Fake News Detection

A Project Report submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

Computer Science and Engineering

by

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Candidate's Declaration

We hereby certify the work being presented in the report entitled **"Fake News Detection"** in partial fulfillment of the requirements for the award of the Degree of **Bachelor of Technology** and submitted in the Department of Computer Science and Engineering at National Institute of Technology Hamirpur(H.P.) under the guidance of **Dr. Lokesh Chouhan,** Assistant Professor, Department of Computer Science and Engineering, National Institute of Technology Hamirpur.

The matter presented in this report has not been submitted by us in any other university/institute for any award of any degree.

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This is to certify that the above statement made by the candidate is true to the best of my knowledge and belief.

(Dr. Lokesh Chouhan)
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15/06/2020

Signature of Supervisor

Abstract

Fake news has become a major problem in today's era. It is a kind of social phenomena which is prevalent among the people at physical level i.e. at social level and also via social media like Instagram, Facebook etc. However, with the increase in the use of social media, spread of fake news has become a bigger as this is acting like a weapon and that too double edged. Although it has some benefits also like easy accessibility, user friendly, less time consuming, easy to convey and we get many perspective about a single news. These various perspectives can be sometimes manipulating or misleading. Fake news are created with an intention to cause harm to an individual, agency or organization. This spreading of fake news is become a menace, so we need to control this, which can be done with the help of artificial intelligence. As this will help to detect such news. Major role in this detection is played by machine learning with some restrictions like quality of data being used. Here in this work different machine learning algorithms has been used such as naïve bayes, SVM, Neural networks, CNN, LSTM for the detection of fake news, which is collected from kaggle and at last results are compared to check which algorithm worked better.

Acknowledgement

We have immense pleasure in expressing our sincerest and deepest sense of gratitude towards our guide Dr. Lokesh Chouhan for the assistance, valuable guidance and co-operation in carrying out this project successfully. We also take this opportunity to thank Head of the Department Dr. T.P. Sharma for providing the required facilities in completing this project. We are greatly thankful to our parents, friends and faculty members for their motivation, guidance and help whenever needed.

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Chapter 1

Introduction

1.1 Introduction to the study

Nowadays life has become easy for people all around the globe should give its credit to everyday emerging Information Technology which has made it easy to communicate with others. We can not deny the fact lot of information is available on internet and has made lives of people easier. But, sometimes this information is manipulated by various people and the presence of social media has made it easier for them to spread such fake news in bulk via different platforms like Facebook, Youtube, Twitter, Whatsapp etc[1]. This is lead to the spread of all kind of inaccurate and wrong "news" to a wider audience without proper monitoring. Moreover, the social media users get biased towards those news depending their own thinking and what their friends share without properly checking its authencity which allows these fake news to promulgate widely across various platform and increasing their credibility.

Fake news is becoming a threat to the society. Fake news are basically produced for commercial purposes in order to appeal viewers. However, people with potentially malevolent plans are known to start these fake news so that they can influence the events or activities happening around the world according to their own interest. Its best example can been seen as the 2016 US president Election[2] where most of people were confused due to the fake news they were receiving which finally affected the President election results. Various studies and researches have been steered around the world to study the effect of the fabricated information on wider audience and their reaction coming from those fabricated news. Major reason for doing this is , recently artificial intelligence has

made major progress in different areas and are working great for various classificiation problems(spam detection , crime detection etc.) because they donot need very expensive hardware and large amount of data is available.In past various ML algorithm have been used like SVM[3], Naive bayes[5],knn[4] etc. Here in this work different machine learning algorithms has been used such as naïve bayes, SVM, Neural networks, CNN, LSTM and at last results are compared to check which algorithm worked better.

1.2 Problem statement

To develop efficient ML(Machine Learning) algorithms to detect fake news depending upon the content acquired.

1.3 Goals

- Predicting that whether a news is fake or not by using various ML algorithms which will help in reducing the spread of fake news.
- Improving the trustworthiness of information in online social networks by identifying the fake news timely.

Chapter 2

Literature Review

2.1 Motivation

In today's world due to the rapid increase in the information available through various social media platforms has made it very challenging to differentiate that whether the information received is true or false. The easy distribution of the news by the means of sharing through social media platforms has lead to exponential increase in its falsification[6]. Fake news can even be used to manipulate voters during election season and can affect the democracy of the entire nation, so detecting them is very important. An excessive amount of work has been fixated in understanding the false new which are spreading on the social media.It has been scene from reports that ability of humans to identify fraud without help of some assitant is 54 percent.So there is a need to use ML for classification of text[7]. And looking at the increasing popularity of the artificial intelligence in every field .We tried to incorporate same in this project and used machine learning to understand such fake news and ways to the apply on the data that is available.

2.2 Related Work

Many researches have been done which address this fake news detection problem. In a paper by , Volodymyr Mesyura, M. Granik [8] on 'Fake News Detection Using Naive Bayes Classifier' on facebook news post dataset using naive bayes classifier ,they an Achieved 74% accuracy but only limitation was they used only naive bayes classifier. In a paper[9] by Julio C.S.Reis, et al. on 'Supervised Learning for Fake News Detection' they achieved

86% accuracy for Random Forest which performed better than KNN and naive bayes but the limitation was they used very less data points(2000). In a paper[10] by Rohit Kumar, Kaliyar on 'Fake News Detection Using a Deep Neural Network' they used methods like cnn, lstm, knn, naive bayes were used and best accuracy was obtained from CNN but the limitation was very less data points were used and combination of cnn-lstm was not used. In a paper[11] by Prannay S Reddy, et al. on "A Study on Fake News Detection Using Na¨ıve Bayes, SVM, Neural Networks and LSTM" they found that best accuracy was obtained using neural network 90.62% but the limitation was they did not removed stop words before classification. In a paper by Oluwaseun Ajao, Shahrzad Zargari[12] et al. on "Fake News Identification on Twitter with Hybrid CNN and RNN Models" they used a hybrid of CNN and LSTM achieved an accuracy of 82% but the limitation was they did not compared it with other classification method and they did not used stemming. In a paper by Veronica Perez-Rosas et al. [13] they used dataset from different areas like CNN,BBC, Cnet etc inorder to detect fake news. In a paper by Prabhas C., Supanya Aphiwongsophon[14] on "Detecting Fake News with Machine Learning Method" they used SVM, naive bayes, neural networks and found that naive bayes performed best with a accuracy of 93.08% but limitation was they did not take into consideration the publisher/authors name only news content was used.

Chapter 3

Methodology

3.1 Predictive Modelling

We used Predictive modeling for making predictions since it has the method which is able to build a model and has the capability to make predictions. This method consists of different algorithms of ML that can study properties from the data used for training which is used for producing predictions. It is split in two major classes one is Regression and other is classification of patterns. Regression models are based upon analysis of the relationship that are present between trends and variable in order to make predictions about the continuous variables. Whereas, the job of classification is to assign a particular class labels to a data value as output of the prediction. Division of pattern classification is in two ways i.e., Supervised and Unsupervised learning. In case of supervised learning we have prior knowledge about the labels and those labels can be used to build the classification models In unsupervised learning, class labels are not available .Models are built only on the basis of informnation available. Here, we worked with supervised learning methods as labels are known .

3.2 Data collection and Preprocessing

- Data Collection is a method in which information is gathered from many sources which is later used to develop the machine learning models. The data should be stored in a way that makes sense for the problem. In this project, data is taken from Kaggle site.

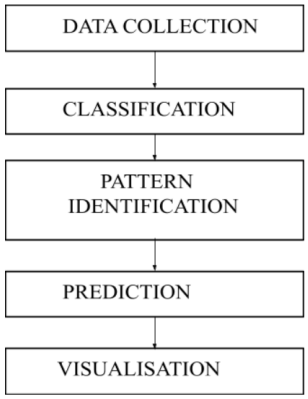

Figure 3.1: Work flow graph

- Data's pre-processing basically involves methods clean and scale the data like removing the infinite or null values from data which might affect the performance of the model. In this step the data set is converted into a format which can be fed into machine learning models. For textual data it includes two steps.
  - Text Prepocessing: Text preprocessing is an essential step for model building as text is most unstructured form of data. In this step standardization and cleaning of the textual data is done. And to make it noise free and so that it is ready of analysis.
  - Text to Features: As the machine learning models do not understand the textual data. So they are needed to be converted into a format which is understandable by models i.e. into vectors. All of this work is done in this step.

3.3 Algorithms Used

- **Naive Bayes**

  The approaches Naive Bayes uses are probabilistic in nature and are Bayes' theorem based. Bayes theorem uses the following formula :

$$P(h|d) = (P(d|h) * P(h))/P(d)$$

$$q = hypothesis, r = data$$

Where, P(q—r) represents the probability of q when r is already true. It is also known as posterior probability, P(r—q) is the probability of r when q is already true, P(q) represents probability of q being true (independent of probability of r). It is also known as prior probability of q, P(r) is the probability of r (independent of probability of q). This deals works by creating a probabilistic distribution of vars present in the given data-sets.And then the response var of value is predicted. Classification of text and medical diagnosis also find them very useful. The NB classifier model has performed splendidly in many complex real-world scenarios. Requirement of less load of training data to access only those parameters which are really necessary for classification seems to be the only advantage of the NB classifier.

- **Support Vector Machine**

  Support Vector Machine(SVM) is basically a Supervised Learning algorithms. Regression problems and classification problems both uses it, although it is used more frequently in Machine Learning for classification concerns than for regression. SVM algorithm has a shared objective of finding the best line or judgment boundary that can divide n-dimensional space into classes such that in the future we can conveniently put the latest data point in the right class. This best judgment boundary is called a hyper-plane.A hyper plane is basically divides a space into 2 diconnected parts in a n-dimensional euclidean space. The goal of SVM is to find best separating hyper-plane given by the equation.

$$y = ax + b$$

  that aims at maximizing the distance between the two classes.

- **Neural Network**

  Artificial Neural network is developed after taking inspiration from biological neuron and try simulate decision making process of human brain. It comprises of huge number of constituents which works cooperatively to process and resolve problems. It is based on prediction by analysing trends in an already existing large amount of historical data. It displays a link between an input neuron and an output neuron. Neurons have some specified weights. Output is calculated by multiplying the input

with the specific neuron weight and then comparing it with the threshold value. If its above given threshold then it is contemplated as the output.

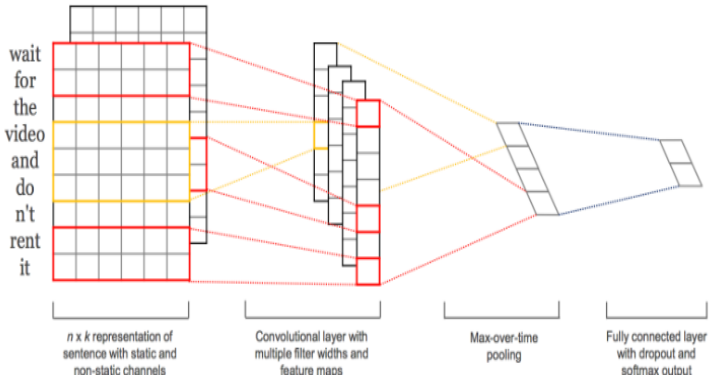

Figure 3.2: Depiction of Convolutional neural network for text Classification[16]

- **CNN**

  CNN basically ahve two parts i.e. fully connected layers and feature extraction layer.It is like neural network and have parameter biases , weights etc. Recommended systems, NLP and more make use of CNN. It can automatically detect the important features without any supervision from humans and is the main advantage over its predecessors, eg, inspite of many images of cars and trucks , it can find the distinctive characteristics of each class on its own.CNN is also efficient in computational matters. It makes use of pooling and convolution operations and performing sharing of parameters. This makes CNN models portable and run on any device, making them globally amiable.

- **LSTM**

  Long Short-Term Memory (LSTM) networks can be called as the better or updated version of RNN(Recurrent Neural Network), making memory recording of past data easier. It is better than RNN, becuase it removes the problem of vanishing gradient. LSTM is commonly used to predicts, classify, process time seriee. If timelags of unknown durations are given then to classify, process and predict time series LSTM are very well applicable. Model is trained by using back-propagation.

3.4 Training and Testing

In this step, after validating the assumptions the algorithm that we have chosen. Model is trained on the basis of given training sample. After traning, the performance of the model is checked on the basis of error and accuracy, At last, the trained model is tested with some unseen data and the model performance is checked on the basis of various performance parameters depending on the problem.

Chapter 4

Implementation

4.1 Data Collection

The data-sets used in this project are taken from Kaggle [15] The training data-set consists of 16,600 data-rows collected from numerous articles found on internet has multiple attributes. But pre-processing of the data was required, in order to train our models.The data has attributes as shown below like id, title, author etc.

data-set consists of the following attributes:

- id: distinctive id for a news article
- title: title of a news article
- author: author of the news article
- text: text in the article; lacking in some cases
- label: a label marking the article as non-dependable
  - 1: fake
  - 0: authentic

	A	B	C	D	E
1	id	title	author	text	label
2	1	FLYNN: Hillary Clinton, Big	Daniel J. Fl	Ever get the feeling your life circles t	0
3	2	Why the Truth Might Get Y	Consortiur	Why the Truth Might Get You Fired	1
4	3	15 Civilians Killed In Single	Jessica Pu	Videos 15 Civilians Killed In Single	1

Figure 4.1: data set used

4.2 Data Preprocessing

This basically involves two steps:

1. **Text Preprocessing:** As, we know text is one of the most unstructured data form that is available. As different types of noises or errors are present in the data and it is not easy to analyse it without preprocessing as it contains many error. Moreover it cannot be fed directly into the models. So text preprocessing is an essential step.

```
def textClean(text):
    text = re.sub(r"[^A-Za-z0-9^,!.\/'+-=]", " ", str(text))
    text = text.lower().split()
    stops = set(stopwords.words("english"))
    text = [w for w in text if not w in stops]
    text = " ".join(text)
    return (text)
```

Figure 4.2: data cleaning steps

   - Removing the stopwords. A stop word is a word which is very commonly used such as “the”, “a”, “an”, “in”. We do not want that these stop should take up our space in our data and lead to increase in the computation time.So, it is needed that we remove them and it can be done by making a list of the stops words and then remove them from the database.
   - Removing empty/null cell. Data sets are not perfect. Sometimes they end up with invalid, corrupt, or missing values. Therefore it is advisable to remove them.
   - Deleting special characters and punctuation. We may want the words, but without the punctuation like commas and quotes.Converting all text to lowercase.

2. **Text to features:** In order to analyze the data which is already preprocessed, it is required to be changed into features i.e. into numeric feature vectors as the models do not understand the text data. So for this purpose Doc2vec is used. The goal of doc2vec is to create a numeric representation of a document, regardless of its length.Text Preprocessing creates list of comma-separated words, which can be

```
text_model = Doc2Vec(min_count=1, window=5, vector_size=vector_dimension, sample=1e-4, negative=5, workers=7, epochs=10,
                     seed=1)
text_model.build_vocab(x)
text_model.train(x, total_examples=text_model.corpus_count, epochs=text_model.iter)
```

Figure 4.3: Text to feature conversion with Doc2vec

input into the Doc2Vec algorithm to produce an 300-length embedding vector for each article. Preservation of word order information makes Doc2Vec useful for our application, as we are aiming to detect subtle differences between text documents.

4.3 Training Models

For training the data is splitted in ratio such that 80 % would be used for training and 20 % is used for testing using sklearn library. As a result we train size of around 114000 data points and test size of around 28000 data points. After trying different combinations of the parameters for each classification algorithm used, the optimal value of accuracy

1. Neural Network: Neural network is implemented using Keras Frame work. Best results were obtained after using 3 dense layers and dropout rate of 0.5. The activation function used in the hidden layers is relu and softmax in the output layer. Maximum accuracy i.e. 92 % is obtained after using combination of categorical crossentropy as the loss function and sgd as the optimizer

```
'''Neural network with 3 hidden layers'''
model = Sequential()
model.add(Dense(256, input_dim=300, activation='relu', kernel_initializer='normal'))
model.add(Dropout(0.3))
model.add(Dense(256, activation='relu', kernel_initializer='normal'))
model.add(Dropout(0.5))
model.add(Dense(80, activation='relu', kernel_initializer='normal'))
model.add(Dense(2, activation="softmax", kernel_initializer='normal'))

# gradient descent
sgd = SGD(lr=0.01, decay=1e-6, momentum=0.9, nesterov=True)

# configure the learning process of the model
model.compile(loss='categorical_crossentropy', optimizer=sgd, metrics=['accuracy'])
return model
```

Figure 4.4: Training of Neural Network

2. SVM: It is basically a regularized linear models which is implemented with the stochastic gradient descent learning and the loss gradient is calculated for every sample at a time and the model is reconstructed or updated along the path with re-

ducing strength schedule . SGD allows minibatch learning by the partial fit method. Here best results were obtained after using default parameters.

```
clf = SVC()
clf.fit(xtr, ytr)
y_pred = clf.predict(xte)
m = yte.shape[0]
n = (yte != y_pred).sum()
print("Accuracy = " + format((m-n)/m*100, '.2f') + "%")

```

Figure 4.5: Training of SVM

3. CNN: As described earlier CNN includes three parting convolution layer, pooling layer and dense layers. Here best results were obtained using one convolution, one pooling layer and 4 dense layers and softmax activation. However the accuracy obtained by this method is less i.e. 72.70 %. THere is a scope of improvment if we can tune hyper parameters more efficiently.Figure 4.6 shows its implementation.

```
    layers.Conv1D(128, 5, activation='relu',input_shape=(300,1)),
    layers.GlobalMaxPooling1D(),

    # part 2: classification
    layers.Dense(128, activation='relu'),
    layers.Dense(128, activation='relu'),
    layers.Dense(100, activation='relu'),
    layers.Dense(2, activation='softmax')

])
model.compile(loss=j[n],optimizer=a[i],
```

Figure 4.6: Training of CNN

4. Naives Bayes: Naive Bayes algorithm is classification algorithm that assumes that presence of one particular feature is unrelated to presence of another feature.Naive Bayes Algorithm is used for large data-sets and is easy to understand and implement .It sometimes also outperforms complex classification algorithms even after being simple in its working.It is easy and . It also perform exceptionally good in case of multi-class prediction. GaussianNB basically uses Gaussian Naive Bayes algorithm in order to do classification. Figure 4.7 shows its implementation.

5. LSTM : Our first layer will be an Embedding layer. We feed our embedding matrix which we've created earlier to the embedding layer and set trainable to false. This

```
gnb = GaussianNB()
gnb.fit(xtr,ytr)
y_pred = gnb.predict(xte)
m = yte.shape[0]
n = (yte != y_pred).sum()
print("Accuracy = " + format((m-n)/m*100, '.2f') + "%")   # 72.94%
```

Figure 4.7: Training of Naive Bayes

is because we are using the pre-trained weights vector and we don't want to train it again. After creating our embedding sequences, it's time to define the LSTM layer which returns the sequence . Our final layer is a dense layer which is of length 1 as is of one length.

```
embedding_vecor_length = 32
model = Sequential()
model.add(Embedding(top_words+2, embedding_vecor_length, input_length=max_review_length))
model.add(LSTM(100))
model.add(Dense(1, activation='sigmoid'))
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
print(model.summary())
model.fit(X_train, ytr, validation_data=(X_test, yte), epochs=epoch_num, batch_size=batch_size)
```

Figure 4.8: Training of LSTM

4.4 Model Evaluation and Metrics

This section shows the results that we have obtained after implementing Naive Bayes, Neural Networks, SVM, CNN, LSTM which includes its test accuracy and confusion matrix.

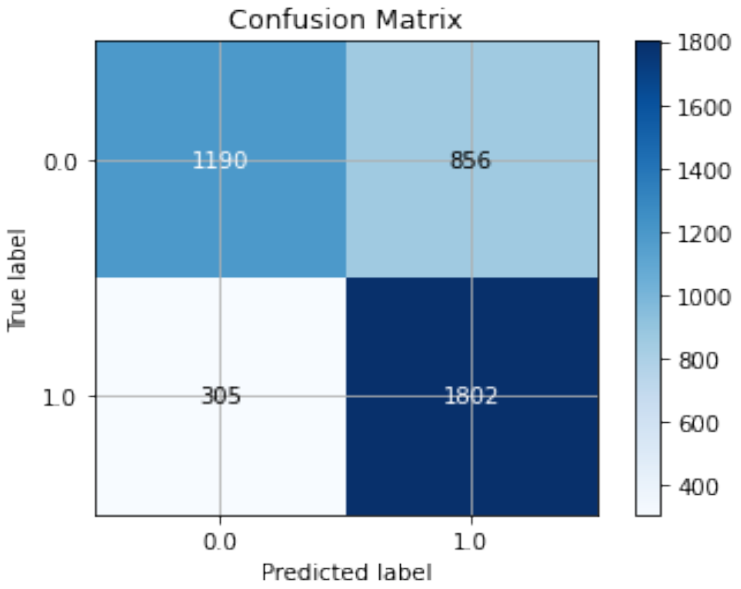

Figure 4.9: Confusion Matrix for Naive Bayes

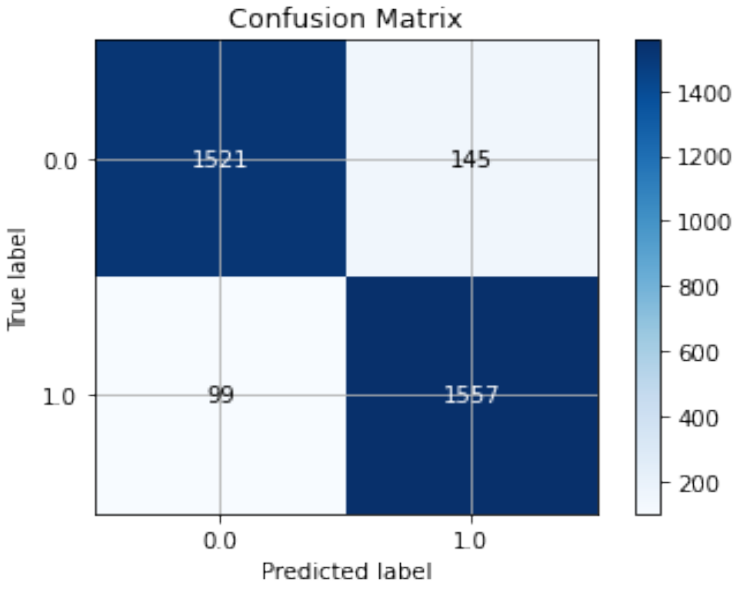

Figure 4.10: Confusion Matrix for Neural Network

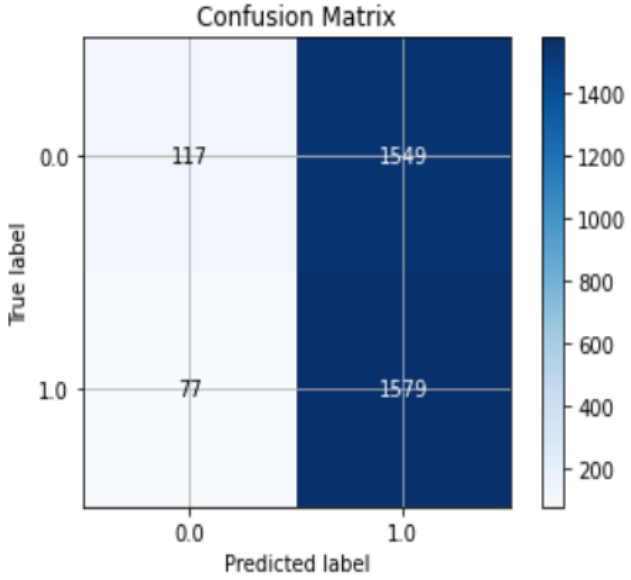

Figure 4.11: Confusion Matrix for LSTM

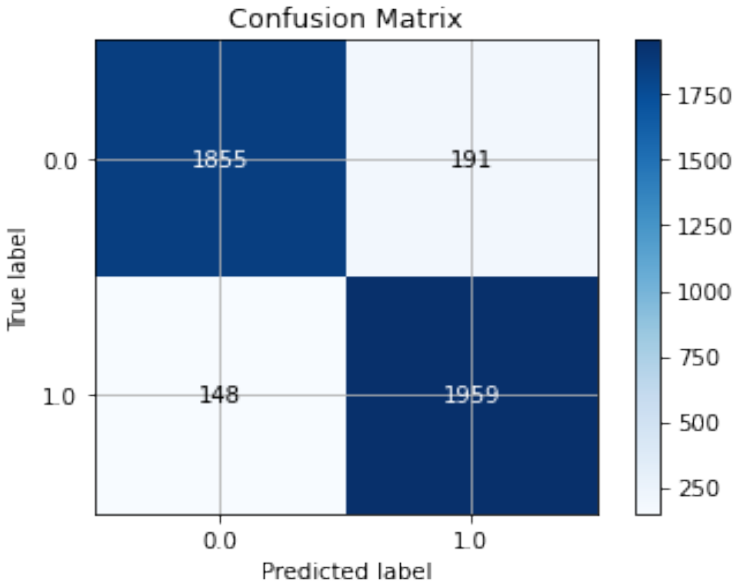

Figure 4.12: Confusion Matrix for SVM

Models	**Accuracy**
Naive Bayes	72.04 %
Neural Network	92.66 %
SVM	88.42 %
CNN	72.70 %
LSTM	51.05 %

Table 4.1: Comparing Accuracies of Models

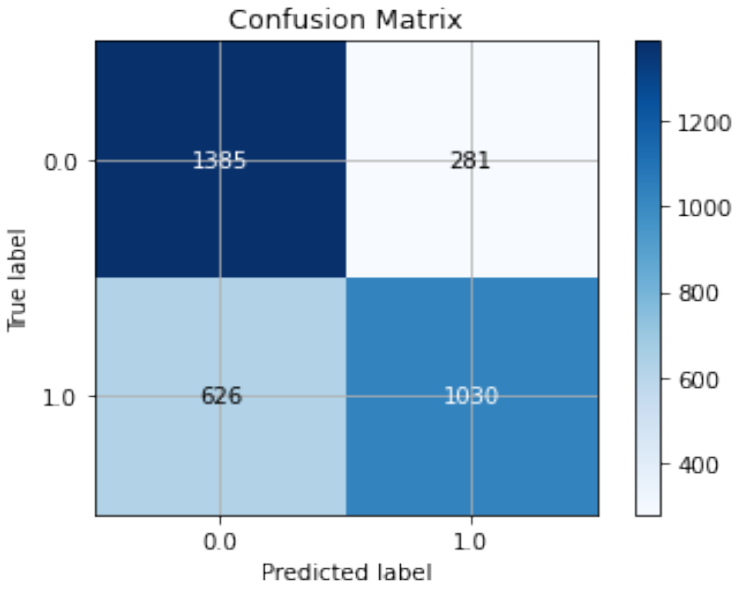

Figure 4.13: Confusion Matrix for CNN

Chapter 5

Discussion and Conclusion

In recent years the modern world has seen the impact of fake news at various fronts whether it be in political or in business fields . Fake news related to a particular person can affect his or her professional as well as private life drastically After doing literature survey we found that various classification algorithms can be used for classifying fake news from the real one like Naive Bayes, Decision tree, SVM, Neural networks, LSTM, CNN and we saw that in different cases different algorithms performed better. But from our study we found out that each of them had some drawback. Some of them used very less data, some did not remove stop words, some did not compare their algorithm with other classification algorithms. So in our work, we tried to remove all these drawbacks and compare the results obtained after implementation of different ML algorithms and the drawbacks and which performed better. From the results it is clear that best results were obtained with help of Neural Network with Keras. Hence, should be used for classification. However which algorithm will work best is also dependent on the dataset that we are using.

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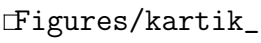
Candidate's Declaration

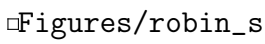
We hereby certify that the work being presented in the report entitled "Towards Wireless Network Coverage through UAVs" from January 2020 to May 2020 under the supervision

of Mr. Nitin Gupta, Associate Professor, Department of Computer Science and Engineering, National Institute of Technology Hamirpur. The matter presented in this report has not been submitted by us in any other university/institute for award of any degree.



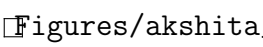
Kartik Saxena

16MI505



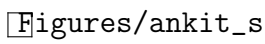
Robin Singh Rana

16MI501



Akshita Doad

16MI521



Ankit Ghunavat

16MI510

This is to certify that the above statement made by the candidate is true to the best of my knowledge and belief.

Nitin Gupta

Date: 09/06/2020 **Assistant Professor**

The B.Tech Project Viva-Voce Examination has been held on .....

Signature of Supervisor **Signature of DBPC Convenor**