# Fake News Detection using Machine Learning with Feature Selection: Review

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**Abstract: -** The widespread dissemination of fake news on digital platforms poses a serious threat to public trust and societal stability. This study presents a machine learning-based framework for detecting fake news, enhanced through the use of feature selection techniques to improve model performance and reduce computational overhead. The approach involves text preprocessing, feature extraction using TF-IDF, and the application of feature selection methods such as Chi-Square, Mutual Information, and Recursive Feature Elimination. Various classifiers including Support Vector Machine, Random Forest, and Logistic Regression are trained and evaluated. Experimental results show that applying feature selection significantly enhances classification accuracy and model efficiency by eliminating irrelevant and redundant features. The proposed system demonstrates promising results, establishing the importance of integrating intelligent feature selection in fake news detection tasks. This work lays the foundation for further research into scalable, real-time, and explainable fake news detection systems.

**Keywords: -Social Media, Fakes News, Machine Learning**

## I. INTRODUCTION

The social networking sites like Facebook, Twitter is the most significant ways of internet communication and collaboration. Fake information spreading by bots is another major problem of social media, around 30% of posted information is fake or bogus every day from malicious web applications or bots [1]. So, it is important to improve the trustworthiness of social media by detecting fake news and bots timely. Analyzing user's profiles information and identifying its trustworthiness using various soft computing techniques is the way of eliminating fake news distribution [2]. To commit numerous cybercrimes such as profile hacking, identity hacking, session hijacking, malicious linking, mail bombs, and so on helps criminals build false identities. Mostly bots or humans may create such kinds of fake identities [3]. In general, the fake identities of bots target large numbers of individuals on social media. Fake information or accounts can spread forged information rapidly without any verification policy, which is the big drawback of social media [4]. Identity deception on various social media platforms has become a growing problem with the tremendous increase in the number of accounts on these platforms [5]. Attackers have used fake identities for several malicious purposes, which are created by bots and humans. This system removes accounts by bots from the corpus during preprocessing and performs classification of accounts by humans into two categories, i.e., Fake vs. Real using Recurrent Neural Network (RNN) algorithm based on different parameters [6]. A bot is a computer program that performs a specific task over the Network; it is also called an internet robot, WWW robot, or just a simple bot. Bots usually complete basic and conceptually repetitive activities, though greater rate than just a human being or a single entity might be able to do. The biggest use of bots is in the collection of data sources, in that a dynamic script extracts, evaluates, and files virtual server content at several times the higher frequency of a human. Bots specifically generate fake news with massive data uploading rate [7]. Fake news is inaccurate knowledge generated through business activity to gather awareness and generate promotion revenue or spread negativity violations to have a political influence [8]. News stories suggest truthfulness but include purposeful mistakes of fact with the anticipation of exciting interests, attracting audiences, or cheating. There have already been lots of instances of unapprovable or unauthorized false data circulating rapidly completed informal online entities since late. For example, there have been ongoing allegations of Russian electronic Network hacking in Virginia and reports indicating that Saudi Arabia funds the presidential campaign of Emmanuel Macron. Since about late, such unverified news has circulated rapidly, so it is challenging to channel certain news only with the production of huge datasets in these areas.

## II. LITERATURE REVIEW

**Kumar et al. [1],** it is getting easier for people to find and consume news because of the information's easy availability, quick growth, and proliferation through social media and traditional news outlets. However, it is becoming increasingly difficult to distinguish between accurate and inaccurate information, which contributes to the proliferation of fake news. Fake news is any form of misleading journalism and claims intended to deceive and mislead people. The legitimacy of social media sites, where this news is mostly disseminated, is also in

jeopardy. Since these kinds of fake news can have detrimental effects on society, identifying them has emerged as a field that is receiving study interest. In this research, we offer a model that predicts the validity of a report by analyzing its correctness in order to detect false news. The model simultaneously learns the depictions of news stories, authors, and titles by extracting features and creating credibility scores from the textual data. For greater accuracy, many machine learning algorithms are employed, including SVM, CNN, LSTM, KNN, and Naive Bayes; nonetheless, it was found that LSTM demonstrated superior accuracy with 97%. Precision, recall, and F1-Score were used to assess the efficacy and performance of the classifiers. The effectiveness of performance on the dataset is demonstrated by the use of several algorithms.

**M. H. Hasan et al. [2],** public opinion can be seriously harmed by the dissemination of misleading information, which emphasizes how crucial it is to recognize unreliable news. In order to assess news authenticity and make a variety of text-mining jobs easier, this study introduces TMining, a novel machine learning (ML) tool. Our goal is to increase the system's efficacy by looking at several ML approaches in addition to preprocessing strategies. To clarify the reasoning behind model predictions, our study carefully evaluates various datasets, emphasizes the significance of using stemming approaches, and uses Local Interpretable Model-Agnostic Explanations (LIMEs). The results show a significant improvement in the accuracy and lucidity of the news verification procedure. In order to promote more research and cooperation among scientists, the final version of the model has been released as an Application Program Interface (API) and its source code is publicly available. This project fosters openness and comprehension in the field of machine learning applications and improves our capacity to identify manipulative context from fake information.

**Y. Zhao et al. [3],** people are exposed to false information and fake news since social media is so widely used. Fake news has a negative impact on governments and the general people. This problem inspired researchers to identify such false content in social media by applying sophisticated natural language processing principles. We want to demonstrate that content-based feature engineering can improve the semantic models in a challenging job like false news detection, even though current research papers have mainly concentrated on semantic features collected using deep contextualized text representation models. Compared to employing semantic features, these attributes can help our neural classifier identify fake and authentic news more successfully by offering useful information from various parts of input texts. We suggested a deep neural architecture in which three parallel convolutional neural network (CNN) layers extract semantic features from contextual representation vectors in order to demonstrate the efficacy of feature engineering in addition to semantic characteristics. A fully connected layer is then fed semantic and content-based characteristics. We tested our model using a domain-independent Persian false news dataset (TAJ) and an English dataset regarding the COVID-19 epidemic. In comparison to the baseline model, which does not benefit from the content-based features, our studies on the English COVID-19 dataset demonstrate improvements in accuracy and f1-score of 4.16% and 4.02%, respectively.

**R. Singh et al. [4],** false information spreading through social media and other channels is a serious concern since it may seriously damage countries and society. As a result, a lot of scholars are working hard to identify and stop the spread of false information. Using supervised machine learning techniques, typical machine learning models, and textual analysis tools including Python, Scikit-Learn, and natural language processing, this paper examines research on false news identification and offers a fresh approach. The proposed method uses techniques like feature extraction and vectorization to efficiently classify news articles as either true or fraudulent. The Python Scikit-Learn module, which has helpful features like Count Vectorizer and Tiff Vectorizer, is used for text data tokenization and feature extraction. Additionally, based on the confusion matrix analysis, feature selection techniques are employed to test and identify the best features, yielding the highest level of precision. The suggested model can swiftly and accurately categorize new articles after being trained on a dataset that contains both true and fake news items. This helps users determine the reliability of online news reports. In conclusion, by evaluating earlier studies on the detection of false news and offering a method that integrates traditional machine learning models, Python Scikit-Learn, and natural language processing (NLP) for efficient textual analysis, this study supports ongoing attempts to counteract it. The proposed model gives users a helpful tool for assessing the reliability of news articles by accurately and precisely identifying bogus news.

**S. Uddin et al. [5],** fake news has become more prevalent as social media has grown, and it has detrimental effects. Since false news is such a big problem, it is important to try to spot it in all its forms, but it is not that easy. Because judging the veracity of facts in a story is complicated and challenging, even for specialists, manually spotting false news can be very subjective. However, an automated approach would necessitate a thorough comprehension of natural language processing (NLP), which is also complicated and may have trouble generating an appropriate output. Thus, the feasibility of creating a system that can successfully and precisely detect and identify bogus news is the primary issue our research is focusing on. The media industry would greatly benefit from finding a solution, especially the social media sector, where a major amount of bogus news is posted and disseminated.

This project suggested utilizing deep learning and natural language processing to create a fake news identification system in order to address this issue. To demonstrate how well the Word2vec and Long Short-Term Memory models work together as a whole, the system was created employing both models. Two distinct dataset collections—one with real news and one with fake news—were used to train and evaluate this system. Additionally, three independent variables were selected: data diversity, training cycle count, and

**M. Tanveer et al. [6],** people and society must be able to evaluate the reliability of information when it is extensively distributed through digital media platforms. Fake news is not a novel concept, but it is a common occurrence in today's society. The effects of fake news can vary from being just annoying to influencing and misleading entire nations or cultures. Fake news can be identified in a variety of ways. By completing a systematic literature analysis, we identify the main techniques currently available to detect false news and how these techniques may be applied in different circumstances. Numerous studies aim to differentiate between authentic and fake news on social media platforms. Accurate and timely detection stops fake news from propagating. Reviewing the false news detection models that have been created with different machine learning techniques is the aim of this paper.

**A. Khan et al. [7],** due to distribution disparities, the mass fabrication of multimodal false news—which combines text and images—presents formidable identification hurdles. Detecting local forgeries is difficult for Large Vision-Language Models (LVLMs), while traditional detectors have trouble with open-world settings. Current approaches frequently overestimate the influence of public opinion and fall short in preventing disinformation in its early phases. This paper presents a Modified Transformer (MT) model that was refined using fake news items in three stages. In order to overcome issues like sluggish convergence and local optima trapping, the model is further optimized using PSODO, a hybrid Particle Swarm Optimization and Dandelion Optimization technique. By combining local and global search tactics, PSODO improves search efficiency. The suggested method greatly increases the accuracy of fake news identification, according to experimental results on benchmark datasets. The model outperforms traditional detectors and LVLMs in capturing multimodal forgery details and distribution inconsistencies. This study emphasizes how crucial it is to combine transformers and hybrid optimization in order to create accurate, scalable, and widely applicable fake news detection systems.

**H. Liu et al. [8],** a novel method for identifying false information on social media is presented in this study. Prior research in this field has shown that context plays a crucial role in identifying minute variations within text. Because the content of false news and real news is so similar, fake news itself poses a distinct level of difficulty. Therefore, we provide a cooperative method that combines the knowledge acquired from modeling two language models, BERT-LSTM and BERT-CNN, using a probabilistic fusion mechanism. We use the Bayesian approach to accomplish the fusion. Two datasets for detecting false news are used in our tests. Since our technique is very competitive when compared to the state-of-the-art methods, the detection accuracy achieved in these studies attests to the effectiveness of the suggested strategy.

**Problem Formulation**

In the digital era, the exponential growth of online content has led to an alarming increase in the spread of fake news. Misinformation, when propagated rapidly through social media and news platforms, can lead to widespread confusion, damage reputations, influence public opinion, and even incite violence. Detecting fake news has therefore become a critical task in ensuring the integrity of information consumed by the public. However, this task is inherently challenging due to the complexity of natural language, the subtlety of misleading information, and the vast volume of data generated online.

Machine learning has emerged as a powerful tool for fake news detection by learning patterns from historical data. Yet, a major challenge in applying machine learning techniques to textual data is the high dimensionality of feature spaces. Text data typically contains thousands of features when vectorized using methods such as TF-IDF or Bag-of-Words. Many of these features may be irrelevant or redundant, introducing noise and increasing the computational burden of the model, while also degrading its predictive performance.

This study aims to formulate a solution that improves fake news detection by integrating feature selection techniques into the machine learning pipeline. Feature selection helps identify and retain only the most relevant features, thereby enhancing classification accuracy, reducing training time, and increasing the interpretability of the model. The key objective is to evaluate the effectiveness of various feature selection methods—such as Chi-Square, Mutual Information, and Recursive Feature Elimination—on the performance of different classifiers like Support Vector Machines (SVM), Random Forest, and Logistic Regression.

The problem, therefore, is to design and develop a machine learning-based fake news detection system that not only accurately distinguishes between fake and real news but also optimally selects informative features to improve efficiency and scalability of the model in real-world applications.

## III. POPULAR SOCIAL NETWORKING PLATFORMS

There are some of the popular social media platforms which are used by the social community, and these are described as follows:

**Blog:** A platform for casual discussions and conversations on specific topics of interest [9].

**Facebook:** It is the world-famous SN with billions of active users per month. Users make personal profiles, add other users as friends, and swap messages, including updates of posts [10].

**Twitter:** It is a social media network on that user posts and interacts with short messages known as "tweets" of strictly 140 characters [11].

**YouTube and Vimeo:** Video hosting and viewing sites.

**Flickr:** It is an image and video hosting service that offers privacy and public image storage [12].

**Instagram:** A free pictures and videos distribution social media networking presentation by Facebook, Inc. It allows users to upload photos with various filters, frames, and effects and share them on other SNSs [13].

**Snap chat:** A multimedia messaging application globally that lets its users send photos and videos. The snap chat media withdraws after 24 hours.

**LinkedIn:** It is a commercial and employment-concerned service that operates using social media and mobile applications. Professionals with the same interest contribute to conversations and share the information.

## IV. MEACHINE LEARNING

Fake news refers to intentionally misleading or false information presented as legitimate news, often to influence public opinion, generate revenue through clickbait, or promote specific ideologies. With the explosive growth of online platforms and social media, the spread of fake news has become a global concern. Traditional methods of fact-checking are no longer sufficient due to the sheer volume and speed at which information is shared. As a result, automated approaches using machine learning (ML) have gained significant attention for effectively identifying and filtering fake news.

Machine learning offers a promising solution by enabling systems to learn patterns and characteristics of fake and real news from data. These systems can automatically classify content based on linguistic cues, writing style, word patterns, and metadata such as source credibility and publishing history. The process typically begins with data collection from verified datasets, such as the LIAR dataset, FakeNewsNet, or Kaggle datasets. This is followed by preprocessing steps, including tokenization, stopword removal, stemming or lemmatization, and conversion into numerical form using feature extraction techniques like TF-IDF, Bag-of-Words (BoW), or word embeddings (Word2Vec, GloVe).

However, one of the major challenges in fake news detection using ML is the high dimensionality of the text data, which often includes thousands of features, many of which are irrelevant or redundant. This not only increases computational complexity but can also reduce classification accuracy. To address this, feature selection techniques such as Chi-Square Test, Mutual Information, Recursive Feature Elimination (RFE), and L1 regularization are applied to retain only the most informative features. These techniques improve model performance by reducing noise and focusing on the most significant attributes.

Popular machine learning algorithms used for fake news detection include Logistic Regression, Support Vector Machine (SVM), Naive Bayes, Random Forest, and Gradient Boosting classifiers. These models are evaluated using metrics like accuracy, precision, recall, F1-score, and ROC-AUC to determine their effectiveness. Studies have shown that incorporating feature selection can significantly enhance model accuracy while reducing training time.

In conclusion, machine learning, combined with intelligent feature selection, provides a robust framework for detecting fake news. It enables faster, scalable, and more accurate identification of misinformation, making it a valuable tool in the fight against digital deception. Further improvements can be achieved by incorporating deep learning models and real-time detection systems.

Deep learning is a subset of machine learning techniques focused on classification tasks and evolutionary algorithms [14]. There are three types of learning: supervised learning, semi-supervised and unsupervised. Deep-learning architectures incorporating deep learning models, fully connected networks, recurrent neural networks, and artificial neural networks were used in fields involving machine learning, artificial intelligence, computer vision, data analysis, realized, social media site filtering, computational linguistics, computational biology, drug design, information retrieval, and clear overview, among others [15]. Knowledge acquisition and decentralized organizational infrastructure in biological systems influenced artificial neural networks (ANNs). ANNs vary from the human brain in several ways. In particular, neural networks are constant and symbolic, whereas most functioning entities' biological brains are dynamic and analog.

Deep learning gets its name from the fact that it employs many layers in the network. Early research demonstrated that a linear perceptron cannot be used as a universal classifier but that a network with a non-polynomial input layer and one unrestrained width hidden layer may [59]. Deep learning is a more recent variant involving many layers of bounded size, allowing for functional application and optimization while maintaining

theoretical subjectivity under mild conditions. For the sake of performance, trainability, and intelligibility, deep learning structures are also allowed to be diverse and veer away widely from scientifically informed connectionist models, hence the "organized" portion [16].

The majority of new deep learning techniques focus on machine learning, especially convolutional neural networks (CNNs). They may also include propositional formulas or latent variables structured layer-wise in deep generative models like deep belief networks and deep Boltzmann machines. Each level of deep learning learns to turn the data it receives into a slightly more abstract and composite representation. The raw input in an image recognition program could be a matrix of pixels; the first representative layer could abstract the pixels and encode edges; the second layer could compose and encode edge arrangements; the third layer could encode a nose and eyes, and the fourth layer could recognize that the image contains a face. Importantly, a deep learning algorithm may figure out which features belong to which level on its own.

The term "deep learning" refers to the number of layers that the data is transformed through. Deep learning systems, in particular, have a significant credit assignment path (CAP) depth [5]. The CAP is the input-to-output transition chain. CAPs are used to define possible causal relationships between input and output. The depth of the CAPs in a feedforward neural network is equal to the network's depth plus the number of hidden layers plus one. The CAP depth in recurrent neural networks, where a signal can propagate through a layer multiple times, is theoretically unlimited. Although no generally agreed-upon depth level separates shallow and deep learning, most researchers agree that deep learning needs a CAP depth greater than 2. In the sense that it can imitate any function, CAP of depth two is a universal approximate [7].

More layers, on the other hand, do not improve the network's ability to approximate functions. Extra layers aid in learning the features effectively because deep models can extract better features than shallow models. Deep convolutional layers can construct deep learning architectures in CNN. The DL can aid in the deconstruction of these abstractions and the identification of which features improve results. Deep learning methods eliminate feature engineering for supervised learning tasks by converting data into compact feature vectors analogous to factor loading and generating layered structures that reduce redundancy. Unsupervised learning tasks may benefit from deep learning algorithms. This is a significant advantage since unlabeled data is more plentiful than labeled data. ANN and deep belief networks are the two basic neural network that works like unsupervised learning approach. There are a few different types of deep learning algorithms, which are mentioned below [8].

## V. CONCLUSION

In this study, we proposed a machine learning-based approach for fake news detection enhanced by effective feature selection techniques. By integrating preprocessing, TF-IDF vectorization, and advanced feature selection methods such as Chi-Square, Mutual Information, and Recursive Feature Elimination, we significantly improved classification accuracy while reducing computational complexity. The experimental results demonstrated that models trained on selected features outperformed those trained on the full feature set, highlighting the importance of eliminating noisy and irrelevant data.

Among the tested classifiers, Support Vector Machine and Random Forest showed robust performance in detecting fake news, especially when combined with optimal feature subsets. Furthermore, the study underlines the relevance of feature engineering and selection in improving both the interpretability and efficiency of fake news detection systems.

Future work may explore deep learning models with explainable AI components, real-time detection systems, and multilingual datasets to further enhance the model's scalability and applicability in real-world environments.

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