**A REVIEW OF MACHINE LEARNING AND NLP FOR**

**FAKE NEWS DETECTION**

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**ABSTRACT**

Fake news identification has become one of the most important problems of the twenty-first century due to the sharp rise in social media use and the falling cost of internet access. The dissemination of rumors and false information has been greatly accelerated by this accessibility, leading to a rise in problems associated with fake news that range from online arguments to violent hate crimes. Despite its dependability, traditional fact-checking techniques are unable to handle the enormous amount of web content produced every day. Therefore, it is crucial to create an effective, scalable, and empirical approach to identify bogus news. In order to solve this issue, this study highlights machine learning (ML) and natural language processing (NLP) as crucial strategies. Real-time, automated news analysis and credibility-based classification are made possible by these technologies. This survey attempts to review previous research in order to compile knowledge, analyze current approaches, and determine their efficacy and correctness. Models' advantages, disadvantages, and areas for development are highlighted through comparison with industry standards. With accuracy as the key to success, the ultimate goal is to provide a template for a more successful false news detecting system. This study offers insightful information about how to use ML and NLP techniques to lessen the effects of false information and promote trust in online communication.

**Keywords:** Fake News Detection, Machine Learning (ML), Natural Language Processing (NLP), Misinformation and Digital Communication.

**1.** **INTRODUCTION**

Fake news identification has advanced significantly between 2019 and 2024, especially with the use of machine learning (ML) and deep learning techniques. With models reaching accuracy levels as high as 95% to 98% when applied to well-known datasets like those from fig1, the accuracy of fake news detection systems has significantly increased during this time. More sophisticated algorithms like BERT (Bidirectional Encoder Representations from Transformers) have shown to be far more effective than more conventional techniques like Random Forest and Logistic Regression, especially when deep learning models became more popular in 2021. Moreover, the capacity to detect in real time has gained significant attention, particularly with the growth of social media platforms that produce enormous volumes of data every day. These developments highlight the growing importance of ML and deep learning in combating misinformation, as they offer scalable, adaptable, and more precise solutions to address the increasing spread of fake news across digital platforms.



**Figure 1:** History of Fake News Detection

# **2. LITERATURE SURVEY**

The increasing proliferation of false information on digital platforms and social media has made the detection of fake news a crucial field of study. To address this problem, numerous studies have looked into different machine learning and deep learning strategies. To classify news as "real" or "fake," for example, Tahura Nikhath et al. [1] and Ranga Rao et al. [2] used Random Forest classifiers on the Kaggle Fake News Dataset, highlighting the shortcomings of straightforward word-count-based models and the necessity of context-aware methods. Similar to this, P. S. Surendra et al. [3] addressed the mixing of bogus and legitimate news on social media by combining natural language processing (NLP) methods with classifiers like Logistic Regression, Naïve Bayes, and SVM to improve detection accuracy. Feature extraction and optimization to enhance detection were the main topics of several studies.

The usage of n-grams, TF-IDF, and dimensionality reduction methods like PCA in conjunction with algorithms like Random Forest was investigated by Yash Shukla et al. [4] and Ch. Sita Kumari et al. [11] in order to improve performance. To develop reliable detection systems, Tejaswi Gaikwad et al. [12] suggested frameworks that make use of feature selection techniques and the Bag of Words. It has also been investigated how user involvement and behavior affect the detection of bogus news. Madre Mario Perez et al. [9] emphasized the incorporation of user engagement data to improve model accuracy, while Anu Shrestha et al. [6] investigated the role of personality factors in disseminating false information. Furthermore, utilizing content, creator, and context-based features, Fátima Leal et al. [20] presented a novel strategy for real-time fake news detection that combines supervised and unsupervised techniques.

This field has seen an increase in the use of deep learning and advanced machine learning models. The higher performance of neural networks and contemporary frameworks like BERT over conventional techniques was demonstrated by studies such as those conducted by Tushar Rane et al. [15] and Ali Raza et al. [7]. Similarly, in order to enhance early detection capabilities, Yuta Yanagi et al. [8] suggested utilizing neural networks to generate artificial remarks. The versatility of false news detection algorithms to different settings was shown by domain-specific research such those by Pop Mihai Ionut et al. [5], which concentrated on economic sectors, and Nagul Cooharojananone et al. [19], which targeted Thai health articles. These initiatives demonstrate how tactics are changing and how crucial it is to use linguistic, contextual, and interaction-based elements in order to successfully handle the difficulties presented by false information.

**Table 1.** Summary of Methodologies

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| --- | --- | --- | --- | --- |
| **Author Name(s)** | **Dataset Used** | **Feature Extraction Method(s)** | **Algorithm(s)** | **Results** |
| Tahura Nikhath et al. [1] | Kaggle Fake News Dataset | Count Vectorizer, TF-IDF | Random Forest | Developed a model to classify articles into real or fake news using a Random Forest classifier, noting limitations due to lack of word order/context |
| L Sai Venkaya Ranga Rao et al. [2] | Kaggle Fake News Dataset | Count Vectorizer, TF-IDF | Random Forest | Applied a Random Forest classifier for binary classification, focusing on detection of fake news in social media contexts like Facebook. |
| Yash Shukla et al. [3] | Custom Dataset | n-grams, TF-IDF | Various algorithms compared | Compared multiple algorithms to find the best fit for fake news prediction, analyzing various feature extraction methods and their effectiveness. |
| Ms. Ch. Uma Devi et al. [4] | Social Media Feeds | NLP Techniques | NLP, Logistic Regression, Naïve Bayes, SVM | Applied multiple classifiers to detect fake news, focusing on social media misinformation and its impact on public perception. |
| Anu Shrestha et al. [5] | PAN at CLEF 2020 Dataset | Writing style, n-grams, BERT embeddings, LIWC | Binary Classification with BERT, Sentiment Analysis | Achieved 0.73 accuracy for English and 0.77 for Spanish, finding personality features significantly impact fake news spreader detection on social media. |
| Ali Raza et al. [6] | Facebook, Twitter, Weibo Datasets | Natural Language Processing, Part-of-Speech Tagging | Naïve Bayes, NLP, Neural Networks | Reviewed current algorithms, emphasizing NLP and neural networks, for detecting fake news on social networks, relevant for ethical and political issues. |
| Yuta Yanagi et al. [7] | News Articles with Generated Comments | Social context generation for fake comments | Neural Network, Deep Learning | Showed that generating fake comments improved detection, supporting early fake news detection when limited social context is available. |
| Mihai-Ionuț Pop et al. [8] | Custom Dataset on Economic Sectors | Scoring model tailored to economic data | Custom Dataset on Economic Sectors | Developed a scoring model for detecting fake news in the energy field, aiming to combat misinformation affecting public perception of economic sectors. |
| Mario Perez Madre et al. [9] | Fake News Net dataset | User engagement, linguistic features | Deep Learning, Logistic Regression, SVM, Random Forest, Light GBM, XG Boost | Demonstrated that including user engagement data improves accuracy over content-only models. |
| Priyanshi Goyal et al. [10] | Signal Media for OpenSources.co | Bi-grams, Probabilistic Context-Free Grammar (PCFG | TF-IDF, PCFG | Explored limitations of machine learning for fake news detection; highlighted potential for deep learning enhancements. |
| Ch Sita Kumari et al. [11] | News Articles Dataset | TF-IDF, Count Vectorizer, PCA | Random Forest, SVM, Logistic Regression, Naïve Bayes | Random Forest with Count Vectorizer achieved the best performance based on accuracy, precision, and recall |
| Tejaswi Gaikwad et al. [12] | Social Media News Dataset | TF-IDF, Bag of Words | Naïve Bayes, SVM, Logistic Regression | Voting classifiers improved accuracy for distinguishing real from fake news |
| Prof. Shweta Kahurke et al. [13] | Large-Scale News and Social Media Dataset | ROC curves, other evaluation metrics | Random Forest, Logistic Regression, LSTM | Focused on Random Forest and LSTM with ROC curve evaluation |
| Shagun Kingaonkar et al. [14] | Labeled News Articles | Normalization | Support Vector Machine (SVM) | Aimed to achieve high accuracy with SVM, noting normalization's importance in data cleansing. |
| Adwait Banda, Tushar Rane et al. [15] | Fake News Dataset, Twitter Datasets | Dimensionality Reduction (PCA, Chi-Square), NLP | CNN, LSTM, PCA, Chi-Square, Decision Tree, Logistic Regression, KNN, Random Forest, SVM, Naive Bayes, RNN, LSTM | Deep learning methods like Attention-based models and BERT outperformed traditional methods for accuracy. |
| E. V. Nagalakshmi et al. [16] | Labeled News Articles | Pattern Learning | KNN, Decision Tree, Logistic Regression | Developed a tool aiming for accurate classification of real and fake news. |
| Mohammed Obaid et al. [17] | Twitter Dataset, Social Media Posts | Twitter API, Sentiment Analysis | SVM, Naive Bayes, Logistic Regression, RNN | Found SVM and Naive Bayes to outperform other models. |
| Pshko Rasul Mohammed Amin et al. [18] | Labeled News Articles, Social Media Data | Classification | Decision Tree, SVM | SVM and Decision Tree showed high performance |
| Nagul Cooharojananone et al. [19] | 582 reliable and 435 unreliable Thai health and medical articles from 8 websites | Textual, sentiment-based, and lexicon features including specific terms like herbs, fruits, and vegetables to identify article objectives | XG Boost with Lasso Feature Selection | 97.76% accuracy, 7.16% improvement over previous model |
| Fátima Leal et al. [20] | Real-time Twitter dataset | Creator-, content-, and context-based features using Natural Language Processing; explainable classification displayed in a dashboard | Combination of unsupervised and supervised ML approaches with online lexica | 80% accuracy and macro-level validation |

**3. CONCLUSION AND FUTURE SCOPE**

In conclusion, machine learning-based techniques, which have been shown to be the most successful in predicting and recognizing fake news, are used in the majority of research on fake news detection (about 95%). Because it affects how the algorithm represents and interprets text data, the word embedding selection has a big impact on improving the detection models' accuracy. Furthermore, deep learning models—in particular, neural networks—have become the most widely used approach, accounting for around 90% of the research in this field and continuously producing remarkable accuracy rates. Future studies should concentrate on strengthening these models' resilience by investigating new word embedding strategies, integrating various machine learning approaches, and tackling the problems of multilingual content and real-time detection. Additionally, in order to better comprehend deep learning models' decision-making process and guarantee transparency in fake news detection systems, efforts should be focused on improving the interpretability of these models.

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