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Fake News Detection Using Recent Machine Learning Algorithms

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***Abstract*—Most of the fraudulent reports have been widely disseminated online recently, due to the rapid diversification of the Internet and availability of online platforms including social media feeds, news blogs, and online news systems and many others. These days we come across many sites which gives us many information in large amount but it might not be a trustworthy or might be intentionally fabricated or misleading news stories & created for a variety of reasons, including financial gain, political propaganda, or simply to attract attention or generate clicks, so this is termed as Fake news. It contains information that might not be properly well defined or researched or it might be non-proven information. To overcome with this, deep learning (DL) models can be used for investigating and confinement of fake news. The proposed model analyzes three recent deep learning classifiers. These are Random Forest, Naïve Bayes and Passive Aggressive classifier.**

Keywords—Naive Bayes, Fake news detection, Passive Aggressive, Random Forest.

I. INTRODUCTION

In earlier days with less information there came less fake news. As the amount of information exchange within society was comparatively slower than today. People relied more on a few sources like newspapers and radio. But, as communication became faster, there was an increase in the demand of social media platforms by the people. And the dependence of people on this platform is increasing day by day. For example, it was seen that after the covid-19 sprang up, this demand was raised. If we check, by 2022 the dependence on social media platforms was having an average growth rate of 10% and it is estimated that 4 billion users were active and used to spend their time of about 2.5 to 4 hours a day. Whereas, if we check the scenarios now. It has increased to about 38% and billions of users are active in this field. We all know that social media has become an intrinsic part of our life. It allows us to share our own thoughts, share our experiences and a lot of new information can be accessed just by sitting at home. Thus, the news content has increased as a result of the ease and low cost of information distribution. This also led to an increase in the quantity of fake news as news content is always not cross-verified. Hence validity cannot be assured. In this era of growing information, it has become necessary for us to classify the information based on the correctness of it. The oxymoron 'fake news' has been coined for both misinformation and the information which is misleading, unintentionally created and disseminated among people. The unintentional creation of fake news may happen generally due to over generalization of issues or by reaching conclusion based on improper analysis. It is also seen that few campaigns spread disinformation intentionally in a well thought manner and attempt to confuse and manipulate people[9].

Nowadays, the most common medium for spreading fake news is internet. It is not just limited to webpages. It is widespread especially in social media platforms like Facebook, Instagram, Reddit, Twitter...etc. Fake news causes too much confusion within the people accessing it. It causes people to have more varied opinions about things based on baseless points built by accessing fake news. This misinformation between the people has its own huge disadvantages like social instability, wrong decisions and it may sometimes in worst cases even lead to the formation of violent groups which are surely harmful for the wellbeing of society. To reduce fake news, the research related to it is done both academically and industrially [1]. One of the most harmful characteristics of fake news is its influential power and speed with which it spreads. This power can be easily and enormously seen in everyday life. The best examples of this would be that in the presidential elections in 2016 [7], the amount of fake news which was spread on Facebook was shared about 37 million times[2] and similarly, the false report that Barack Obama was hurt in an explosion causes 130 billion dollars' worth of stock to be lost [3]. Fake news can also reduce the impact of real news by competing with it. This makes it more dangerous. Actually, the term "Fake news" was first used during the 1890s. However, throughout the work on fake news detection.

The term "fake news" has different interpretations. These interpretations can be reduced to two definitions. These definitions are based on the intentions behind fake news. The first way of defining fake news classifies as fake if it is intentionally fake. For example, many incidents were reported in the cyber portal in which people were getting fraud messages saying, your bank account is not safe. To guard this a one-time password (OTP) will be required. People with no knowledge or negligible knowledge used to get worried about their money and to safeguard their money they used to say the password and the money used to get debited from the victim [3]. The second type of defining fake news labels the news independent of the intentions behind the news [2]. The amount of information which comes in the form of news is large in comparison to earlier. Thus, it is impossible to manually verify the correctness or intentions behind the news.

Many actions have been taken and this advancement in technology helps in detecting this scam. Tools for fact-checking news have been created to compare it to a network

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of knowledge. However, because of the always expanding information base, the process might take a while.

Previous works on detecting of fake news has utilized various techniques including deep learning, machine learning, NLP and statistically driven approaches. In this particular paper, the focus is on analyzing ML classifiers for fake news detection.

II. LITERATURE REVIEW

The increasing advancements in the Internet have simplified the ways to access online news. It is now the most popular way of sharing information. During this period, it has been seen that there is a considerable amount of increase in fake news. It is becoming a matter of large importance as many researchers like us, considered to work on detecting the fake news. The present work on this could be classified based on propagation structure, user information and news content. In propagation structure, the propagation of news (like transmission of news via some social network, likes, dislikes, re-tweets and other parameters) plays a major role. Methods for detecting the fake news can be categorized into two main groups: propagation via structure based methods and methods based on user's information. Propagation via structure based methods analyze the patterns of propagating news on digital media platforms to know the credibility of news. On the other hand, user's information based methods focus on characteristics of individuals playing role in the spread of news, including publishers, sharers, and commenters. These methods use features from user profiles such as gender, location, and number of followers to assess the credibility of the news. However, both these methods are limited by data issues such as missing or inaccurate information, as well as difficulties in collecting data. These limitations can affect the accuracy and reliability of the results obtained using these approaches [3].

In the paper [4], Ozbay, F. A. et al., proposed using Supervised AI algorithms to detect fake news by applying pre-processing to dataset to convert unstructured data to convert it into structured format. And then the texts in the structured dataset were later analyzed by 23 supervised AI algorithms along with various text mining techniques. But the other to detect fake news is in the paper [1], Kim et al., where summarization techniques along with graphs were used.

In paper [5], Rohit Kumar Kaliyar et al. proposed a deep learning model aimed at improving the detection of fake news by prioritizing tensor factorization. The researchers combined news content and social context by employing a coupled matrix-tensor factorization method to derive representation of both aspects. The model was designed with diverse filters over each layer and incorporated dropout to enhance accuracy. To classify the content of news and social context separately and together, a deep neural network was utilized. For evaluating the effectiveness of their approach, the authors conducted experiments on two real-world datasets: PolitiFact and BuzzFeed. The results demonstrated that their model, named Echo Fake'd, performed well than the existing baseline methods, achieving a validation accuracy 92.30%. This study signifies a significant progress in the field of fake news detection, showcasing the potential of this technique for accurately classifying fake news.

In the paper [6], Tanik Saikhet al., they describe various systems for detecting the fake news, including those based on machine learning with statistics, deep learning and both. Empirical evaluations suggest that these systems demonstrate promising performance, surpassing the current state-of-the-art systems.

In the paper [8], Hadeer Ahmed et al. used a model that blends n-gram analysis with machine learning methods. The authors used two separate feature extraction approaches and six different classification approaches to compare in order to assess the efficacy of this strategy.

TABLE I. REVIEW

Paper no	Dataset used	Objective	Methods used	Results	Limitations
[1]	HDFS dataset	Fake news detection	Novel graph-based fake news identification techniques utilizing graph- summarization method.	Their last proposed model shows best performance compared to comparison and baseline Models with around 12.68%p as well as 10.34%p, respectively.	They plan to perform new assessments with vast datasets and plan to use generative pertaining transformer models with other different summarization methods in order to identify fake news.
[3]	LUN and SLN, Weibo and RCED	Fake news detection	SLN and LUN test	The preliminary outcome illustrates the steadiness along with advantage of using proposed model.	The multimodal information techniques are not utilized to decode the issue of numerous-views fraud news identifying.
[4]	ISOT Fake News Data set, Buzz-Feed Political News Data set, Random Politi-cal News Data set	Fake news detection	Decision Tree algorithm, Zero-R, CVPS, WIHW algorithms	The decision tree algorithm provides the prime mean values of the accuracy, precision and F-measures.	The subsequent task is to enhance the current work by surveying latest algorithms and to incorporate intelligent optimization algorithms for good results.
[5]	Buzz-Feed along with Politi-Fact from the Fake News Net.	Fake news detection	Echo Fake D	With the usage of Buzz-Feed f-n, f-p rate were 13.64% (f-n) and 9.52% (f-p), while the f-n and f-p rate with Politi-Fact were found to be 9.52%(f-n) and 13.04(f-p).	Their future initiative: to investigate a precise classification with the help of temporal information.
[6]	Emergent dataset	Fake news detection	Traditional supervised ML along with Deep-learning approaches	Results obtained the score of 72.13 for FNC, MLP with SVM scored a 56.04 utilizing ML.	Many new linguistic based attributes with labeling the matters can be used
[8]	Horne and Adali dataset	Fake news detection	N gram analysis along with different feature extracting techniques	71% accuracy achieved.	Their upcoming work mainly focuses on racing through other openly accessible datasets

The earlier work was mostly about fake news detection using different methods like summarization along with graphs, supervised AI or ML algorithms, neural networks. However, most of these methods have certain limitations such as google search engine dependency and explain ability of ML and ML-based fake news detection methods and systems is not provided.

III. PROPOSED SYSTEM

The proposed solution involves the use of deep learning algorithms for detecting of fake news that would contain misinformation or misleading information. As these deep learning algorithms help us to classify the news it becomes easy to detect fake news once the news is classified. We used Fake news dataset that we obtained from Kaggle.com in our Proposed model. Our proposed system uses three deep learning approaches which are Naïve Bayes Classifier, Passive Aggressive Classifier and Random Forrest Classifier. These are discussed below.

A. Naive Bayes Classifier

Naive Bayes classifier is an algorithm which is based on a probability which is calculated via Bayes Theorem. It is used to infer which class a new possible feature will belong to in a given sample for given time.

$$P(B) = \frac{P(B \mid A) \times P(A)}{P(B)} \quad (1)$$

As Bayes theorem uses conditional probability A and B are given as conditions. Here, the classifier considers every semantic feature as a condition and classify the samples with the highest occurring probability [9].

B. Random Forest Classifier

In this classifier the classifying model is a decision tree, in which several circumstances branch out from their parent nodes, with every leaf node signifying a class label each. A random forest classifier, on the other hand, is an ensemble technique that mixes many decision trees to increase prediction accuracy. We may enhance the functionality of the random forest model by modifying variables like max depth, n estimators, random state and min samples split. The greatest depth of a decision tree is represented by max depth, the least number of samples needed to split an internal node is denoted by min samples split, and the number of estimators corresponds to decision trees count in the random forest [9].

C. Passive Aggressive Classifier

The Passive Aggressive Classifier is a simple to use incremental learning technique. In an effort to fix the error, it modifies the weight vector for each incorrectly categorized data point. The classifier is referred to as "passive" for successfully categorized data and "aggressive" for incorrectly classified data [10].

IV. RESULTS AND DISCUSSIONS

The results are obtained by implementing the model on the dataset. First a confusion matrix is computed based on the dataset. Then, measures such as accuracy, Fig. 7. score, recall is obtained. This is done with and without text pre-processing for both title and body of the news.

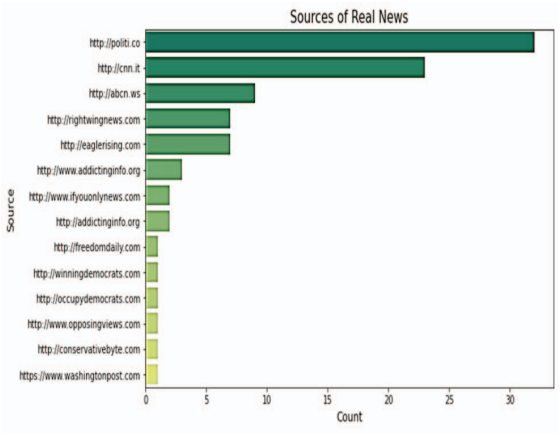

Fig. 1. Sources of real news

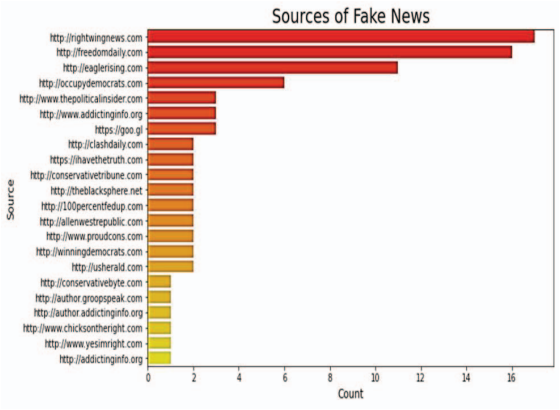

Fig. 2. Sources of Fake news

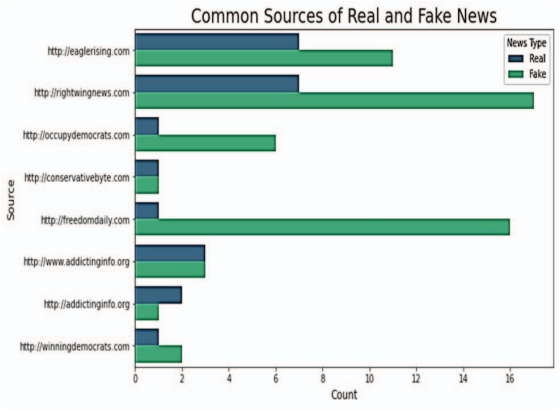

Fig. 3. Sources of real and fake news

The above graphs show the frequency of a specific kind of news and their sources. The URL sources contained in Fig. 1. are observed to publish only real news. Whereas, the sources in Fig. 2. are observed to only produce fake news. In Fig. 3. the URLs are observed to be the sources of both fake news and real news. This analysis on data provides us data about the realness of the news.

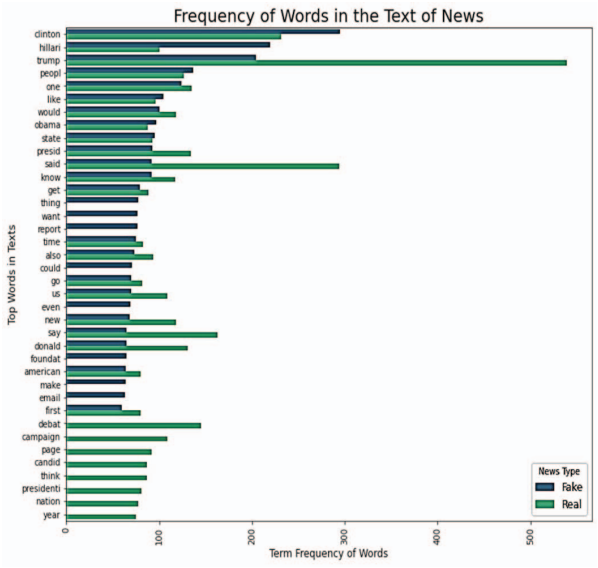

Fig. 4. Frequency of words in text of news

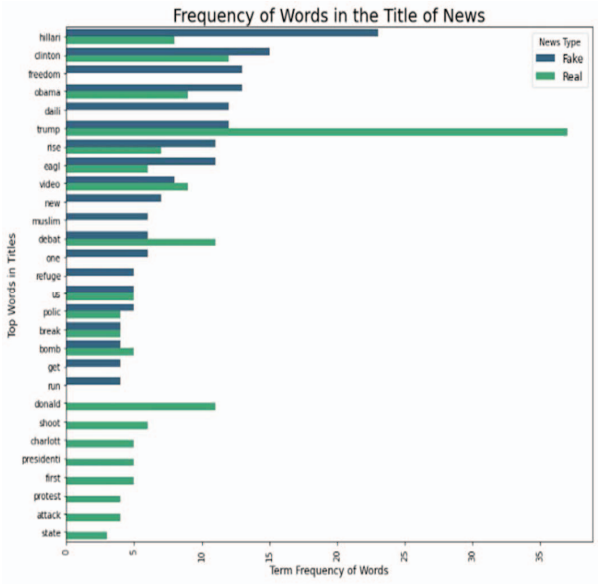

Fig. 5. Frequency of the words in title of the news

The Fig. 4. is a bar graph in which the y axis represents words and the x axis represents their frequency. Here, in this graph the words listed are the most frequent words in titles of news articles. The frequency of words in these titles provides a better idea for further analysis of data. Similarly, Fig. 5. provides the same frequency analysis but this time with text without titles of articles. This text analysis also plays a good role to know what the topic is about in the news.

Whereas In Fig. 6. is a distribution curve, it is plotted against density vs title length. The graph clearly shows that the mean value of distribution of fake news is larger than the mean value of the distribution of real news. This shows that on an average the title length of fake news is larger than that of the real news.

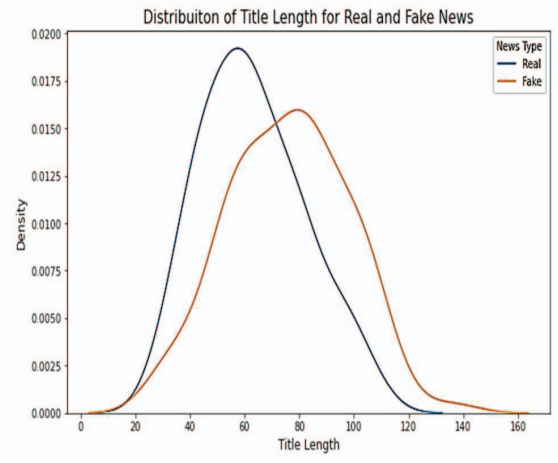

Fig. 6. Distribution for Real and Fake News

The dataset is analyzed using three classifiers. These classifiers are Random Forest classifier, Naive Bayes Classifier and Passive Aggressive classifier. For each classifier a confusion matrix is computed. This helps us to get a better idea about the classifier. The confusion matrix is computed first without preprocessing and next with preprocessing on the text news body. This also helps us to analyze the improvements while modeling the dataset. The results of these are stimulated as follows:

```
[[18  8]
 [ 6 23]]

              precision    recall  f1-score   support

        Fake       0.75      0.69      0.72        26
        Real       0.74      0.79      0.77        29

    accuracy                           0.75        55
   macro avg       0.75      0.74      0.74        55
weighted avg       0.75      0.75      0.74        55
```

Fig. 7. Random Forest Classifier without Text Pre-processing

```
[[22  4]
 [ 7 22]]

              precision    recall  f1-score   support

        Fake       0.76      0.85      0.80        26
        Real       0.85      0.76      0.80        29

    accuracy                           0.80        55
   macro avg       0.80      0.80      0.80        55
weighted avg       0.80      0.80      0.80        55
```

Fig. 8. Random Forest Classifier with Text Pre-processing

On analyzing with Random Forest classifier, the accuracy is observed to be 75I% without preprocessing (as shown in Fig. 7.). After preprocessing the accuracy is 80% (as shown in Fig. 8.). The 5% increase in accuracy shows the improvement in modeling.

```
[[25  1]
 [17 12]]

              precision    recall  f1-score   support

        Fake       0.60      0.96      0.74        26
        Real       0.92      0.41      0.57        29

    accuracy                           0.67        55
   macro avg       0.76      0.69      0.65        55
weighted avg       0.77      0.67      0.65        55
```

Fig. 9. Naive Bayes Classifier without Text Pre-processing

```
[[22  4]
 [13 16]]

              precision    recall  f1-score   support

        Fake       0.63      0.85      0.72        26
        Real       0.80      0.55      0.65        29

    accuracy                           0.69        55
   macro avg       0.71      0.70      0.69        55
weighted avg       0.72      0.69      0.69        55
```

Fig. 10. Naive Bayes Classifier with Text Pre-processing

Similarly, in case of Naive Bayes Classifier the accuracy is observed to be 67% without preprocessing (as shown in Fig. 9.). whereas, the accuracy increases from 67% to 79% with preprocessing (as shown in Fig. 10.). This increase shows us the improvement.

```
[[21  5]
 [ 3 26]]

              precision    recall  f1-score   support

        Fake       0.88      0.81      0.84        26
        Real       0.84      0.90      0.87        29

    accuracy                           0.85        55
   macro avg       0.86      0.85      0.85        55
weighted avg       0.86      0.85      0.85        55
```

Fig. 11. Passive Aggressive Classifier without Text Pre-processing

```
[[20  6]
 [ 8 21]]

              precision    recall  f1-score   support

        Fake       0.71      0.77      0.74        26
        Real       0.78      0.72      0.75        29

    accuracy                           0.75        55
   macro avg       0.75      0.75      0.75        55
weighted avg       0.75      0.75      0.75        55
```

Fig. 12. Passive Aggressive Classifier with Text Pre-processing

Lastly, on analyzing data using Passive aggressive classifiers the accuracy without preprocessing was found to be 85% (as shown in Fig. 11.) and with preprocessing the accuracy is 75% (shown in Fig. 12.) i.e., a loss of 10% accuracy was observed.

```
[[16 10]
 [10 19]]

              precision    recall  f1-score   support

        Fake       0.62      0.62      0.62        26
        Real       0.66      0.66      0.66        29

    accuracy                           0.64        55
   macro avg       0.64      0.64      0.64        55
weighted avg       0.64      0.64      0.64        55
```

Fig. 13. Random Forest Classifier without Text Pre-processing

```
[[22  4]
 [11 18]]

              precision    recall  f1-score   support

        Fake       0.67      0.85      0.75        26
        Real       0.82      0.62      0.71        29

    accuracy                           0.73        55
   macro avg       0.74      0.73      0.73        55
weighted avg       0.75      0.73      0.72        55
```

Fig. 14. Random Forest Classifier with Text Pre-processing

On analyzing with Random Forest classifier, the accuracy is observed to be 64% without preprocessing (as shown in Fig. 13.). After preprocessing the accuracy is 73% (as shown in Fig. 14.). The 11% increase in accuracy shows the improvement in modeling.

```
[[22  4]
 [19 10]]
```

	precision	recall	f1-score	support
Fake	0.54	0.85	0.66	26
Real	0.71	0.34	0.47	29
accuracy			0.58	55
macro avg	0.63	0.60	0.56	55
weighted avg	0.63	0.58	0.56	55

Fig. 15. Naive Bayes Classifier without Text Pre-processing

```
[[21  5]
 [17 12]]
```

	precision	recall	f1-score	support
Fake	0.55	0.81	0.66	26
Real	0.71	0.41	0.52	29
accuracy			0.60	55
macro avg	0.63	0.61	0.59	55
weighted avg	0.63	0.60	0.59	55

Fig. 16. Naive Bayes Classifier with Text Pre-processing

Similarly, in case of using Naive Bayes Classifier on titles the accuracy is observed to be 58% without preprocessing (as shown in Fig. 15.). Whereas, the accuracy increases from 58% to 60% with preprocessing (as shown in Fig. 16.). This increase shows us the improvement.

```
[[20  6]
 [17 12]]
```

	precision	recall	f1-score	support
Fake	0.54	0.77	0.63	26
Real	0.67	0.41	0.51	29
accuracy			0.58	55
macro avg	0.60	0.59	0.57	55
weighted avg	0.61	0.58	0.57	55

Fig. 17. Passive Aggressive Classifier without Text Pre-processing

```
[[20  6]
 [15 14]]
```

	precision	recall	f1-score	support
Fake	0.57	0.77	0.66	26
Real	0.70	0.48	0.57	29
accuracy			0.62	55
macro avg	0.64	0.63	0.61	55
weighted avg	0.64	0.62	0.61	55

Fig. 18. Passive Aggressive Classifier with Text Pre-processing

Lastly, on analyzing data using Passive aggressive classifier on titles the accuracy without preprocessing was found to be 58% (as shown in Fig. 17.) and with preprocessing the accuracy is 62% (shown in Fig. 18.) i.e., an increase of 4% accuracy was observed.

V. CONCLUSION

These days of large amounts of information coming to us through various sources we know that a part of the information is incorrect and usually comprises false or misleading facts this type of news is termed as Fake news. It has been observed that fake news contains content which is poorly researched. Spreading fake news may have varied aims like damaging the dignity of people, to create demand for a product…etc. In order to maximize the effectiveness of fake news detection we have proposed three classifiers which are the Naive Bayes classifier, the Passive Aggressive classifier and the Random Forest classifier. The accuracy obtained using these ML classifier algorithms are 69% (with text preprocessing), 85% (without text preprocessing) and 80% (with text preprocessing) respectively. Thus, the model using the Passive Aggressive classifier has the highest accuracy of 85%. In future work, we will improve the accuracy of the model using other deep learning models.

REFERENCES

[1] Kim, G., & Ko, Y. (2021). Effective fake news detection using graph and summarization techniques. Pattern Recognition Letters, 151, 135-139.

[2] Freire, P. M. S., da Silva, F. R. M., & Goldschmidt, R. R. (2021). Fake news detection based on explicit and implicit signals of a hybrid crowd: An approach inspired in meta-learning. Expert Systems with Applications, 183, 115414.

[3] Wang, Y., Wang, L., Yang, Y., & Lian, T. (2021). SemSeq4FD: Integrating global semantic relationship and local sequential order to enhance text representation for fake news detection. Expert Systems with Applications, 166, 114090.

[4] Ozbay, F. A., & Alatas, B. (2020). Fake news detection within online social media using supervised artificial intelligence algorithms. Physica A: statistical mechanics and its applications, 540, 123174.

[5] Kaliyar, R. K., Goswami, A., & Narang, P. (2021). EchoFakeD: improving fake news detection in social media with an efficient deep neural network. Neural computing and applications, 33, 8597-8613.

[6] Saikh, T., Anand, A., Ekbal, A., & Bhattacharyya, P. (2019). A novel approach towards fake news detection: deep learning augmented with textual entailment features. In Natural Language Processing and Information Systems: 24th International Conference on Applications of Natural Language to Information Systems, NLDB 2019, Salford, UK,

June 26–28, 2019, Proceedings 24 (pp. 345-358). Springer International Publishing.

[7] Kaliyar, R. K., Goswami, A., & Narang, P. (2021). FakeBERT: Fake news detection in social media with a BERT-based deep learning approach. Multimedia tools and applications, 80(8), 11765-11788.

[8] Ahmed, H., Traore, I., & Saad, S. (2017). Detection of online fake news using n-gram analysis and machine learning techniques. In Intelligent, Secure, and Dependable Systems in Distributed and Cloud Environments: First International Conference, ISDDC 2017, Vancouver, BC, Canada, October 26-28, 2017, Proceedings 1 (pp. 127-138). Springer International Publishing

[9] Bharadwaj, P., & Shao, Z. (2019). Fake news detection with semantic features and text mining. International Journal on Natural Language Computing (IJNLC) Vol, 8.

[10] Gowri, S., Jenila, J., Reddy, B. S., & Sheela, M. A. (2021, March). Scrutinizing of Fake News using Machine Learning Techniques. In 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS) (pp. 223-227). IEEE.