

# Political Fake News Detection from Different News Source on Social Media using Machine Learning Techniques

Mahfujur Rahman, Mehedi Hasan, Md Masum Billah, and Rukaiya Jahan Sajuti

**Abstract**— People are more dependable on online news systems than ever in this modern time and day. The more people depend on online news, magazines, and journals, the more likely it will have more significant consequences of fake news or rumors. In the era of social networking, it has become a significant problem that negatively influences society. The fact is that the internet has become more accessible than ever, and its uses have increased exponentially. From 2005 to 2020, overall web users have increased from 1.1 billion to 3.96 billion [16]. As most individuals' primary sources are microblogging networks, fake news spreads faster than ever. Thus it has become very complicated to detect fake news over the internet. For that purpose, we have used four traditional machine learning (ML) algorithms and long short-term memory (LSTM) methods. The four traditional methods are as follows logistic regression (LR), decision tree (DT) classification, k-nearest neighbors (KNN) classification, and naive bayes (NB) classification. To conduct this experiment, we first implemented four traditional machine learning methods. Then we trained our dataset with LSTM and Bi-LSTM (bidirectional long-short term memory) to get the best-optimized result. This paper experimented with four traditional methods and two deep learning models to find the best models for detecting fake news. In our research, we can see that, from four traditional methods, logistic regression performs best and generate 96% accuracy, and the Bi-LSTM model can generate 99% accuracy, which outbreaks all previous scores.

**Keywords**—Fake News, Political Violence, Long Short-Term Memory, Bidirectional Long-Short Term Memory, Logistic Regression, Decision Tree, K-Nearest Neighbors, Naive Bayes.

## I. INTRODUCTION

IN this modern era of technology, the quick rotation of news makes it very difficult to detect if it's false or true. Online-based newspapers have gained popularity rapidly. People can

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access the newspaper website with a click to check on current news. As it has become straightforward and accessible also, at the same time, yellow journalism has thrived to the maximum. There are thousands of news portals that can be found online, but very few can be trusted fully. Manual detection of fake news is a tough job and can't be done if the database is enormous. Various methods of detecting fake news have been proposed, but very few give high accuracy. Also, there are very few tools online that can be used to detect fake news. Obtaining and disseminating data across web-based media stages has become remarkably simple; distinguishing based on the content of information makes it difficult and nontrivial [1].

Automated fake breaking news detection is the task of assessing the truthfulness of claims in the news. For instance, openness to fake news can cause perspectives of inefficacy, estrangement, and criticism toward certain political up-and-comers. Fake news even identifies with actual rough occasions that undermine public wellbeing. Distinguishing fake news from the news source is a significant application in the modern world. This application can perform by using natural language processing (NLP). It likewise has more extensive effects on how innovations can encourage the verification of the integrity of cases while teaching the overall population. Fake news can be characterized as totally deceptive or made-up data purposefully circulated, guaranteeing apparent data. Manually fact-checking is very hard and tedious work. It is almost impossible to manually fact-check and authenticate when the database or dataset is too large. Our research aims to find fake news from different news sources. We have found outstanding performance using our proposed algorithm.

For this reason, automated fake news detection has become necessary, and therefore, many methods and algorithms have been developed over the years to solve this problem. There are many algorithms and methods for detecting fake news, but very few give accurate results. For detecting text-based fake news, many NLP methods are used nowadays. In this paper, we used a dataset from the kaggle website to check the accuracy of the result by testing through all the models, both traditional and deep learning [2].

The remainder of the paper is organized in the following manner. Section II discusses the objective of this research. Section III discusses the methodology used in this research in more detail. Section IV discusses the dataset and the preparation processes we took on the dataset, the

implementation of this research, and the model's accuracy. Section V concludes our novel research, gives some analysis discussion and suggests some future works.

## II. RELATED WORKS

The first fake news stance identification challenge was launched in 2017 [3]. The work proposed inspired the Fake News Challenge Stage 1 (FNC-1) location recognition challenge, where the position of a single sentence of a news feature was grouped against a particular guarantee [3]. A half-named dataset derived from the emergent dataset was used in the FNC-1 test [4]. The location was determined at the archive level, where the entire news story is classified alongside a feature. Talos Research Intelligence group's SOLAT developed the best performing system in the SWEN [5]. The method was to combine deep neural networks (DNN) with pre-prepared vectors from google new as well as angle-assisted decision trees. The approach was based on a 50% weighted normal troupe technique.

For dealing with the location discovery problem from the FNC-1 assignment, the model achieved 82.02% precision, and a profound learning technique was used [3]. It combines neural consideration components and bi-directional recurrent neural networks (RNNs) with max-pooling to create derivations from features and a group of news features. It then combines the derivations with external comparability items. Pre-planning and a mixture of neural portrayals and outer closeness highlight an accuracy of 83.8% [6]. Another study employs a profound repetitive model to register neural implanting, a weighted n-gram chunk of text model to determine observable highlights, and highlight designing heuristics to exclude hand-made outside highlights. Finally, all of the highlights were merged using DNNs to classify the feature body contents as concur, contradict, discuss, or irrelevant. The model showed an accuracy of 89.29%. It was observed that neural network-based organization works better than hand-crafted highlights.

The model is read to achieve 86.5% exactness by performing a mutual multi-point of view coordinating with models and enhancing the current alternative parser with a total instrument between words in body content and features. With consideration, a conditional encoding LSTM model achieves an 80.8% score. A model Bi-LSTM with worldwide highlights is used in another project. It illustrates that a combination of universal highlights and near-world implanting highlights is more accurate at anticipating the location of feature article sets than either of them individually, with an accuracy of 87.4% [7]. Rather than using a classification-based strategy, this investigation uses a positioning-based approach to tackle the task of identifying news positions. The positioning-based methodology considers and improves the distinction between legitimate and erroneous headline and article body positions. The method yields an accuracy of 86.66%. A traditional model such as logistic regression was introduced in 1960 as an alternative to the ordinary least

square (OLS) method because it wasn't ideal for handling diploid outcomes. This OLS model was not efficient because of its strict statistical assumption. It became popular and routinely available in the early 1980s.

KNN classification has been developed to perform discriminant analysis because parametric estimates of probability densities are not always known or somewhat challenging to determine. Fix and Hodges used a non-parametric system for pattern classification in an unpublished paper of the US Air Force School of Aviation Medicine report in 1951 [8].

NB classification is a method that is a simple probabilistic classifier. It applies the bayes theorem with naïve independence assumption. It is named after the Reverend Thomas Bayes (1702-61). After his death, his friend Richard Price continued and presented his work in 1763 [9].

DT classification uses a decision tree where the nodes are attributes, branches are decisions, and leaves are outcomes. It mimics the thinking level of humans, so it's very simple to use the data and get interpretations. The first decision tree was used in the "AID" project by Morgan and Son Quist in 1963 [10].

## III. METHODOLOGY

This research aims to identify fake news from different news sources and give the actual end-user. Our novel research used some traditional machine learning models to detect fake news. We have used different traditional ML models (such as: logistic regression, decision tree, k-nearest neighbors, and naive bayes) to identify the fake and accurate news from the news sources. We also used deep learning methods (such as: long short-term memory, bidirectional long-short term memory) which outperformed excellent results. We have integrate deep learning and traditional model both for finding accuracy in our simulation.

**Logistic Regression:** Logistic regression is a supervised machine learning process usually used to obtain a probabilistic ratio in the dataset. Logistic regression is mostly used to find binary or boolean results such as zero/one, true/false, yes/no etc. It is a statistical-based analysis method used to predict value based on prior observation of the dataset.

**Decision Tree:** A decision tree is another type of non-parametric supervised machine learning process that is used to act like a typical tree representation. Usually, a tree can be two types of entities, and it follows a flowchart-like structure. The decision tree algorithm is used in classification and regression, which are the essential data mining technique. It helps to divide data into training datasets when the sample dataset size is too large [11].

**K-Nearest Neighbors:** K-nearest neighbors classifier, known as KNN, is one of the simple methods in machine

learning cause it has the simplest algorithms for regression and classification of the problem. Usually, the KNN classifier assumes the data that are very close to each other. It detects the data based on the similarity of the dataset.

**Naive Bayes:** The naive bayes classifier is a technique based on the bayes theorem. It has independence of assumption of predicting the data. The probabilistic approach of naive bayes is mainly used to create a classifier. The naive bayes algorithm is mainly used to classify text with multiple class problems [12].

**Long Short-Term Memory:** Long Short-Term Memory, known as LSTM, is a type of recurrent neural network. It can learn the order dependence in sequence, detecting the prediction words, but can't predict the future world. First, we must apply one hot representation on our news to use this model. Then we have to give the dataset input value through the embedding layer and train this model.

**Bidirectional Long-Short Term Memory:** Bidirectional long short-term memory, known as Bi-LSTM, is an extension of traditional LSTM. It can give more accuracy or more

performance on order dependence sequences. The main feature of this model is this model can predict the future world, which is very helpful for detecting fake news [13]. Usually, the bidirectional method has two ways: one is passed to the future, and another is from end to past. Using these two processes can predict information from the future and use the two hidden states [14].

Firstly, we created the target column for both CSV files, true and fake. Then we set the 0 (zero) and 1 (one) values, where 0 represents fake news and 1 illustrates real news. After that, we combined and dropped the title and text column by using the concat() function. We did this to rearrange the queue because it will not benefit us if we perform text and title columns separately. But we had some problems with the dataset. In the date column, there was some links and headline of the news. When converting the date column to time and date format, it can create a problem. For this issue, we removed the links and headlines of the news. After doing this, we converted the date column to time and date format by using the datetime() function. Figure 1 represents the pre-processing steps of the dataset.

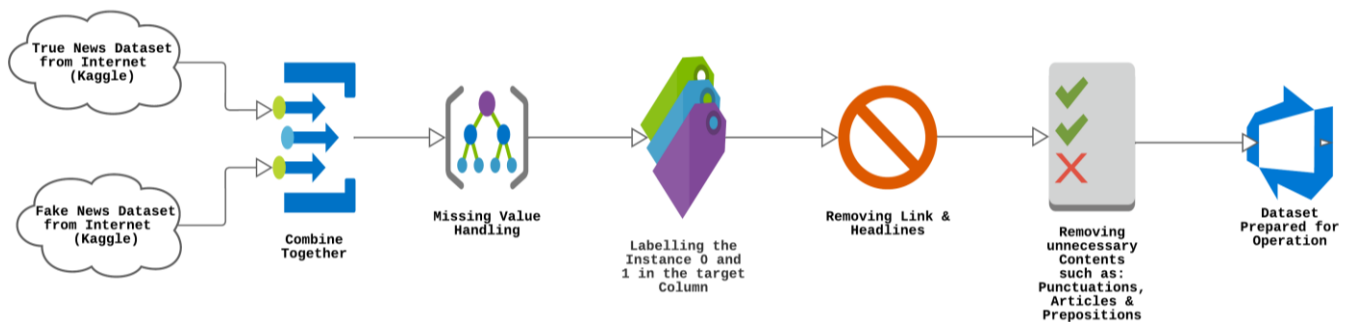


Fig. 1. Preprocessing steps of the dataset

We have used two deep learning and four traditional ML models. We pre-processed our dataset before implementing models. We also gave the data for performing our model. After calculating result, we compared our proposed work with

previous researches by applying some evaluation parameters. Our proposed approach is depicted in figure 2, along with the phases of our proposed methodology.

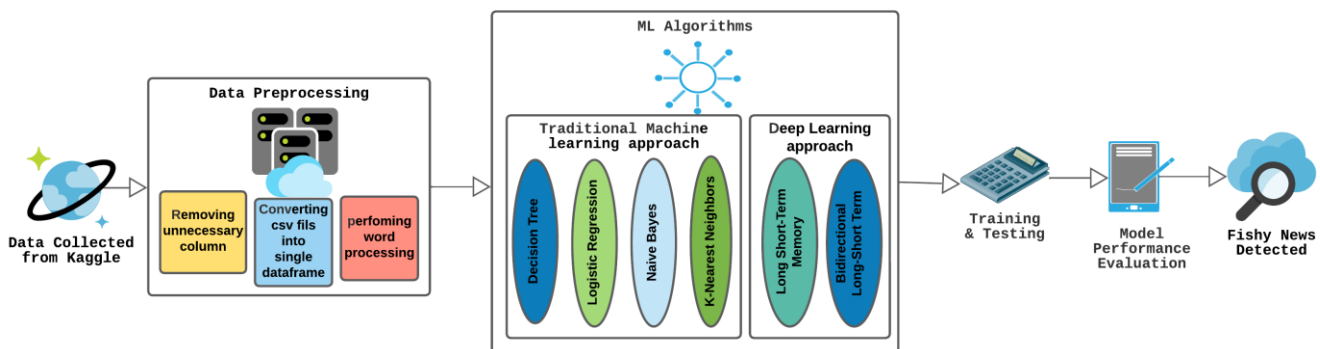


Fig. 2. Proposed method for detecting fake news

We appended our dataset to perform our model. Then we converted our two CSV files into a single data frame. After that, we moved to word processing, which is a crucial step for implementing the model. There might be some unwanted text

and unnecessary content in our dataset. If we don't remove this, it can create problems in our model, and the model will not perform fluently. For that issue, we processed our text. In-text processing, first, we removed the punctuations from all

the columns. Then we removed some unwanted words like (a, an, in, of, the) from column by using the stop words function. After completing this, we did some exploratory data analysis like measuring accuracy, precision, recall, f-measure, and error rate or our predicted results. At last, we compare our research results with previous research data and validate our novel research.

#### IV. RESULTS AND DISCUSSIONS

We use four traditional ML models and two deep neural networks (DNN) to implement our research. The four traditional models are logistic regression, decision tree classification, k-nearest neighbors, and naive bayes classification. And we also used LSTM and Bi-LSTM methods of deep learning. The model we mentioned above gives the best accuracy that we expect, which is higher than any other model.

We used a fake and true news dataset from kaggle to implement our model [15]. In this research, we present a strategy for automatically classifying news stories based on whether they agree, disagree, are irrelevant, or are being discussed. The level of agreement between the headline and the body given to headlines is used to classify them. The model we used minimized the layer and provided great accuracy. We got a great result with minor errors and ideally.

We used LR, DT, KNN, NB classification, and deep learning methods LSTM and Bi-LSTM. All the methods have been done by using the data pre-processing technique. We reshaped all the data to make them compatible with the network. It can detect any news, whether it is fake or real. The effectiveness of feature reduction-based methods is compared to four classical models: linear regression, decision tree

classification, gradient boost classification, and random forest classification, as well as one deep learning method, LSTM. The experimental results show that the suggested model improves the f-measure and accuracy when using the decreased feature set compared to the other strategies.

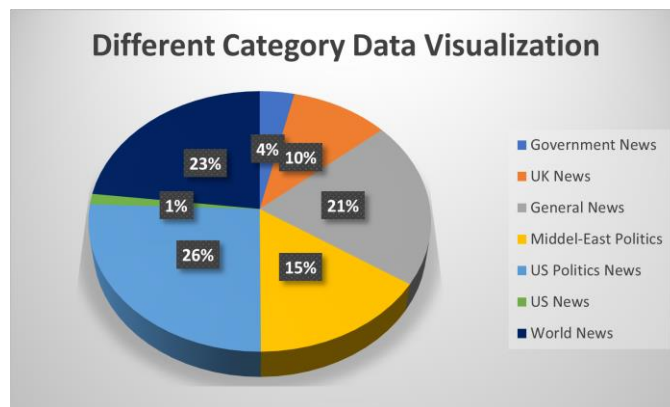


Fig. 3. Pie-chart of the dataset

The dataset we have used in this research has been collected from kaggle [15]. We created a pie chart in figure 3 to indicate the count of the news. In this dataset, we have found six categorical news: government news, US news, Middle-East news, political news, world news, and usual regular news. All news is stored in a CSV file labeled 0 (for fake) and 1 (for true).

We can see that different category news contains different frequencies of news. Of all categories, the news is two common categories, fake and real. Figure 4 shows the number of fake news in each category news. This job is performed by counting the news headlines in our dataset.

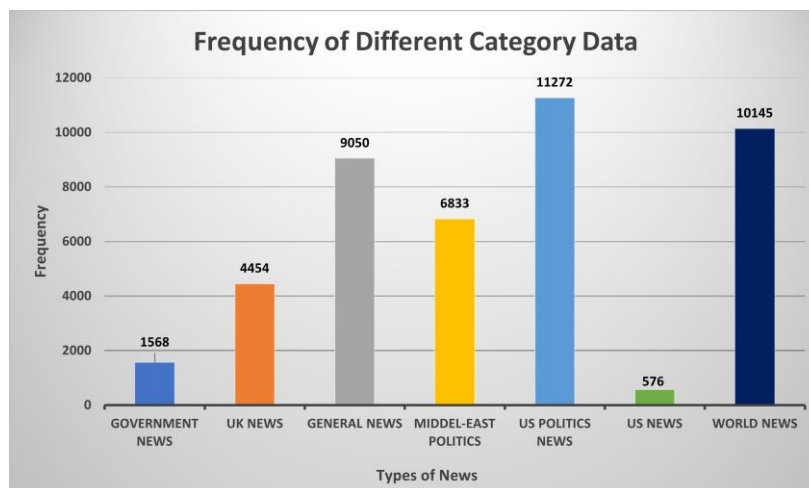


Fig. 4. Fake news statistics

In figure 4, we can see the frequencies of fake news in different category news. If we visualize again in figure 3 and 4, we can see that the ratio of political-fake news is more in our data sources. That's why the main target of this research is to identify political-fake news and help to avoid political

violence in the world. If we can successfully detect fake and true political news from the spreading on social media, we can set a procurement plan to develop our nation from the government.

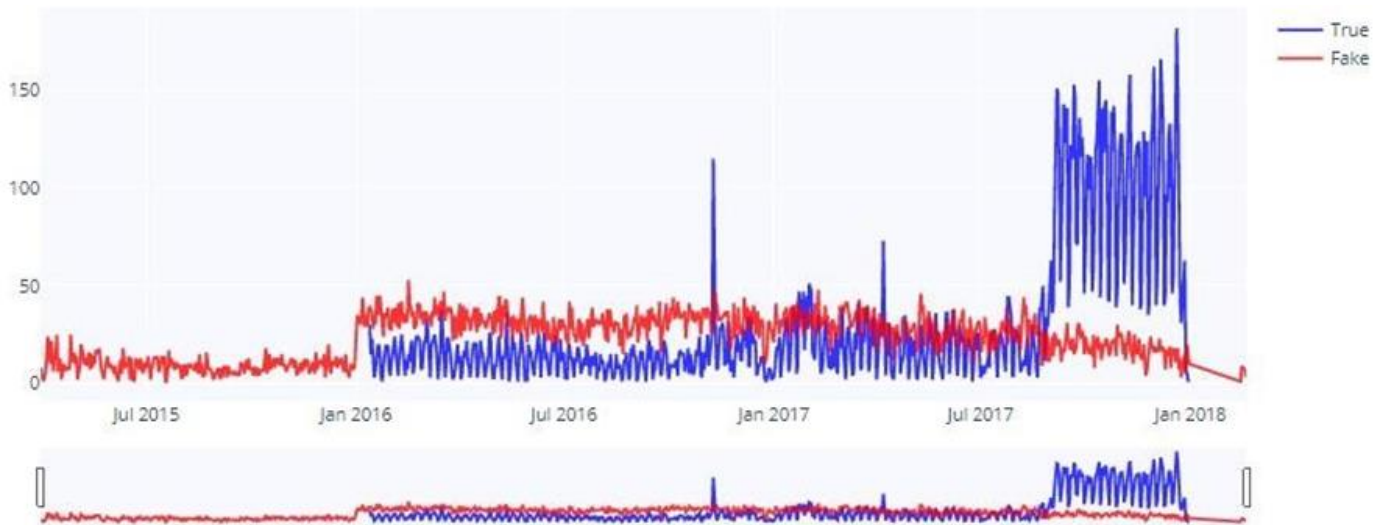


Fig. 5. Timeline visualization of fake and true news

In figure 5, we can see, in the 2017 month of august, trustworthy news is higher, which is good. But we can also see from the timeline that in 2015 there is no accurate data. For this issue, the detection of fake news will be accurate. We stemmed on the review data frame to convert the word into its root word. We could use another technique which is lemmatization. It also works the same as stemming. But it takes a lot of time.

For this reason, we used stemming. After that, we converted words into 0 and 1. Because the computer will not understand these words for that issue, we have to convert these words into 0 and 1. For doing this, we used TF-IDF (Term Frequency-Inverse Document Frequency). Then we checked the balance of data. We checked because if we work with imbalanced data, our model will become biased and return maximum output. We saw our dataset is balanced. Lastly, we used an operational train test split. We split the dataset into an accurate ratio. Let's see the confusion matrix of logistic regression, which has generated the highest score of all traditional ML models.

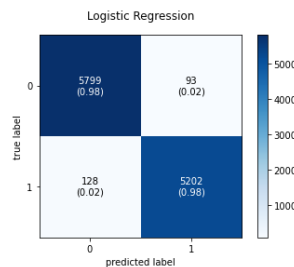


Fig. 6. Confusion matrix of logistic regression

From the confusion matrix of logistic regression showing in figure 6, we can see that our model predicted 5799 and 5202 news accurately. Rest 128, 93 news are predicted wrong by our model. Now Let's see the confusion matrix of deep learning models. LSTM breaks the logistic regression score and gives more precise results guaranteed from the data

below.

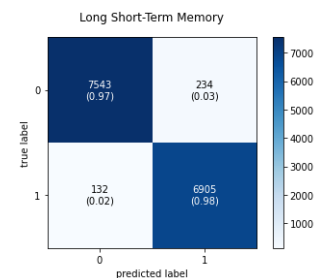


Fig. 7. Confusion matrix of LSTM

In figure 7, we can see from the confusion matrix of the LSTM model that predicted 7543 and 6905 news accurately. Rest 132, 234 news are predicted wrong by our model. Then we apply the Bi-LSTM network to improve the result generated from LSTM. In the following figure, we can visualize that, Bi-LSTM successfully overcame all the scores and gave the highest accurate result.

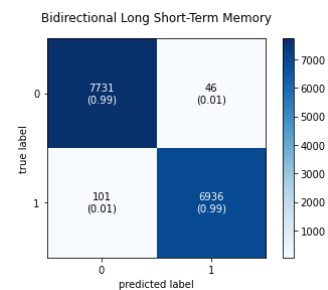


Fig. 8. Confusion Matrix of Bi-LSTM Model

We can notice from the confusion matrix of the Bi-LSTM model in figure 8 that predicted 7731 and 6936 news accurately. Rest 101, 46 news are predicted wrong by our model. After implementing all models, the final accuracy is listed in the following table. Here we observe accuracy and f-measure for all the traditional and deep learning algorithms. After visualizing the data displayed in the following table, we can easily compare the model's score.



TABLE I  
COMPARISON TABLE OF DIFFERENT MODELS

Algorithms Used for Detecting Fake News		Accuracy	F-measure
Traditional Machine Learning Classifiers	Logistic Regression *	0.96 *	0.98 *
	K-Nearest Neighbors	0.61	0.61
	Decision Tree	0.93	0.93
	Naive Bayes	0.93	0.91
Deep Learning Models	Long Short-Term Memory	0.96	0.97
	Bidirectional Long-Short Term Memory	0.99 *	0.99 *

In table 1 demonstrate that, logistic regression achieve 96% accuracy among the four traditional models, which is higher than the others. On the other hand, we used LSTM and then modified it into Bi-LSTM to get more accurate results. From basic LSTM, we got 96% accuracy, and after modifying it into Bi-LSTM, we got 99% accuracy. Logistic regression will be

the best choice if we want to detect fake news using traditional classifier models. If we're going to detect fake news using deep learning methods, then the Bi-LSTM process will be the best choice. Figure 7 shows the accuracy and f-measure score of different machine learning algorithms used in this research.

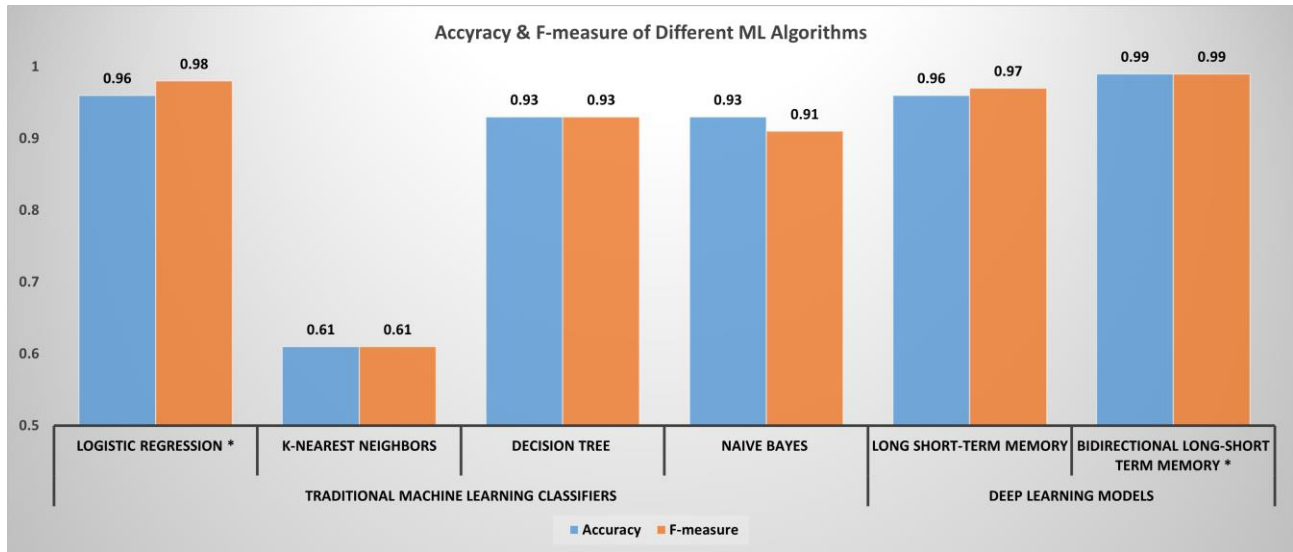


Fig. 9. Accuracy & F-measure Score of Different ML Algorithms

We have analyzed different performance methods in similar fake news detection. In table 2 shows the performance analysis of fake news detection in different methods. Here we

compare our result with previous researches and get outstanding performance using in different methods.

TABLE II  
COMPARISON ANALYSIS BETWEEN DIFFERENT METHODS IN SIMILAR CONCEPT

Paper	Algorithms/Method Used	Accuracy
Mihaylov T. et al. [1]	SVM classifier with RBF	90.63%
Abedalla, A. et al. [2]	Deep learning models using CNN and LSTM	71.2%
FNC-1 [3]	Weighted average between gradient-boosted decision trees and deep CNN	82.02%
Mihaylov T. et al. [6]	Pre-planning and a mixture of neural portrayals and outer closeness	83.8%
Long Y. et al.[7]	Hybrid LSTM model with attention mechanism	87.4%
Roy, A. et al. [8]	Deep Ensemble Framework (Combination of RNN, CNN and Bi-LSTM Model)	44.87%
Ferreira, W. et al. [9]	Stance classification using multiclass logistic regression	73%
Proposed Algorithms *	Logistic Regression (Traditional ML Classifier)	96%
	Bi-LSTM (Deep Learning Model)	99%

We trained our dataset by perfectly tuning the parameters. We have worked using the different parameters to implement our model. Based on the enormous parameters, it took a lot of time to train. Google co-lab and TensorFlow Jupiter both were crashing because of huge parameters. For solving the enormous parameters, we minimized the parameters then adjusted the epochs and for the precision and the recall which is increased the model accuracy by more than 3% from the previous accuracy. Our proposed system find out the satisfactory result.

## V. CONCLUSION

In this paper, we implemented some models for detecting fake news. In our paper, we used two datasets, fake and true. We pre-processed our data for accuracy. After that, we implemented four classifier models and deep learning models. Almost all classifier models gave more than 90% accuracy except KNN. We achieved the highest accuracy (which is 96%) for logistic regression from the four traditional ML models. After that, we try deep learning models for better performance and accuracy than logistic regression. We again get 96% accuracy from the LSTM model. After adjusting the LSTM model, we improved and hyper-tuned by using Bi-LSTM, which provided almost 99% accuracy, which is excellent. In the future, we will try to detect fake news on social media by using social media structure and user behavior. We plan to see the performance of our model with a larger dataset. We will develop a tree-based learning model because the tree-based learning model can perform more accurately than another model. We will try to add different textual features to increase the performance of our model. BERT is a well-known deep learning method in the field of NLP, the algorithm efficiency is also high. But it needs high computation cost with high configuration devices setup.

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