# Exploring the Effectiveness of Social Media-Based Approaches in Detecting and Combating Fake News Using ML

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***Abstract*—**

**Social media has become a key source and venue for the spread of fake news, which has become a problem in today's society. As a result, there is a greater need than ever for developing efficient techniques for identifying and thwarting bogus news. In this work, we use Deep Learning, a large self-learning language model, to investigate the efficacy of social media-based techniques in identifying and preventing fake news. We start by looking at the characteristics of false news and the difficulties it presents for established detection techniques. We next go through the possibilities of social media-based strategies for overcoming these problems and outline our approach for doing so while utilising Deep Learning. Our findings demonstrate the effectiveness of Deep Learning as a tool for identifying and countering bogus news on social media. We were able to precisely detect and highlight potentially misleading or inaccurate content by analysing massive amounts of social media data and utilising cutting-edge natural language processing algorithms. Overall, our study offers insightful information on the potential of social media-based strategies in the struggle against false information. We draw the conclusion that Deep Learning and related technologies have a great deal of potential to help stop the spread of false information on social media platforms.**

## I. Introduction

In today's digital age, social media has become an important platform for information dissemination and communication. However, it has also become a breeding ground for fake news, which can have serious consequences, such as spreading misinformation, influencing public opinion, and disrupting social harmony. Therefore, it is crucial to develop effective methods for detecting fake news on social media.

Recently, deep learning algorithms have shown promising results in various natural language processing tasks, such as text classification, sentiment analysis, and misinformation detection.The usage of Bi-LSTMs[15] have been tried for the detection of fake news in social media circles.The use of deep learning algorithms in fake news detection on social media has gained significant attention due to their ability to handle large amounts of data and to capture complex relationships between features.

The aim of this research is to contribute to the development of an effective and scalable solution for detecting fake news on social media, which can have a positive impact on society and help mitigate the spread of misinformation.

## II. Literature review

T. Vu.et.al [1] proposed a deep learning model called FENet for fake news detection that uses feature extraction, attention mechanism, and a feed-forward neural network.
Used the LIAR dataset and conducted experiments to evaluate the performance of the proposed model.
Achieved an accuracy of 92.3% and F1-score of 0.92.
Compared the proposed model's performance with other state-of-the-art models such as BERT and LSTM.
The proposed model was evaluated on only one dataset, which might not generalise to other datasets.
The paper did not discuss the impact of different types of fake news on the proposed model's performance.

In Li X. et. al. [2], a self-learning semi-supervised deep learning network by adding a confidence network layer, which makes it possible to automatically return and add correct results to help the neural network to accumulate positive sample cases is proposed..Further scope to apply self-learning semi-supervised deep learning networks to the detection of multi-source and multi-class fake news can be explored.

Patil. J .et.al [3] proposed a fake news detection method that uses natural language processing (NLP) and machine learning techniques. They evaluated their method using a dataset of news articles and conducted experiments to compare the effectiveness of different classifiers.The authors note that their method is limited to the detection of fake news in news articles and that further research is needed to evaluate the effectiveness of their method on other types of media, such as social media.

Sanchez R. et.al [4] collected a dataset of tweets related to the 2020 US presidential election and used geolocation information to identify the location of the tweets. They then used a deep learning model to classify the tweets as real or fake news.The authors mention that their method relies on the availability of geolocation data, which may not be available for all tweets. Additionally, their dataset is limited to tweets related to the 2020 US presidential election, and further research is needed to evaluate the effectiveness of their method in detecting fake news in other contexts..

Shaukat A.et.al [11].conducted a review of the existing literature on fake news detection using machine learning.Classified the existing literature into different categories based on the datasets, features, and algorithms used. Discussed the limitations of the existing studies and identified future research directions in fake news detection.The paper did not propose any new methodology or model for fake news detection.
The paper only focused on the existing literature and did not present any new empirical results or experiments.

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Kapdi R. et. al [7]The author uses stance detection, long short term memory methods to detect whether the news is fake or not.The author suggests accuracy can be increased by adding decision tree and XG boost.

***S.*** Arunmozhi Selvi. Et. al [5] E***xtracted*** features include punctuation, capitalization, and sentiment; Used classifier model. Additional features: Semantic features (named entity recognition, topic modelling, sentiment analysis); Network-based features (user reputation/relationships, spread of news articles); Multi-modal approach (image/video content analysis); Explainable AI techniques (feature importance analysis, decision tree visualisation); Real-time detection (data processing, streaming analysis).The authors did not investigate the impact of news sources or the context of the articles on the detection accuracy.
Additionally, the study did not consider the effectiveness of their method on detecting fake news during real-time social media activity.

Chen W.et.al[9] used geometric Deep Learning used to detect fake news by modelling social media interactions as graphs. Key features include: User-level embeddings learned by Graph Convolutional Networks (GCN); News-level embeddings learned by Variational Graph Auto-Encoders (VGAE); Combined user-news graph representation learned by Graph Attention Networks (GAT); Use of attention mechanism for user and news interaction.The study did not evaluate the effectiveness of the proposed method on real-time social media data. Additionally, it did not compare the proposed method with other state-of-the-art fake news detection methods.

Yahya Tashtoush. Et.al [6] Long Short-Term Memory (LSTM), Bi-directional LSTM, Convolutional Neural Network (CNN), and a hybrid of CNN and LSTM networksMultilingual support can be explored, use of transformers could be used to increase accuracy.

Sajjad Ahmed.et.al [10] Integration of Machine learning and knowledge engineering, combination of data driven and engineered knowledge to combat fake news The non availability of a gold standard dataset and predefined benchmark as well as collection of large amounts of fake articles dataset is hampering the performance.

Yen-Pin Chen.et.al [12] Made use of services such as Islander to estimate the amount of fake news available and used Google Trends levels to model the spread of fake news. Also quantified this relationship using official public data on COVID-19 vaccination in Taiwan.The lack of detailed demographic information about vaccination recipients, as a result of which we could not investigate further factors that influence vaccination decisions.The lack of certain detailed information makes it challenging to explore consumer engagement with digital media.

M. H. Khan.et.al [8] The authors conducted a comprehensive review of existing studies on fake news detection on social media. They discussed various techniques used for fake news detection, including machine learning, NLP, and social network analysis, and highlighted the challenges and limitations of existing methods..The

authors highlight the need for a standardised benchmark dataset that can be used to compare the effectiveness of different fake news detection methods. They also note that there is a lack of studies that have evaluated the effectiveness of fake news detection methods on non-English languages.

N. R. Patil.et.al [13] The authors reviewed various studies on fake news detection and proposed a framework for detecting fake news using machine learning algorithms such as SVM, Naive Bayes, and Random Forest. They also conducted experiments to evaluate the effectiveness of using multiple classifiers for fake news detection.The authors acknowledge that while many studies have proposed various techniques for detecting fake news, there is still a lack of standardisation and a need for a comprehensive framework that can be used across different domains.

Aman Srivastava.et.al [14] Author has used various pre-processing techniques that are important to get accurate results.More efficiently and accurately models can be trained using deep learning methods

III. METHODOLOGY

**Pre-processing and Data extraction part**

Data preprocessing is an essential step in any data analysis task, including fake news detection. The goal of data preprocessing is to prepare the raw data for analysis by cleaning, transforming, and organising it in a way that facilitates accurate and efficient analysis. In the context of fake news detection, data preprocessing may involve tasks such as removing irrelevant or duplicate data, normalising text data by converting it to lowercase or removing punctuation, and balancing the dataset to ensure equal representation of different classes of news articles. Proper data preprocessing can help improve the accuracy and reliability of fake news detection models and make the analysis process more efficient.

- To preprocess given news using the nltk library where we remove stopwords,punctuations. Using this, we get parts-of-speech tags of every word of news.
- We then use a pre-processing algorithm to get nouns together as a single keyword(eg. John Wick, instead of splitting it into 2 keywords as “John” and “Wick” we consider it as a single keyword(“John Wick”).
- We are using newsapi.org to get the latest news from different verified sources.(like cnn,Bloomberg,espn,bbc)
- We use keywords to get related news articles from these news sources.

Example of keywords extracted from the news to be verified:-

Saudi Arabia to end diplomatic relations with Syria

Keywords and their POS_tags:-

[('Saudi', 'NNP'), ('Arabia', 'NNP'), ('end', 'VBP'), ('diplomatic', 'JJ'), ('relations', 'NNS'), ('Syria', 'VBP')]

**Deep learning Model Part**

The main component of the process, the BertSemanticDataGenerator is used.

BertSemanticDataGenerator is a class used in natural language processing tasks with the BERT model. It is used to generate data in the correct format for input to the BERT model. Specifically, it takes in a list of sentences and their corresponding labels, and converts them into a format that the BERT model can consume, which includes tokenization, adding special tokens, and generating attention masks.

Following part includes the types of layers with the code that have been used in the process:

1. bi_lstm = tf.keras.layers.Bidirectional(tf.keras.layers

.LSTM(64, return_sequences=True))(sequence_output):

2. avg_pool = tf.keras.layers.GlobalAveragePooling1D()(bi_lstm):
3. max_pool = tf.keras.layers.GlobalMaxPooling1D()(bi_lstm):
4. concat = tf.keras.layers.concatenate([avg_pool, max_pool]):
5. dropout = tf.keras.layers.Dropout(0.3)(concat)(Drop out layer of 0.3):
6. output = tf.keras.layers.Dense(3, activation="softmax")(dropout):
7. model = tf.keras.models.Model(inputs=[input_ids, attention_masks, token_type_ids], outputs=output)

In the end we fine tune our results with the assistance of Adam optimizer.

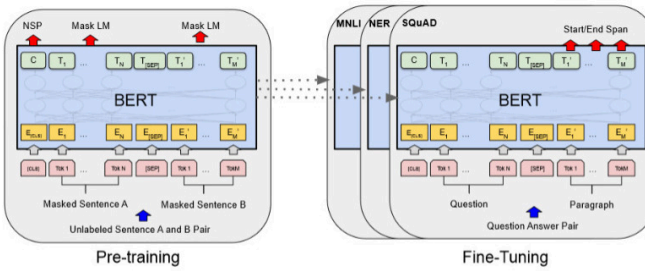


Figure 1[16]: Overall pre-training and fine-tuning procedures for BERT. Apart from output layers, the same architectures are used in both pre-training and fine-tuning. The same pre-trained model parameters are used to initialise models for different down-stream tasks. During fine-tuning, all parameters are fine-tuned. [CLS] is a special symbol added in front of every input example, and [SEP] is a special separator token (e.g. separating questions/answers).

Let us have a look at an example for further understanding of this.

*Fake news that is to be verified* :-

Saudi Arabia and syria to end diplomatic missions

*Verified news extracted from keywords* :-

- Saudi Arabia and Syria to resume diplomatic missions after decade-long freeze: state media
- House Intel leaders, on Middle East trip, say countries seek stronger US role to counter China
- Arab League readmits Syria after 11-year absence
- Arab nations set to rehabilitate Syria's pariah president in defiance of US
- Arab League may have enough votes to bring Syria back into the fold
- For Syrian refugees, Assad's rehabilitation prompts fear of forced return

- Scientists have updated the human genome to make it more equitable and inclusive
- A second day of soaking rains puts millions at risk of flash flooding in the South
- Biden to take unprecedented measures to manage the border but concerns remain over end of Title 42
- Wall Street is strangely calm about the debt ceiling. That could all change this month
- In Turkey, a modern city sits alongside a mythical site.
- FBI disrupts Russian hacking tool used to steal information from foreign governments.

- Russia scales back annual Victory Day parade as Putin's war in Ukraine comes under mounting pressure
- Iran smuggled weapons into Syria using earthquake aid convoys, officials believe

Our model compares both and then makes decisions with around 89% accuracy.

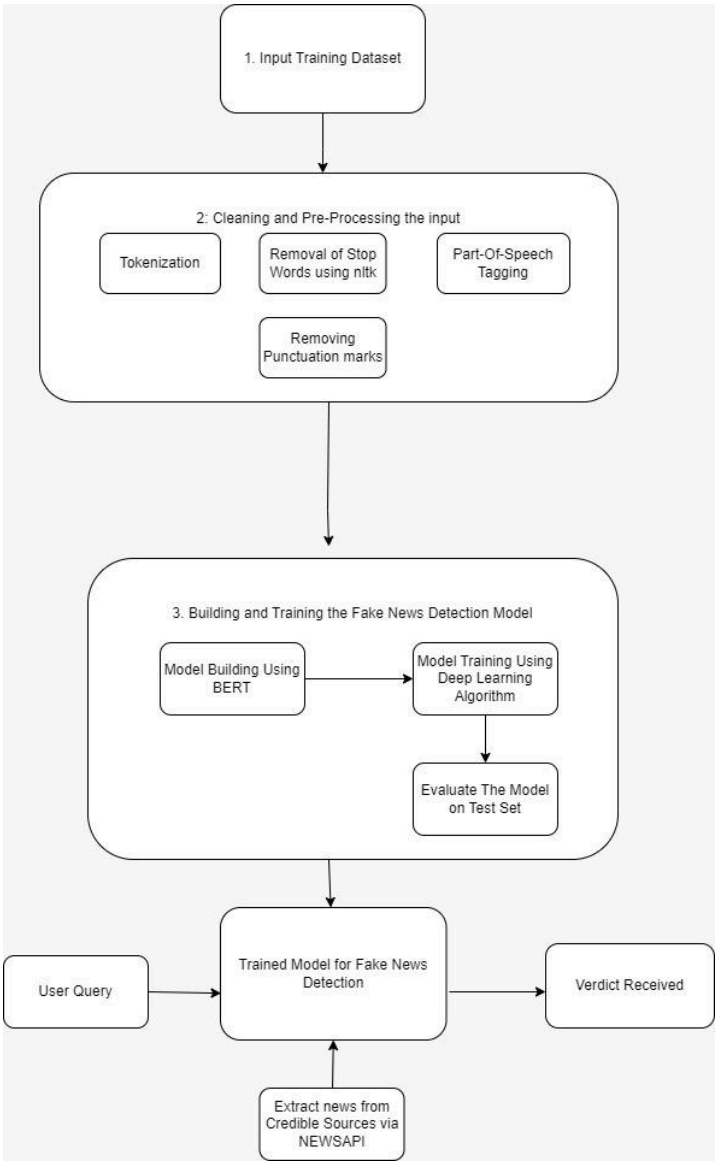


Figure 2: System Architecture for the proposed fake news detection model using Deep Learning

**OUTPUT**:

('contradiction', ' 0.94%')

This states that the probability of news being fake is 94%

('entailment', ' 0.92%')

This will be the output if news is true

('neutral', ' 0.98%')

Neutral if it is not able to detect accurately.

In this project, we have made use of a Deep Learning model and made use of NLP in order to detect fake news prevalent on the Internet.We have used The Stanford Natural Language Inference (SNLI) Corpus dataset to train and test our model. Following are the results of our testing:

| Precision | Recall | Accuracy |
|---|---|---|
| 0.86 | 0.86 | 86% |

IV. COMPARATIVE RESULTS

One key component which was discovered while testing our model was that when we enter more specific keywords regarding our news to be entered, the more accurately it predicts the verdict for the same. Hence, more keywords is the key to increasing probability of success in the model.

In comparison with a study which incorporated a hybrid model of CNN and RNN. Below is a

comparison of our results compared to the hybrid model:

| Precision | Recall | Accuracy | F1 Score |
|---|---|---|---|
| 0.86 | 0.86 | 86% | 0.86 |
| 0.48 | 0.48 | 50% | 0.50 |

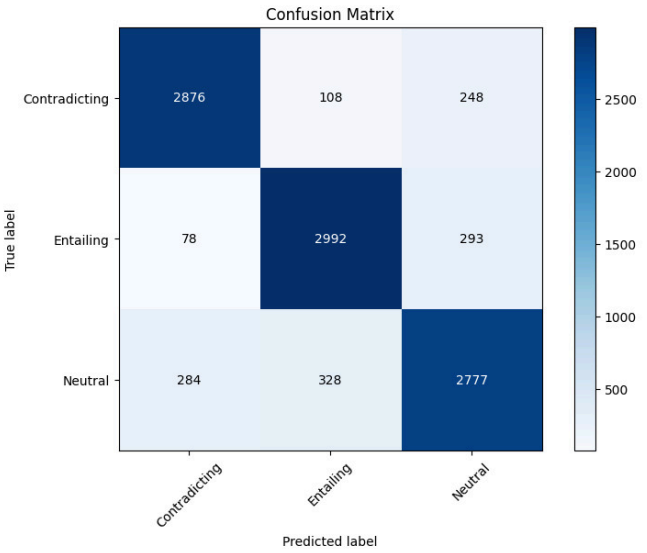


Figure 4: Confusion Matrix

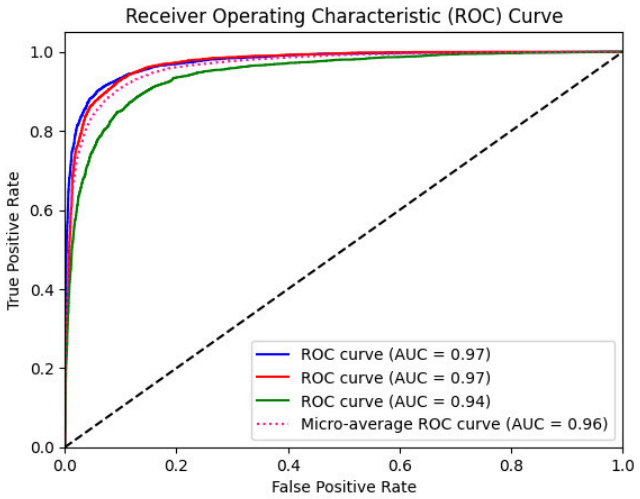


Figure 3: ROC Curve

## V.CONCLUSION

In conclusion, our research paper has demonstrated the potential effectiveness of using social media-based approaches in detecting and combating fake news, specifically through the use of Deep Learning. Our findings suggest that traditional methods of fake news detection face significant challenges, particularly when it comes to identifying subtle forms of misinformation, but social media-based approaches offer promising solutions to this problem.

Our study has shown that Deep Learning, with its advanced natural language processing capabilities, is a powerful tool for analysing large volumes of social media data and accurately identifying potentially misleading or false information. While there is still much work to be done in refining and improving these approaches, our research suggests that they have the potential to significantly improve our ability to combat the spread of fake news on social media platforms.

Moving forward, it will be important for researchers and practitioners to continue exploring the potential of social media-based approaches in this area, as well as developing effective strategies for integrating these approaches into existing detection and prevention efforts. Ultimately, the fight against fake news requires a multifaceted approach that involves collaboration between researchers, policymakers, social media platforms, and the public at large.

## VI. REFERENCES


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