IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Hybrid NLP And Machine Learning Approach For Fake News Detection And News Popularity Prediction

[1]Gaurav Kumar, [2]Saurav Kumar, [3]Raushan Kumar, [4]Jay Prakash Kumar, [5]Ajeet Kumar Gupta

[1,2,3,4]B. Tech Student, [5]Assistant professor

Department of Computer Science and Engineering

Darbhanga College of Engineering, Darbhanga, India

Abstract **-** The rapid growth of digital media has made it easier to find information, but it has also made it easier for fake news and misinformation to spread, which is a major threat to public discourse. At the same time, predicting how popular news articles will be is important for understanding how users interact with content and how it spreads. In this paper, we created a new dual-task machine learning framework that uses both textual content features and user engagement metrics to find fake news and predict how popular news will be. We used Natural Language Processing methods, specifically TF-IDF vectorization, to get useful representations from news headlines. We also added user-focused features like past behavior, engagement patterns, sentiment analysis, and source reliability to make the credibility assessment more accurate. We used Support Vector Machine (SVM) to tell the difference between real and fake news and Random Forest to guess how popular something will be. We developed a web interface where users can input news headlines and engagement metrics to receive real-time fake news detection and popularity predictions. Experimental results demonstrate that our approach achieves superior performance compared to traditional content-based methods, validated through confusion matrices and standard classification metrics.

Keywords: Fake News Detection, News Popularity Prediction, TF-IDF, SVM, Random Forest, NLP, User Engagement.

I. INTRODUCTION

Rapid growth in the internet and social media has led to easy access to information all around the world at an unparalleled pace. In comparison to other conventional media like newspapers and journals, the internet and social media are now considered the major sources of news because of their instant availability. However, this area can produce any information that may deceive society and cause chaos [1]. Detection of fake news is difficult because of several reasons, such as scarcity of data, manipulation of language used, and dynamicity of internet content. Machine Learning (ML) and Natural Language Processing (NLP) methods have been widely applied to solve this problem by automatically categorizing the news article [2]. TF-IDF, bag-of-words, and n-gram models are commonly applied for feature extraction, and SVM, Naïve Bayes, and Passive-Aggressive classifiers have been successfully used to detect fake news [3].

From recent studies, it appears that content-based analysis alone is not sufficient for detection purposes. Using features involving the credibility of the users, such as user behavior, interactions, and reliability of the sources shared, significantly improves detection results. Using content-based and user-based features together provides better results for detecting misinformation and stopping its spread [4]. Along with verification, predicting the popularity of news has become an important area since interesting news tends to spread regardless of their validity. Predicting popularity is done using metrics such as shares, likes, and

views [5]. Several researchers have used UCI Machine Learning Repository datasets with a focus on Mashable News data.

Some of the popular models that have been used to predict news popularity include Random Forest, Logistic Regression, Gaussian Naïve Bayes, K-Means, and Multinomial Naïve Bayes. Among all these models, Gaussian Naïve Bayes was highly accurate with accuracy of 92% and was also effective for dealing with imbalanced data and detecting outliers [6]. Some other advanced approaches considered were based on the use of LightGBM, XGBoost, and One-Class SVM, where One-Class SVM showed 88% accuracy while performing well when combined with autoencoder algorithms [7],[8]. In this paper, the machine learning-based solution for detection of fake news and predicting their popularity is suggested. This approach combines the use of text features and user activity metrics. Text features will be extracted by using the TF-IDF algorithm and will be utilized by classifiers such as SVM, Naïve Bayes, and Passive-Aggressive for detecting fake news. Popularity will be predicted using engagement metrics through information propagation analysis. Python along with Scikit-learn framework will be used for implementing the project.

II. RELATED WORKS

The area of detecting fake news has gained much attention in recent times because of the high level of spreading misinformation through social media and the effect that this misinformation has on other fields including political, economic, and healthcare [21], [22]. The popular machine learning algorithms, such as Logistic Regression and Naive Bayes, perform well and serve as a standard to compare the future work against. Nevertheless, they have many disadvantages, including inability to capture complicated contexts and heavy dependency on the quality of both dataset and feature extraction [4], [11], [13], [18].

With advancements in Natural Language Processing (NLP) and deep learning, more powerful models have been developed. Techniques such as CNN, LSTM, and attention-based models outperform traditional methods by capturing semantic and contextual information more effectively [17], [24]. Transformer-based models further enhance performance by understanding deeper linguistic relationships in text [3], [7]. However, relying only on textual data is often insufficient, which has led to the development of multimodal approaches.

Multimodal detection for fake news incorporates both textual as well as visual content. Research suggests that multimodal models perform better than the unimodal approach in terms of accuracy due to integration of features from both text and image [9], [14], [16]. The recent research is concentrated more on cross-modal interaction and progressive fusion approach for better handling the relationships among the modalities [15], [16]. Light weight models utilize semantic similarities for improving textual feature through captions [9].

Besides content-based methods, recent literature shows that it is necessary to take into account features regarding both the users and publishers. Features such as user credibility, influence, behaviour, and sources' authenticity considerably increase the effectiveness of fake news detection [8], [10], [19], [20]. Furthermore, there are some techniques based on network and community detection methods [12].

Another area that has received considerable interest is news popularity prediction. Algorithms like Random Forest, Support Vector Machine, Neural Networks, and Naïve Bayes are employed to predict the popularity of the news using engagement metrics like sharing, liking, and viewing [5], [6], [23]. This research shows that the integration of content features with engagement features improves the performance of prediction, especially when dealing with unbalanced datasets.

Current studies are centered around the combination of fake news identification and popularity prediction through hybrid and multimodal methods. The methods employ text, image, and user interaction characteristics together to improve the efficiency of the system [6], [7], [15]. But issues like class imbalance, dynamic nature of misinformation, and high computation complexity persist.

In our research, a machine learning model is designed that integrates the detection of fake news along with predicting news popularity. TF-IDF method is employed to extract features from text, and classifiers like SVM, Naïve Bayes, and Passive Aggressive are used to detect fake news. Moreover, measures of user engagement such as likes, shares, and views are considered to predict the popularity of news items. Through the fusion of textual information and user interaction data, the proposed model seeks to attain high levels of accuracy and provide an effective means of analysis.

III. METHODOLOGY

The proposed system is designed to perform fake news detection and news popularity prediction using machine learning and Natural Language Processing (NLP) techniques. The system follows a structured approach consisting of multiple stages such as data collection, preprocessing, feature extraction, model training, and prediction. These stages ensure accurate classification and efficient performance.

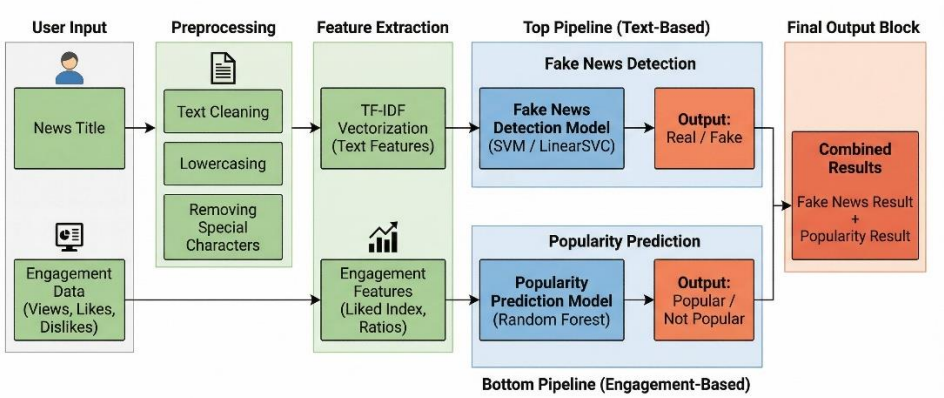

Fig. 1: System Architecture of Proposed System

The overall architecture of the proposed system is shown in Fig. 1. It consists of different modules including user input, preprocessing, feature extraction, machine learning model, and output generation. The user provides a news title along with engagement-related features, which are processed through each module sequentially to generate prediction results.

The system integrates two main components:

- Fake News Detection Model
- Popularity Prediction Model

Both models work together to provide final output to the user.

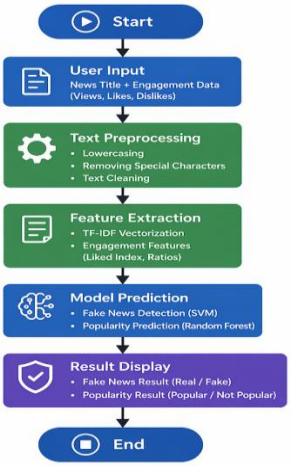

Fig. 2: Workflow of Fake News Detection System

The workflow of the system is illustrated in Fig. 2, which shows the step-by-step execution process. The system begins with user input, followed by preprocessing of text, feature extraction, model prediction, and final result display. Each stage contributes to transforming raw input data into meaningful predictions.

	title	views	liked	disliked	liked_index	label
35	eagenda aaj tak cm special cm yogi said situation	116923	1994	417	0.827042721	0
36	yogi said in eagenda aaj tak cm special we started t	55986	600	106	0.849858357	0
37	yogi said in eagenda aaj tak cm special full help will	46338	506	88	0.851851852	0
38	yogi said in eagenda aaj tak cm special we took car	40879	567	147	0.794117647	0
39	every news of your city your state cities news may	386932	4266	767	0.847605802	1
40	number of corona patients in the country crosses th	213942	2176	403	0.843737883	1
41	big news of this time in the country and the world i n	202468	3108	469	0.86888454	1
42	police attacked for erecting barricades in quarantin	58230	519	136	0.792366412	0
43	big news of this time in the country and the world i m	62036	939	159	0.855191257	0
44	your stars daily horoscope deepak kapoor i may	34600	640	66	0.906515581	0
45	the big morning news in one which is important for y	145380	2595	416	0.86183992	1
46	big news of this time in the country and the world i n	2684987	24281	3316	0.879842012	1
47	corona patients arrived in maharashtra in one day t	110731	719	164	0.814269536	0
48	new cases of corona in last hours in maharashtra p	27417	336	67	0.833746898	0

Fig. 3: News Dataset

The dataset used in this study is self-collected from online news sources and social media platforms to ensure real-world relevance. It contains news titles, labels (fake/real), and engagement features such as views, likes, dislikes, and liked index. A sample of the dataset is shown in Fig. 3, which highlights the structure and attributes used for training.

In the preprocessing stage, the input text is cleaned by converting it to lowercase and removing special characters using regular expressions. This step improves data quality and ensures consistency. After preprocessing, feature extraction is performed using the TF-IDF (Term Frequency–Inverse Document Frequency) technique, which converts textual data into numerical vectors.
Unigram and bigram features are used, and a numerical feature (liked index) is also combined with textual features to improve performance.

$$TF\text{-}IDF(t,d) = TF(t,d) \times \log\left(\frac{N}{DF(t)}\right)$$

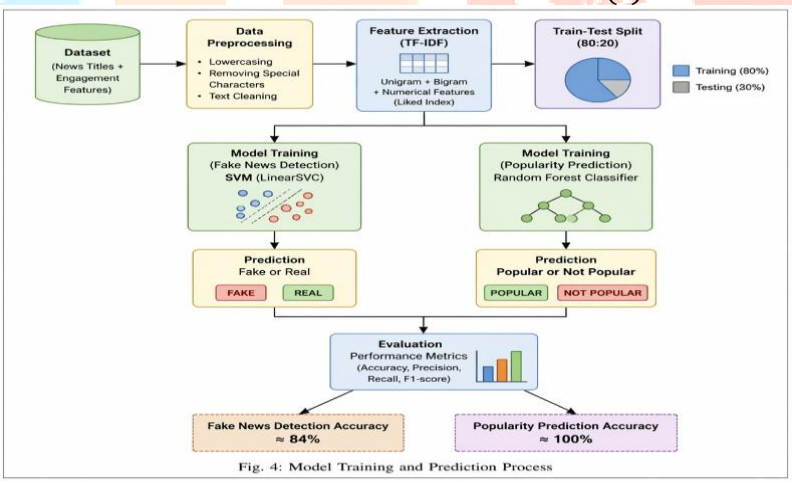

Fig. 4: Model Training and Prediction Process

The model training and prediction process is shown in Fig. 4. The dataset is divided into training and testing sets in an 80:20 ratio. A Support Vector Machine (LinearSVC) model is used for fake news detection, achieving an accuracy of approximately 84%. For popularity prediction, a Random Forest Classifier is used, which classifies news as popular or not based on engagement features, achieving an accuracy of 100%.
Overall, the system processes input data through multiple stages and produces two outputs: fake news classification (real/fake) and popularity prediction (popular/not popular). This integrated approach helps in analyzing both the credibility and potential reach of news articles effectively.

IV. Result and Discussion

The performance of the proposed system is evaluated using standard machine learning evaluation metrics. The system is tested on the self-collected dataset, and the results demonstrate the effectiveness of combining textual and engagement-based features for fake news detection and popularity prediction.

For the fake news detection task, the Support Vector Machine (LinearSVC) model is used. The dataset is divided into training and testing sets in an 80:20 ratio. The model achieves an accuracy of approximately 84%, indicating that it can effectively classify news articles as real or fake. The performance shows that TF-IDF feature extraction combined with machine learning algorithms provides reliable results for text classification tasks.

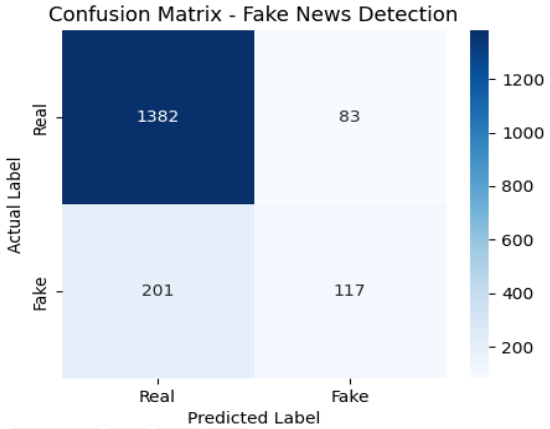

Fig. 5: Fake News Confusion Matrix

The confusion matrix for fake news detection is shown in Fig. 5**,** which represents the number of correctly and incorrectly classified instances. The model performs well in identifying real news articles, while a few misclassifications occur in borderline cases where textual patterns are similar. This indicates that although the model is effective, further improvements can be made by incorporating more advanced features or larger datasets.

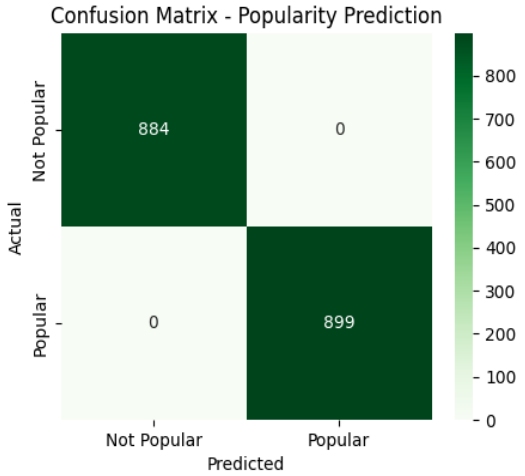

Fig. 6: Popularity Confusion Matrix

The confusion matrix for fake news detection is presented in Fig. 6, which shows the distribution of correctly and incorrectly classified instances. The model performs well in identifying real news articles; however, some misclassifications occur, particularly in distinguishing fake news, due to similarities in textual patterns. This suggests that incorporating more advanced features or larger datasets could further improve performance.

For the news popularity prediction task, a Random Forest Classifier is used. The model takes engagement-related features such as views, likes, dislikes, and liked index as input. The popularity of news is determined based on whether the number of views exceeds a defined threshold (median value). The model achieves an accuracy of 99.9%, demonstrating excellent performance in classifying news as popular or not popular.

The high accuracy of the popularity model indicates that engagement features are strong indicators of news popularity. However, this result may also suggest that the dataset is relatively simple or well-structured, and further validation on larger datasets may be required to ensure generalization.

A comparative analysis of both models shows that:

- The fake news detection model depends mainly on textual features and achieves moderate accuracy
- The popularity prediction model relies on numerical engagement features and achieves very high accuracy

This highlights the importance of combining different types of features for better system performance.

Overall, the proposed system successfully integrates fake news detection and popularity prediction into a single framework. The results demonstrate that the system can analyze both the credibility and potential reach of news articles. Despite achieving good performance, the system can be further improved by using larger datasets, deep learning models, and multimodal features such as images and user behaviour.

V. CONCLUSION

In this paper, a machine learning–based system for fake news detection and news popularity prediction has been proposed and implemented. The system integrates Natural Language Processing (NLP) techniques with user engagement features to analyze both the credibility and potential reach of news articles. TF-IDF is used for feature extraction from textual data, while machine learning models such as Support Vector Machine (SVM) and Random Forest are employed for classification tasks. The experimental results demonstrate that the proposed system is effective in detecting fake news, achieving an accuracy of approximately 84%, and highly efficient in predicting news popularity with an accuracy of 99.9%. These results highlight the importance of combining textual analysis with engagement-based features for improved performance. Although the system shows promising results, there are certain limitations such as dependency on dataset size and the absence of multimodal features like images and user behaviour. Future work can focus on incorporating deep learning models, larger datasets, and multimodal data to further enhance the performance and robustness of the system. Overall, the proposed approach provides a practical and efficient solution for addressing the challenges of fake news detection and popularity prediction in real-world scenarios.

REFERENCES

[1] Baarir, N. F., & Djeffal, A. (2021, February). Fake news detection using machine learning. In *2020 2nd International workshop on human-centric smart environments for health and well-being (IHSH)* (pp. 125-130). IEEE.

[2] Shaikh, J., & Patil, R. (2020, December). Fake news detection using machine learning. In *2020 IEEE international symposium on sustainable energy, signal processing and cyber security (iSSSC)* (pp. 1-5). IEEE.

[3] Khanam, Z., Alwasel, B. N., Sirafi, H., & Rashid, M. (2021, March). Fake news detection using machine learning approaches. In *IOP conference series: materials science and engineering* (Vol. 1099, No. 1, p. 012040). IOP Publishing.

[4] Gupta, A. K. (2023). Fake News Detection based on User Credibility: A Comprehensive Analysis. In *Proceedings of 2nd International Conference on Research in Multidisciplinary Studies-2023*.

[5] Gupta, A. K. Artificial Intelligence (AI) in Healthcare: A Comprehensive Analysis.

[6] Tsai, M. J., & Wu, Y. Q. (2022). Predicting online news popularity based on machine learning. *Computers and Electrical Engineering*, *102*, 108198.

[7] Devaraj, J. (2024). A Comparative Analysis of Deep Learning Models for Fake News Detection and Popularity Prediction of Articles. In *Intelligent Systems and Sustainable Computational Models* (pp. 246-265). Auerbach Publications.

[8] Gupta, A. K., & Kumar, P. (2018). A comparative analysis of machine learning techniques for fake news detection. *International Journal of Research and Analytical Reviews (IJRAR), E-ISSN*, 2348-1269.

[9] Gupta, A. K., Kumar P., Kumar S. (2019). Enhancing fake news detection through user credibility analysis. *International Journal of Research and Analytical Reviews (IJRAR), E-ISSN*, 2348-1269.

[10] Jarrahi, A., & Safari, L. (2023). Evaluating the effectiveness of publishers' features in fake news detection on social media. *Multimedia Tools and Applications*, *82*(2), 2913-2939.

[11] Sudhakar, M., & Kaliyamurthie, K. P. (2022). Effective prediction of fake news using two machine learning algorithms. *Measurement: Sensors*, *24*, 100495.

[12] Amira, A., Derhab, A., Hadjar, S., Merazka, M., Alam, M. G. R., & Hassan, M. M. (2023). Detection and analysis of fake news users' communities in social media. *IEEE Transactions on Computational Social Systems*, *11*(4), 5050-5059.
[13] Hamed, S. K., Ab Aziz, M. J., & Yaakub, M. R. (2023). A review of fake news detection approaches: A critical analysis of relevant studies and highlighting key challenges associated with the dataset, feature representation, and data fusion. *Heliyon*, *9*(10).
[14] Segura-Bedmar, I., & Alonso-Bartolome, S. (2022). Multimodal fake news detection. *Information*, *13*(6), 284.
[15] Li, X., Qiao, J., Yin, S., Wu, L., Gao, C., Wang, Z., & Li, X. (2025). A survey of multimodal fake news detection: a cross-modal interaction perspective. *IEEE Transactions on Emerging Topics in Computational Intelligence*.
[16] Jing, J., Wu, H., Sun, J., Fang, X., & Zhang, H. (2023). Multimodal fake news detection via progressive fusion networks. *Information processing & management*, *60*(1), 103120.
[17] Mridha, M. F., Keya, A. J., Hamid, M. A., Monowar, M. M., & Rahman, M. S. (2021). A comprehensive review on fake news detection with deep learning. *IEEE access*, *9*, 156151-156170.
[18] Capuano, N., Fenza, G., Loia, V., & Nota, F. D. (2023). Content-based fake news detection with machine and deep learning: a systematic review. *Neurocomputing*, *530*, 91-103.
[19] Sitaula, N., Mohan, C. K., Grygiel, J., Zhou, X., & Zafarani, R. (2020). Credibility-based fake news detection. In *Disinformation, misinformation, and fake news in social media: Emerging research challenges and Opportunities* (pp. 163-182). Cham: Springer International Publishing.
[20] Azer, M., Taha, M., Zayed, H. H., & Gadallah, M. (2021). Credibility detection on twitter news using machine learning approach. *International Journal of Intelligent Systems and Applications*, *10*(3), 1.
[21] Olan, F., Jayawickrama, U., Arakpogun, E. O., Suklan, J., & Liu, S. (2024). Fake news on social media: the impact on society. *Information Systems Frontiers*, *26*(2), 443-458.
[22] Gupta, A. K., & Singh, M. P. (2025). Multimodal Fake News Detection Through Semantically Enriched Image Captions. *SN Computer Science*, *6*(8), 1020.
[23] Gupta, A. K., & Singh, M. P. (2026). Self and cross-modal attention based features fusion for fake news detection. *Multimedia Tools and Applications*, *85*(1), 10.
[24] Gupta, A. K., & Singh, M. P. (2026). Multimodal Fake News Detection using Semantic-Visual Alignment and Attention Fusion. *SN Computer Science*, *7*(4), 305.