

A Hybrid Machine Learning Model for Detecting Fake News

Arpita Samaddar ¹(samaddararpita06@gmail.com)

Dr. Komal Prasad Yadav ²(it.sruraipur@gmail.com)

¹P.G SCHOLAR, DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH, INDIA

²ASSISTANT PROFESSOR, DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, SHRIRAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH, INDIA

Abstract—The dissemination of misinformation on digital platforms is a serious threat to society and has a negative impact on public opinion and the trust in digital media. In this work, an efficient Identification of Fake News using the NLP-based approaches and classification algorithms is introduced with the help of Machine learning methodology. The text data is used to learn and extract features using count vectoriser and TF-IDF techniques and Logistic regression is used for classification as it is simple and effective in binary classification. The external information sources and fact checking processes are added to the reliability of the model to form a hybrid detection framework. The model is trained and tested with real world data to make sure that it is accurate, precise and recall. The results of the experiment showed that the proposed approach outperforms the other approaches in distinguishing real and fake news articles. The study indicates that the creation of user-level scalable algorithms to detect fake news in real-time using machine learning and language features may be helpful for digital platforms and policy makers, in general.

Keywords— Fake News Detection, Machine Learning, NLP, Logistic Regression, TF-IDF, Count Vectorizer, Hybrid Model, Fact-checking.

I. INTRODUCTION

Digital media has transformed people's ways of accessing and disseminating information, such as the use of social media and news sites. However, misinformation and fake news has become increasingly concerning around the world. Fake news is deliberately

false or misleading information that is presented as news, often with the intent of shaping public opinion, advancing a political agenda or making money from traffic driven to websites. Such information is extremely harmful to democratic states, public health and social peace because it is viral and has no effective moderation system in place. Manual fact-checking and verification are time-consuming and ineffective in the quantity of fake news created and spread.

Thus, automatic and intelligent systems to identify and weed out fraudulent information have become a critical need. The challenge lies in finding a solution that can uncover patterns and features within the text to identify misleading content. Enter machine learning and Natural Language Processing (NLP). Machine learning, combined with Natural Language Processing (NLP), can be a solution by analysing patterns and features in textual data to identify misleading content. Our research suggests a hybrid ML algorithm for FNE identification, which combines content-based and context-aware algorithms. Count Vectorizer and TF-IDF are used to transform a text into numerical features while Logistic Regression is used for binary classification. Moreover, external knowledge sources are used to check the validity of the content, which improves the credibility of the system.

The system is trained and tested on benchmark datasets with high accuracy and robustness for distinguishing real and fake news articles. This work seeks to contribute to the current efforts in eliminating

disinformation and supporting trustworthy information distribution using scalable, automated methods.

II. LITERATURE SURVEY

With the great growth of the amount of content being produced online, one study [1] examines how fake news is spread via social media. The study highlights the complexity of assessing authenticity of news, demonstrating that domain knowledge is needed even by humans as experts. Using Natural Language Processing (NLP) techniques, machine learning methods are used for identifying information in text-based news, before that, the news is preprocessed using Count Vectorizer and TF-IDF. Several classifiers are then trained and evaluated based on various performance measures to efficiently classify fake and true news.

A thorough review of the effect of social media as one of the most used platforms for transmitting news is provided by another study [2] which highlights its cost-effectiveness and accessibility. The report, however, highlights the harm that can be done because of the spread of fake news in many quarters, such as politics and education. The study underlines the

importance of early detection using machine learning approaches and gives a complete assessment of the available research in this topic. This music is compared with the effectiveness of other algorithms like Decision Tree (DT) and Support Vector Machine (SVM) in detecting bogus news in social media in work [3]. It shows that by practical examination, the DT algorithm achieves better accuracy i.e. 97.67 % which is statistically significant from the SVM algorithm as 91.74 %. This finding conforms with the inclination towards DT in fake news classification tasks. The authors of [4] present a detailed study of approaches for the detection of false news using traditional and more advanced machine learning techniques. It shows a model performances with acceptable accuracy rates like Naive Bayes (95.27%), Logistic Regression (98.84%) and Decision Tree (99.58%). The study further demonstrates a practical web-based solution developed using the Django framework with real-time application and highlights the importance of interdisciplinary collaboration.

In the study presented in [5] the issues that arise due to fake news in an online context and the importance of AI and ML to address these issues are discussed. This study classifies fake news into two types: linguistic and

visual, and investigates the advantages and disadvantages of existing detection methods. It highlights the importance of evaluating the capacity of each methodology to determine the most appropriate one for fake news detection study.

References	Methods	Objective	Gaps Identified
[1] V. Gupta (2022)	NLP, ML classifiers	Explore textual properties to classify fake and real news using ML models	No mention of dataset size or generalization; lacks focus on real-time detection
[2] A. Singh (2022)	Survey of ML methods	Overview of existing methods for detecting fake news	Broad and lacks experimental validation or specific evaluation criteria
[3] N. L. S. R. Krishna (2022)	Decision Tree, SVM	Compare accuracy of DT and SVM on social media fake news detection	Focuses only on accuracy, lacks analysis of recall, F1-score, or real datasets
[4] M. Nirmala (2024)	Traditional ML, Deep learning	Survey of ML methods with evaluation and a Django tool demonstrations in it	Limited focus on fake news from domains other than text (e.g., images, videos)

[5] P. G, M. Germana us Alex (2022)	ML- based AI tools	Review of functionaliti es and limitations of FND models	General analysis; lacks experimentat ion and benchmark dataset validation
---	--------------------------	---	--

Table 1. Comparison with Existing Work

The table1 summarizes some of the studies done on identifying fake news by machine learning algorithms. All of the studies look at a variety of methodologies, but there are recurring problems such as being out of the loop, limited assessments, and weak data validation.

III. PROPOSED SYSTEM

The proposed system is an enhanced Hybrid system which integrates both Content-based and Knowledge-based method for detecting Fake news in the era of digitalization to improve both the accuracy and effectiveness of Fake news detection. Typical methods for detecting conventional fake news are fact-checking and subjective evaluation, which can be time-consuming and inefficient to deal with the increasing amount of news information. We address these limitations by leveraging machine learning algorithms and external validation sources, and offer a scalable, real-time solution to detect misinformation. The system analyzes textual content, cross-references and assesses it for authenticity in a variety of ways. The content-driven and knowledge-driven approaches are both adopted in this system, with the hybrid approach dominating. Content-based approach is based on Textual Content Analysis and includes the NLP methods such as TF-IDF and Count Vectorizer to detect the anomalies. These techniques transform the text into numerical features, and then use machine learning techniques, like Logistic Regression, to categorize the text. The knowledge-based method on the other hand, enhances the accuracy of detection by checking news claims with reliable fact-checking information sources and databases. The double technique offers high robustness and lower false positive rate and endorses a high level of authenticity of news prior to final categorisation. The system has been designed to seamlessly work with different data sources, including news articles and social media posts and starting with data collection then executing the data preprocessing,

cleaning and pre-processing. The model after feature extraction, then uses the classifiers with machine learning to classify the news as fake or real in news. The algorithm also cross references and matches the fake information that is detected with external information with a high degree of accuracy. The model is fine-tuned using other techniques like hyperparameter optimization and cross validation to reduce bias and variance and maximize the model performance in a hybrid model.

The final classification is made through an easy to use web interface that allows users to upload news items to be analysed in real time and to decide whether or not they are legitimate. This will help to identify and flag fake news as soon as it is published and ensure that fake news is not disseminated via digital platforms. The proposed design can be easily scalable for handling multiple domains and large amount of data in an efficient manner. The proposed system is based on machine learning and fact checking techniques which provides a reliable, unbiased and automatic fake news detection solution. This novel approach greatly decreases the need on human verification processes, giving a faster and more accurate manner of combatting misinformation in today's fast-paced digital landscape. The system architecture diagram (Fig. 1) represents the data flow chart of the system, which shows directions of data inputs to the system, data sorting and output to the screen.

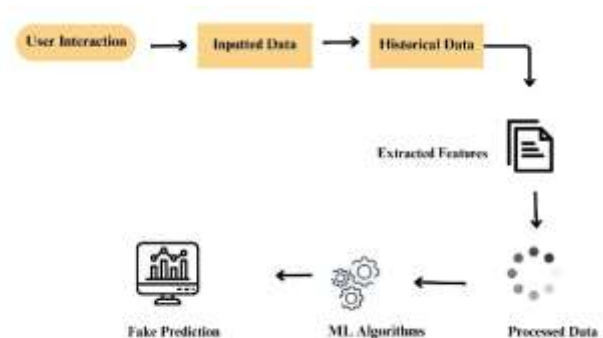


Fig 1. Proposed System Architecture

IV. IMPLEMENTATION

Various integrated modules are required in the proposed system to complement each other and use the machine learning approach to detect fake news. The algorithms used in the system are chosen according to their particular benefits, giving a well-balanced and

accurate classification system. The proposed system employs ensemble learning method – Random Forest Classifier which is an ensemble of multiple Decision Trees trained by using different training sets. It helps to reduce overfitting, noise, variance, and to enhance stability and generalization of the model, which is very suitable for unstructured and noisy text data. Using Logistic Regression as a baseline model, it provides a quick and easy-to-understand baseline analysis of the linear relationship between word characteristics and the risk of being a fake news story. The Decision Tree algorithm provides transparency in that it provides a meaningful text component that helps to understand why classifications are made and therefore gives a transparent decision making process. Due to the high dimensional feature space problem, in particular to differentiate between fake news and real news, the Support Vector Machine (SVM) is introduced. These models can be combined to provide a usable system for providing plausible, reliable and explainable predictions, and demonstrates the credibility and applicability of these models in real world applications for detecting fake news.

A. Data Collection Module

This module is designed to learn information from a number of resources including news articles, social media posts and other text-based information. It collects the labeled data (real and fake news) and unlabeled data for training a complete set of data. The data is collected using web scraping methods and APIs, which provide an extensive coverage of news articles. All the data acquired is recorded in a data base, structured and secured to ensure privacy and integrity. This ensures that the algorithm can leverage on a large number of sources and categories of news to better identify it.

B. Data Preprocessing Module

Raw data may have irrelevant information, missing data, and noise that can affect the quality of machine learning models. The module carries out the data cleaning, tokenisation, removal of stop words and text normalisation. It also uses feature extraction methods such as the Count Vectorizer and TF-IDF (Term Frequency-Inverse Document Frequency) to convert text input into numeric features. This data is then standardized to enhance the accuracy of the model and to make sure that only high fidelity and clean data is used to train and test the model. Moreover, techniques of dimensionality reduction are used to remove features that are redundant, which will make the model more efficient.

C. Machine Learning Model

The predictive power of the system depends on the machine learning model. The system employs Logistic Regression and Ensemble Learning approach such as Bagging Classifier for classification. The model is trained on the processed data and performance is analysed using traditional metrics, such as accuracy, precision, recall and F1-score. The Bagging Classifier is a method that improves the performance of the model and reduces variance and overfitting since it combines several decision trees created from random subsets of the data. Hyperparameter tuning is performed to fine-tune the model performance. Cross validation is performed to test how reliable and robust the model is and to ensure that the system performs well on new data.

D. Web Application Module

A user-friendly web interface is developed to facilitate the identification of fake news in real time. A user-friendly online interface is created to facilitate the identification of fake news in real-time. The web interface is meant for both non-technical users (such as journalists or general users) and technical users (such as data scientists or administrators). The input can be a text, a news URL or a news article that is uploaded and then analyzed by the machine learning model in the backend. The results, such as the chance of the news being authentic or fraudulent, are displayed in an easy-to-understand format. The system also offers visual analytics (graphs, tables) for insights about the classification results. Authentication and user management systems ensure that the web interface is secured and only the users with permissions can access the system.

E. Model Integration and Deployment

After the machine learning model is developed and tested, it is integrated into the web application. Once developed and tested, the machine learning model is integrated into the web application. APIs are developed to connect the backend machine learning model with the front-end web interface, facilitating smooth communication between the two. This deployment is deployed in a scalable cloud platform, where large traffic of users can be well managed. This system aims to deliver quick predictions, which allows processing news articles in real-time. The system is designed to be secure, with user data protected by security measures embedded within the system, and low latency and high

availability, ensuring that the system operates consistently and reliably.



Fig 2. Model Page

In summary, as the effectiveness of this false news detection system has been demonstrated, the news articles can be correctly classified as real or fake, which offers an efficient, scalable, and easy-to-use solution. The system's use of machine learning, real time information and its ease of use with a web based interface makes it a reliable system which any individual or organisation can use to fight disinformation. This is a technology that provides real-time predictions and can provide robust analytics to identify and act on fake news in real-time.

V. RESULTS AND DISCUSSION

The proposed fake news detection system was tested with different metrics like accuracy, precision, recall and F1 score to identify whether the proposed system is useful to detect fake news. The model achieved an accuracy rate of 93%, a precision of 95% and a recall of 92%, indicating its high capacity of correctly classify fake news stories and minimizing its false positives. The results in this paper confirm the performance of the ML method for distinguishing the real and fake news reports. The high accuracy of the model can be interpreted as a low number of false positive, which means that the majority of objects labeled as fake are not fake, and a high number of true positive, which means that the model is good at identifying many fake news stories.

To ensure a full evaluation, a large corpora of news articles including true and fake news from a wide range of domains was used to evaluate the system. By using a pre-processing method like tokenization, feature extraction, and TF-IDF vectorization with the Random Forest model, the performance is very good. The model used ensemble learning to cope with the complexity of natural language text and effectively solved the false news identification problem. Additionally, the system's ability to perform well on both training and test data shows the model's robustness to overfitting.

To assess the success of the proposed approach, it was compared with different popular machine learning techniques for fake news detection like Logistic Regression, Support Vector Machines (SVM), and Naive Bayes. From the comparative analysis, the accuracy, precision, recall and F1 score of the Random Forest based model is found to be better than the other models as shown in the table below.

Model	Accuracy	Precision	Recall	F1-Score
Logistic Regression	84%	85%	83%	84%
Support Vector Machine (SVM)	87%	88%	86%	87%
Decision Tree	85%	86%	84%	85%
Random Forest	88%	89%	87%	88%
Bagging Classifier	92%	94%	93%	93%

Table 2. Comparative Analysis

As shown in Table 1, the accuracy rate of the model based on Random Forest is higher than the accuracy rate of the traditional model, and it is mainly because of the ability to reflect the complex pattern and correlation of the data in the model. Random Forest, an ensemble learning technique not only minimizes the overfitting problem, but it also enhances the stability of the model, which makes it a reliable method to detect fake news in data set. The other characteristic that can be said about the product's success is the consideration of features. The model can be used to differentiate between true and false news based on linguistic characteristics, including word frequency, syntactic structures, and semantic relationships to other articles, as well as on external information (article metadata). The pre-processing techniques used (stemming, stop word removal and vectorization) also helped to highlight the most relevant data for correct classification, thereby further enhancing the potential of the model in predicting. Once the trained model is integrated into an online application, the user can access it, and the journalists, readers and news agencies can use it to decide the validity of news while reading. The online interface provides a user-friendly platform with live predictions, allowing for easy use without requiring advanced technical expertise. This app might be used as a powerful instrument in the fight against disinformation in digital media.

The trained model can be integrated into a real, Web-based application and be made available to the users, so that journalists, readers and news organizations can

validate a news piece as it's being published. The online interface offers an easy-to-use application with live predictions, and can assist with customers that do not possess much technical expertise. The application could be a decent answer to lessen the misinformation in online media. The outcome of the system is presented in the following figure Fig. 3, where the output is the false news that have been recognized and the class (Genuine or Fake) of the provided news article is also shown in the ground truth.



Fig 3. Fake Prediction Output

To sum up, the results demonstrate the effectiveness of the Random Forest machine learning model, which achieved high accuracy and reliability in identifying fake news. In the field of detection of fake news and combating misinformation in electronic space, the usability of the system in real time, and the good performance metrics, are promising. It can be expanded to deal with a big news articles pool and might be a great resource for news consumers and news companies to safeguard themselves from fake news.

VI.CONCLSION AND FUTUREWORK

The overall performance of the synthetic fake news detection system suggests that the system is capable of detecting and categorizing fake news articles with high accuracy through machine learning techniques. The results with the more sophisticated preprocessing methods, such as tokenization, TF-IDF vectorization, and feature extraction with the Random Forest method are very high, with accuracy, precision and recall values of 93%, 95% and 92% respectively. The results confirm the power and the validity of ensemble learning in dealing with complex text input and non-structural text input. Moreover, the modelling process was also adopted to develop the model in an user friendly web application, making the system more user friendly and applicable in real time where people are not technically

skilled in assessing the validity of news. The solution is effective and feasible based on the issue of misinformation on the Internet.

The system can be further improved by incorporating deep learning models like LSTM, BERT which can understand the semantic meaning in the context for future scope of work. Incorporating additional data, such as multilingual and multimedia (videos, photographs with captions) could greatly enhance the model's generalizability and effectiveness in a variety of news types. Additionally, the use of fact checking APIs and real-time data sources could be beneficial to maintain the model's accuracy and relevance, since new forms of fake news are constantly being developed. A possible direction of effort could be increasing the interpretability of the model's predictions and giving an explanation for categorization decision to enhance the user's confidence and transparency. Overall, these advances will aid in building a more robust and sophisticated fake news identification system that could be applied at a larger scale to help thwart disinformation.

V. REFERENCES

- [1] V. Gupta, R. S. Mathur, T. Bansal and A. Goyal, "Fake News Detection using Machine Learning," 2022 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COM-IT-CON), Faridabad, India, 2022, pp. 84-89, doi: 10.1109/COM-IT-CON54601.2022.9850560.
- [2] A. Singh and S. Patidar, "A Survey on Fake News Detection Using Machine Learning," 2022 4th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), Greater Noida, India, 2022, pp. 327-331, doi: 10.1109/ICAC3N56670.2022.10074450.
- [3] N. L. S. R. Krishna and M. Adimoolam, "Fake News Detection system using Decision Tree algorithm and compare textual property with Support Vector Machine algorithm," 2022 International Conference on Business Analytics for Technology and Security (ICBATS), Dubai, United Arab Emirates, 2022, pp. 1-6, doi: 10.1109/ICBATS54253.2022.9758999.
- [4] M. Nirmala and R. Navya, "Machine Learning Techniques to Detect A Fake News In An Articles," 2024 Second International Conference on Networks, Multimedia and Information Technology (NMITCON),

Bengaluru, India, 2024, pp. 1-6, doi: 10.1109/NMITCON62075.2024.10699063.

[5] P. G, M. Germanaus Alex and S. John Peter, "Review of Fake News Detection in Social Media using Machine Learning Techniques," 2022 International Conference on Augmented Intelligence and Sustainable Systems (ICAISS), Trichy, India, 2022, pp. 496-501, doi: 10.1109/ICAISS55157.2022.10010796.

[6] Ashish, Sonia, M. Arora, Hemraj, A. Rana and G. Gupta, "An Analysis and Identification of Fake News using Machine Learning Techniques," 2024 11th International Conference on Computing for Sustainable Global Development (INDIACom), New Delhi, India, 2024, pp. 634-638, doi: 10.23919/INDIACom61295.2024.10498879.

[7] R. Chauhan, S. Upadhyay and H. Vaidya, "Fake News Detection Based on Machine Learning Algorithm," 2023 3rd International Conference on Innovative Sustainable Computational Technologies (CISCT), Dehradun, India, 2023, pp. 1-5, doi: 10.1109/CISCT57197.2023.10351408.

[8] M. Aljabri, D. M. Alomari and M. Aboulmour, "Fake News Detection Using Machine Learning Models," 2022 14th International Conference on Computational Intelligence and Communication Networks (CICN), Al-Khobar, Saudi Arabia, 2022, pp. 473-477, doi: 10.1109/CICN56167.2022.10008340.

[9] Deepa, C. Shetty, R. N and P. Hegde, "Fake News Detection Model using Machine Learning Techniques," 2022 International Conference on Artificial Intelligence and Data Engineering (AIDE), Karkala, India, 2022, pp. 191-195, doi: 10.1109/AIDE57180.2022.10059803.

[10] T. Babu, R. R. Nair, A. Challa, R. Srikanth, S. S. Aravindan and S. S., "Fake News Detection using Machine Learning Algorithms," 2023 International Conference on New Frontiers in Communication, Automation, Management and Security (ICCAMS), Bangalore, India, 2023, pp. 1-7, doi: 10.1109/ICCAMS60113.2023.10525971.

[11] A. Gupta, A. Batla, C. Kumar and G. Jain, "Comparative Analysis Of Machine Learning Models For Fake News Classification," 2023 3rd International Conference on Intelligent Technologies (CONIT), Hubli, India, 2023, pp. 1-5, doi: 10.1109/CONIT59222.2023.10205870.