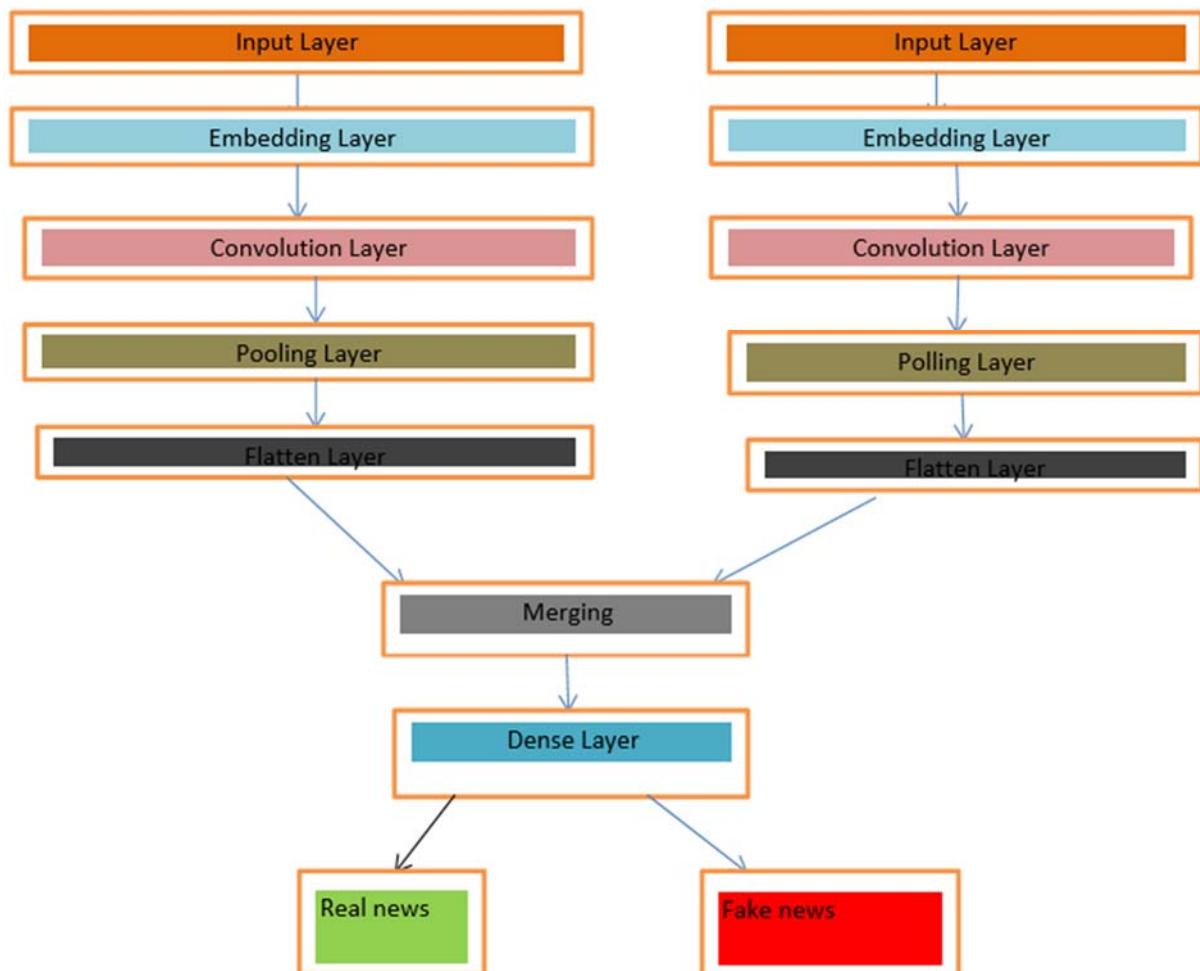


Figure 1: Multi Channel Convolution Neural Network

In the model developed since individual convolution layers are used, all the flatten layers are merged and passed as input to the Dense layer. The activation function used is RELU. The different kernel sizes are used such as 4, 6, and 8. The last dense layer uses a Sigmoid Activation function that is used to find the fake news from real. The loss function used is binary cross-entropy and the optimizer is Adam. The data in the three datasets is passed as input to the individual Convolution set in the form of an array and merged and given to the Dense layer which further classifies into fake or real.

### 5. Experiment and Results

#### 5.1 Performance and Metrics

The performance metrics used to evaluate the detection of fake news are precision and recall, and F1 score. Accuracy is another performance metric that plays a major role in identifying how accurately the model can classify. Based on the information of the confusion matrix the precision, recall, f1-score are predicted [10]. Accuracy is determined by how well the model is trained on the dataset.

**Confusion Matrix:** The confusion matrix is used to describe the performance of how well the classification is performed. The confusion matrix consists of values such as true positive, true negative, false positive, and false negative. In the confusion matrix comparison is done between predicted and actual values.

**True Positive(TP):** It states that both the actual and predicted values are correct.

**True Negative(TN):** In this, the predicted value is correct but not the actual value

**False Positive(FP):** In this the actual value is correct but the predicted value is false

**False Negative(FN):** In this both the actual and predicted values are wrong.

	<b>Predicted values</b>	
	<b>True Positive TP</b>	<b>False Positive FP</b>
<b>Actual values</b>	<b>False Negative FN</b>	<b>True Negative TN</b>

**Recall:** Recall is the ratio of correctly predicted values to all the values

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}}$$

**Precision:** Precision finds the true value from all the truth values

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}}$$

**F1 Score:** The average of precision and recall

$$\text{F1 Score} = \frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

The table below shows the performance metrics achieved by the Multi-Channel Convolution Neural Network on *dataset 1* that is the *Getting real about the fake news*

Label	precision	recall	f1-score
0	0.96	0.98	0.967
1	0.97	0.96	0.964

Here label 0 indicates Real News and label 1 indicates Fake News. The precision achieved in correctly classifying the Fake news is 97% and Recall is 96%

The accuracy achieved by Multi-Channel Convolution Neural Network for dataset 1 is as follows

Training Accuracy: 94.586% Testing Accuracy: 93.234%

The table below represents the performance metrics achieved by the Multi-Channel Convolution Neural Network on *dataset 2* that is the *Fake News*

Label	precision	recall	f1-score
0	0.92	0.92	0.93
1	0.94	0.92	0.93

Here label 0 indicates Real News and label 1 indicates Fake News. The precision achieved in correctly classifying the Fake news is 94% and Recall is 92%

The accuracy showed by Multi-Channel Convolution Neural Network for dataset 2 is as follows

Training Accuracy: 94.23% Testing Accuracy: 92.73%

The table below depicts the performance metrics achieved by the Multi-Channel Convolution Neural Network on dataset 3 that is *the Covid-19 fake news dataset*

Label	precision	recall	f1-score
0	0.96	0.98	0.97
1	0.98	0.95	0.96

Here label 0 indicates Real News and label 1 indicates Covid -19 Fake News. The precision achieved in correctly classifying the Covid -19 related fake news is 98% and Recall is 95%

The accuracy gained by Multi-Channel Convolution Neural Network in efficiently classifying dataset 3 is Training Accuracy: 97.586%

Testing Accuracy: 96.234%

## 6. Conclusion

In this paper, three datasets are testing on the proposed model of Multi-Channel Convolution Neural Network. One of the datasets used contains recent information regarding the fake news that propagated regarding COVID-19.

Multi-Channel Convolution Neural Network could efficiently work on all three datasets including the COVID-19 fake news dataset for efficiently classifying the fake news. This Multi-Channel Convolution Neural Network can further be implemented on different datasets with different types of word embeddings to achieve better accuracy and other performance metrics

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