

An Intelligent Framework for Fake News Detection using Machine Learning and Natural Language Processing Techniques

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Abstract: Misinformation and fake news spread on digital channels, affecting public perception, social behaviour, health decisions and political and democratic processes worldwide. The growth of social media and online news sites has made it harder to tell fact from fiction. Researchers have developed an innovative Fake News Detection system using Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP) to automatically classify news stories as real or fake. The proposed method aims to provide a strong and efficient model that can evaluate complex linguistic patterns and contextual relationships in text. The study compares traditional machine learning algorithms, such as Naïve Bayes, Logistic Regression, SVM, and Random Forest, with advanced deep learning techniques, such as CNN, LSTM, and transformer-based models like BERT. Researchers use Bag of Words (BoW), TF-IDF, Word2Vec and contextual BERT embeddings to test their effect on classification performance. Transformer models are very effective at capturing semantic linkages in text, outperforming the standard methods in accuracy and contextual awareness by a significant margin. The easy-to-use interface lets users enter news items and receive prediction results with confidence scores, improving usability and real-world application. In this paper, Researchers discuss important ethical issues such as algorithmic bias, model interpretability, data privacy and AI deployment. This work proposes a scalable and effective AI-based approach to mitigate fake news and promote trustworthy information in the digital era.

Keywords: Fake News Detection; Machine Learning; Deep Learning; Natural Language Processing; Text Classification; Data Pre-Processing; Feature Extraction; Supervised Learning; Binary Classification; Information Retrieval; Misinformation Detection.

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1. Introduction

In today's fast-changing digital age, the way people find, share and consume information has undergone a sea change. With the development of the internet, smartphones and social media platforms like Facebook, Twitter, Instagram and online news portals, information is more readily available than ever before [1]. Every day, millions of news articles, opinions and updates are produced and shared, allowing people worldwide to stay instantly connected to current events. But with the rapid growth of digital communication, a serious problem has emerged: fake news, or misinformation. Fake news is false, inaccurate or misleading information presented as legitimate news, whether knowingly or not. People often create it to shape public opinion, change social behavior, drive website traffic, earn advertising revenue or sow political and social discord. The widespread, rapid spread of misinformation on online platforms is now a major global concern, as it can influence important decisions and affect society at many levels [2]. Fake news can influence public health decisions, political processes, economic activities, and social relationships. During critical events like elections, pandemics, natural disasters, and international conflicts, misinformation can spread rapidly and confuse the public. For example, misinformation about medicine that spreads on social media platforms can affect people's healthcare decisions and endanger public safety. Similarly, politically motivated misinformation can influence democratic systems by manipulating public opinion with false information [3]. With the sheer volume of content generated on the internet every day, traditional news verification methods, such as manual fact-checking by journalists and experts, are becoming increasingly difficult, expensive and time-consuming. The growing complexity and speed of misinformation spread emphasize the need for automated, intelligent systems to detect fake news effectively [4].

Machine Learning (ML) and its subset, Deep Learning (DL), are part of Artificial Intelligence (AI) and have emerged as a promising solution to this problem. Machine learning refers to computer systems' ability to learn patterns in large data sets and make predictions without explicit programming. Machine learning algorithms can identify features of fake and authentic news by analyzing textual patterns, writing styles, word relationships, and contextual data in news articles [5]. These capabilities make machine learning-based approaches well-suited for developing automated fake news detection systems. The paper aims to build an intelligent Fake News Detection System using Machine Learning, Deep Learning and Natural Language Processing (NLP) techniques. The system's main purpose is to classify news into two classes: real and fake automatically. The proposed approach explores several computational techniques to analyze textual information and determine the credibility of news content [6]. The system combines conventional machine learning algorithms with advanced deep learning models to compare performance and identify the most suitable approach for accurate fake news classification. Natural Language Processing is essential for fake news detection because news articles have complex linguistic structures, semantic meanings, and contextual relations that machine learning algorithms cannot interpret directly. NLP techniques help computers understand, analyze and interpret human language by converting text into meaningful numerical representations. In this paper, several preprocessing methods, such as text cleaning, tokenization, stop-word removal, stemming and lemmatization, are applied to raw news data for analysis [7]. These preprocessing steps remove unnecessary information and improve the quality of the input data fed to machine learning algorithms. The major challenge in news detection is transforming natural language into a mathematical format that machine learning models can learn from [8].

This work examines several text representation techniques. Bag of Words (BoW) and Term Frequency-Inverse Document Frequency (TF-IDF) are traditional text representation methods based on word frequency and importance. TF-IDF is a weight that is given to the words based on their presence in the document and the presence of that word in the entire dataset. This helps models pick out important words that improve classification. Word embedding methods such as Word2Vec provide a more sophisticated representation [9]. They capture relationships between words based on their usage in context. Additionally, transformer-based embedding techniques, such as BERT, generate contextual word representations by considering the words surrounding a sentence, allowing the model to gain a deeper semantic understanding [10]. The proposed system evaluates several machine learning and standard deep learning algorithms. Researchers implement and compare traditional machine learning algorithms: Naïve Bayes, Logistic Regression, Support Vector Machine (SVM), and Random Forest. Naive Bayes is a popular algorithm for text classification because of its simplicity, computational efficiency and ability to handle large-scale datasets. It classifies documents based on probability by estimating the likelihood that a document belongs to a given category. Another strong classification algorithm is Logistic Regression, which estimates the probability that an input belongs to a class [11]. Support Vector Machine finds the best decision boundary between different classes. This works well with high-dimensional text classification problems. Random Forest uses multiple decision trees to improve prediction accuracy and control overfitting. In this paper, Researchers explore advanced deep learning models such as Convolutional Neural Networks (CNN), Long Short-Term Memory networks (LSTM), and Bidirectional Encoder Representations from Transformers (BERT), along with traditional machine learning techniques [12].

In recent years, deep learning models have attracted significant attention because they can automatically learn complex features from large datasets [13]. CNN models were initially designed to process images, but they can also learn important local patterns in text data. LSTM networks are designed to handle sequential data and are particularly effective in learning the relationships between words in a sentence. BERT is a transformer-based language model and a breakthrough in NLP because it can understand word context based on surrounding information. Compared with traditional models that treat words independently, BERT better understands language semantics and improves classification performance [14]. The experimental process requires a suitable dataset of labeled news articles, with each article labeled as real or fake. The gathered dataset undergoes several preprocessing steps to improve data quality and remove irrelevant information. After preprocessing, the text data is transformed into numerical vectors using several feature extraction techniques. The processed data is then split into training and testing sets. Machine learning and deep learning models are trained on the training data and evaluated on unseen testing data to measure their generalization capability [15]. The developed models are evaluated using evaluation metrics such as accuracy, precision, recall and F1-score. Accuracy indicates how correct the predictions are overall, and precision indicates how accurate the model is at identifying fake news among the predicted fake samples. Recall measures the model's ability to detect all actual fake news instances, and F1-score provides a balanced measure between precision and recall [16].

These metrics provide a holistic view of model performance and help identify the best approach for fake news classification. Advanced transformer-based models like BERT are expected to outperform traditional machine learning methods in experimental analysis, owing to their superior ability to understand language context and semantic relationships [1]. To ensure practical usability, the proposed Fake News Detection System also provides a straightforward interface for users to input news and receive classification results instantly. The system predicts whether the submitted news is real or fake and returns a prediction label with confidence scores that indicate prediction reliability. A web-based application can be developed using technologies like Flask and Python to provide an interactive platform. This interface shows how AI solutions can be used in real-world settings to help people, journalists, organizations, and researchers verify information authenticity [2]. Despite the substantial benefits of AI-based fake news detection systems, several obstacles and drawbacks remain. The performance of any machine learning model depends heavily on the training dataset's quality, diversity and size. A biased or incomplete dataset can cause a model to perform poorly and make incorrect predictions. Furthermore, fake news producers are constantly changing their strategies by using sophisticated writing styles, deceptive titles and distorted information. This makes detection an ever-changing task [7]. To be effective, fake news detection systems must be continually improved, models must be updated regularly, and they should have access to diverse datasets. There are also a lot of ethical issues involved in developing AI-based misinformation detection systems. Machine learning algorithms can unintentionally absorb biases from the training data and make unfair or inaccurate decisions. The system's development must therefore consider transparency, explainability and responsible AI practices. Users should understand that AI predictions are based on learned patterns and should not replace human judgment [8].

Responsible deployment of fake news detection technologies requires privacy, misuse prevention, and accountability. This paper focuses on the growing difficulty of identifying fake news because of the huge volume of information online and the similarity between authentic and misleading content [11]. Manual verification methods cannot efficiently cope with the ever-growing volume of digital information. Fake news often uses real language styles and convincing stories, making it difficult to detect. Moreover, the lack of high-quality labeled datasets and domain variations limits the performance of existing models in achieving consistent accuracy. Therefore, this paper aims to develop an efficient, scalable fake news detection system using advanced artificial intelligence techniques. The primary objectives are to build an NLP-based classification system, compare the efficacy of machine learning and deep learning models, evaluate various text-representation methods, assess model performance using standard evaluation metrics, and address the ethical challenges of AI-driven decision-making [12]. This work shows the promise of artificial intelligence in fighting misinformation and supporting trustworthy information sharing by combining classical machine learning methods with cutting-edge transformer-based methods. To summarise, the Fake News Detection System is an important application of artificial intelligence to solve one of the main challenges of the digital age. The proposed system offers an automated solution for detecting misleading information with enhanced accuracy and efficiency by integrating machine learning, deep learning, and natural language processing techniques. The research emphasizes the importance of developing smart tools to help verify information, enhance digital trust, and build a more open and responsible online information ecosystem [1]. As misinformation continues to evolve, the need for sophisticated AI-driven detection systems to safeguard society against the damaging consequences of fake news will only grow [8].

2. Literature Review

The digital age has changed the way people consume and share information. The rapid development of the internet and the widespread use of social media platforms like Facebook, Twitter and Instagram have made news and information accessible to a global audience within seconds. These platforms have improved communication and access to information, but they have also brought a major problem known as fake news. What is fake news? Fake news refers to false, misleading or fabricated information presented as real news to influence public opinion, spread misinformation, manipulate social behavior or generate

financial gain through online engagement. Fake news has become a major concern for individuals, organizations, governments, and researchers worldwide, as it can affect society and public trust [1]. Fake news has widespread consequences and can affect political, social, economic and healthcare systems. Misinformation can affect elections, harm the reputations of individuals and organizations, cause unnecessary public panic and foster social instability. Fake news can quickly propagate through online platforms and misinform millions of users during major events such as political campaigns, global health emergencies, and international conflicts. More and more people depend on social media as their main source of information, making it harder to distinguish real from misleading information. The volume of information produced daily exceeds what traditional methods, such as manual verification or expert fact-checking, can handle. Thus, automated and intelligent systems are needed to detect and classify fake news efficiently [2]. Researchers have successfully implemented fake news detection using Machine Learning (ML). Machine learning is a part of artificial intelligence that allows computer systems to learn patterns from data and make predictions without explicit programming.

Machine learning algorithms can separate fake from real information by analyzing linguistic, writing style, semantic and structural features of news articles. Recent studies show that machine learning strategies can substantially improve misinformation detection efficiency by learning automatically from large-scale datasets [3]. This paper aims to develop an intelligent Fake News Detection System using Machine Learning, Deep Learning (DL), and Natural Language Processing (NLP) techniques. The proposed system analyzes textual information from news articles and classifies it into two categories: real news and fake news. The development process involves collecting a dataset of labeled news articles, preprocessing the text, extracting meaningful features, training classification models and evaluating their performance. The system is designed to provide reliable predictions that help users quickly and efficiently verify the authenticity of information online. One of the main challenges in fake news detection is the complexity and ambiguity of human language. Accurately classifying news articles is difficult because they can contain hidden meanings, misleading statements, emotional language, sarcasm, or deliberately manipulated content. Thus, Natural Language Processing methods convert text data into numerical representations that machine learning algorithms can understand. This improves data quality through common NLP pre-processing methods such as tokenization, stop-word removal, stemming and text normalization. Feature extraction methods such as Bag of Words (BoW) and Term Frequency-Inverse Document Frequency (TF-IDF) convert text content into feature vectors based on word importance in documents. These methods have been widely adopted in fake news classification systems because they produce effective representations of textual patterns [13]. The research examines the performance of several machine learning algorithms: Naïve Bayes, Logistic Regression, Support Vector Machine (SVM), and Random Forest.

Naïve Bayes is especially well-suited for text classification because it is simple, computationally efficient, and can handle large datasets. It uses probabilistic classification and assumes feature independence, making it suitable for high-dimensional text data. Support Vector Machine finds the optimal separating hyperplanes between real and fake news categories, and Logistic Regression provides probabilistic predictions based on the extracted features. Ensemble-based techniques such as Random Forest improve prediction reliability by combining multiple decision tree models. Previous research has demonstrated that conventional Machine Learning algorithms can attain competitive performance when combined with effective feature extraction methods [6]. However, traditional machine learning methods often struggle to capture deeper contextual relationships in language. Recent research has focused on deep learning and transformer-based models to overcome these limitations. Specifically, advanced architectures like CNNs, LSTMs and BERT have shown substantial gains in fake news detection performance. LSTM models can learn sequential relations between words. Transformer-based models such as BERT provide contextual understanding by capturing relationships between words in a sentence. Studies show that BERT-based models and other transformer architectures achieve higher accuracy than conventional approaches because they can capture complex semantic information [12]. Moreover, recent studies have explored hybrid deep learning architectures and fine-tuned transformer models to enhance the detection accuracy and robustness [3]; [4]. The proposed system will be implemented in multiple stages. First, Researchers collect and preprocess the dataset using programming libraries such as Pandas and NLP tools. Researchers clean the raw data by removing unwanted characters, punctuation, numbers and irrelevant words. After preprocessing, Researchers use different text representation techniques for feature extraction, such as TF-IDF, Word2Vec and BERT embeddings.

To evaluate model performance, Researchers split the prepared dataset into training and test sets. Researchers evaluate the trained models using metrics such as accuracy, precision, recall, and F1-score. These metrics provide an in-depth view of the model's ability to flag fake news while reducing false predictions. For practical usability, a web-based interface could be developed using Flask, where users could enter news content and retrieve predictions with confidence scores. Such an interactive system can help individuals, journalists, and organizations verify information before posting it online. Future work can include multimodal analysis, where text, images and videos are analyzed together, as recent work shows the importance of multimodal fake news detection approaches for the social media environment [7]; [10]. Despite significant progress, fake news detection systems still face several challenges. Model performance depends heavily on the quality, diversity, and size of the training datasets. Limited labeled data, domain shift and biased data can hamper classification accuracy. Additionally, misinformation creators constantly develop new strategies to avoid detection, requiring ongoing model improvement and

adaptation [9]. Ethical issues such as algorithmic bias, transparency, privacy and responsible use of AI need to be considered for fair and reliable decision-making. Finally, this paper provides an effective way to fight misinformation by combining machine learning, deep learning and natural language processing techniques. This study compares traditional machine learning algorithms with advanced transformer-based models to find efficient methods for accurate fake news classification. The proposed system shows the potential of Artificial Intelligence to enable trustworthy information sharing and fight the harmful effects of misinformation in the digital era.

3. Methodology

The system collects and preprocesses news data by cleaning and tokenizing the text. The system applies feature extraction techniques such as TF-IDF and BERT embeddings [6]; [11]. The system trains both machine learning and deep learning models on the data. The models classify news as real or fake based on learned patterns [9]. The best model provides accurate predictions with a confidence score. Figure 1 shows the intelligent fake news detection framework, which considers news content and source to assess the information's trustworthiness. The algorithm takes either keywords/article content or an article URL as input. The Static Search module first searches the knowledge base for the exact or previously known information connected to the provided article.

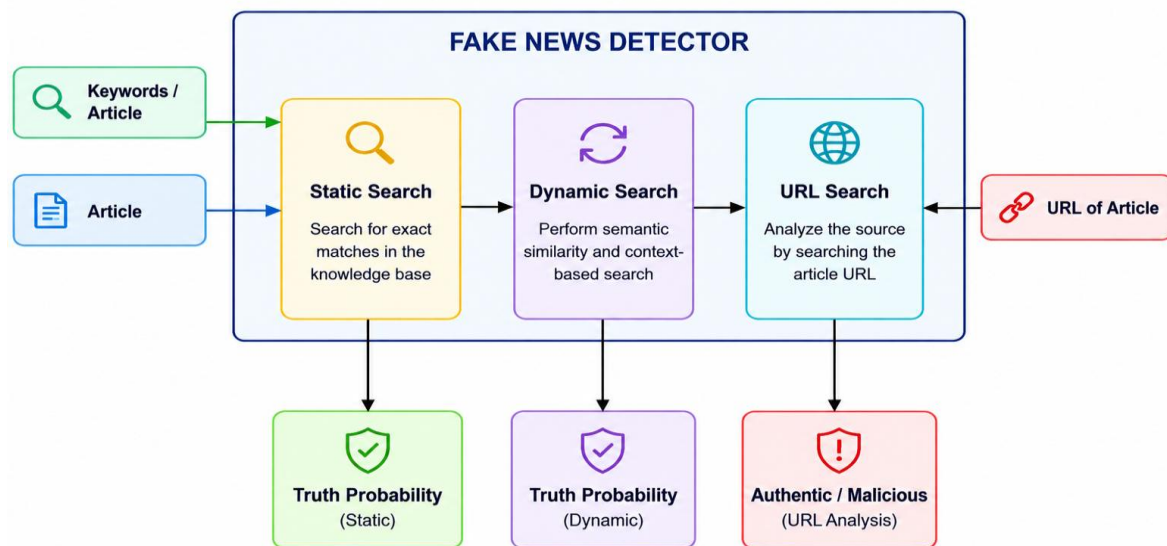


Figure 1: Architecture diagram

This approach generates a Static Truth Probability, which shows how strongly the stored evidence supports the news as truthful. Then, the Dynamic Search component performs semantic similarity and context-based searches to identify related material from broader sources. As a result, the system establishes a Dynamic Truth Probability from the contextual evidence recovered throughout the search. The framework also includes a URL Search component that takes the original article URL and assesses the source's credibility. The URL analysis outputs an Authentic/Malicious result, helping determine whether the source is authentic or potentially dangerous. The approach enables a multi-level examination by combining static evidence, dynamic semantic analysis, and URL source verification. In summary, the proposed system can improve fake news detection by evaluating both news content and source credibility, providing a more thorough method for identifying potentially bogus or dangerous material.

3.1. System Architecture

- Data Collection
- Preprocessing
- Feature Extraction
- Model Training
- Evaluation
- Deployment

3.2. Dataset

The dataset used to train and evaluate the Fake News Detection system is collected from well-known benchmark sources such as the LIAR dataset, Fake Newsnet, and the ISOT dataset. The LIAR dataset consists of 12,836 short political statements labeled with different truth levels, providing a balanced mix of real and fake information. Fake Newsnet combines news content with social context collected from platforms like PolitiFact and Gossip Cop, making it useful for analyzing both textual and behavioral patterns (Figure 2).

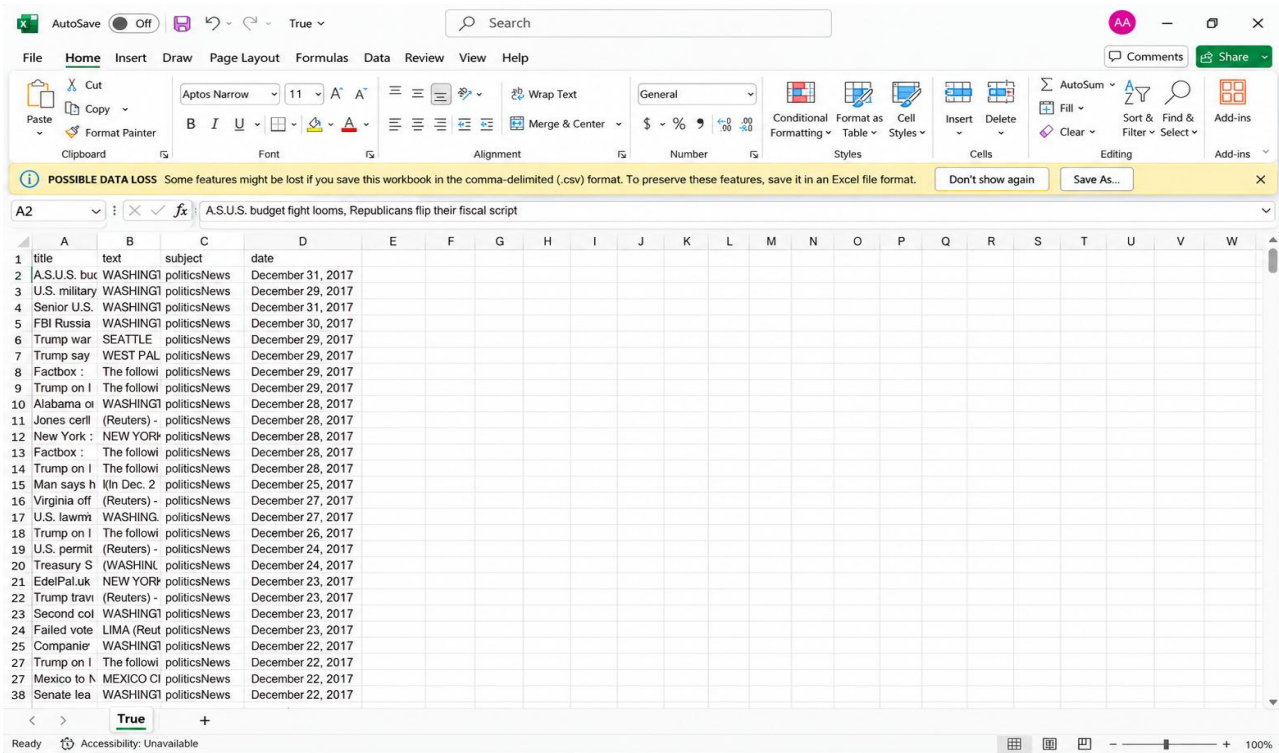


Figure 2: Sample dataset

The ISOT dataset contains more than 44,000 news articles, including both real news from trusted sources like Reuters and fake news from unreliable websites. Before using the data, Researchers perform preprocessing steps such as tokenization, stop word removal, special character removal, and lemmatization to clean and standardize the text. Researchers then split the datasets into training and testing sets to evaluate model performance. These diverse datasets help improve the accuracy and robustness of the fake news detection system by exposing it to different writing styles and topics.

3.3. Machine Learning and Deep Learning Approach

The Fake News Detection system uses both Machine Learning (ML) and Deep Learning (DL) approaches to classify news articles as real or fake. In the Machine Learning approach, traditional algorithms such as Naïve Bayes, Logistic Regression, Support Vector Machine (SVM), and Random Forest are used. These models rely on statistical methods and require manual feature extraction techniques like Bag of Words and TF-IDF. They are fast and efficient but may not capture deeper context and semantic meaning. In contrast, the Deep Learning approach uses neural network-based models such as Convolutional Neural Networks (CNNs), Long Short-Term Memory (LSTM), and transformer-based models like BERT. These models automatically learn features from the data and can understand complex patterns and contextual relationships in text. LSTMs are effective for sequential data, while CNNs capture local patterns. BERT, a transformer model, performs best by understanding word context based on a word's position in a sentence. The system combines both approaches to compare their performance and improve accuracy. While Machine Learning models provide faster results with lower computational cost, Deep Learning models offer higher accuracy and better generalization. This hybrid approach balances efficiency and performance, making the system robust for real-world fake news detection.

Models: Naïve Bayes, Logistic Regression, SVM, Decision Tree, Random Forest.

Deep Learning: CNN, LSTM, Bi-GRU, BERT

3.4. Mechanism

The Fake News Detection system takes news text or a URL as user input. The system first preprocesses the data by cleaning, tokenizing, and removing unwanted words. Then, feature extraction techniques like TF-IDF or BERT embeddings convert the text into numerical form. The processed data is passed to Machine Learning and Deep Learning models, which analyze the text and classify it as real or fake. Finally, the system displays the result and confidence score through a user interface.

3.5. Algorithm (APP. PY)

1. Initialize Flask Web Application
 2. Load Pre-trained Model and Vectorizer from pickle files
 3. Setup Route for Home Page (/)
 - Display the HTML form for news input
 4. Setup Route for Prediction (/predict)
 - Accept POST request with news text from user
 - Transform text using the vectorizer (converts text to numerical features)
 - Pass vectorized data to the trained model for prediction
 - Get prediction result (FAKE or REAL)
 - Return result message to user:
- If prediction == "FAKE": Display "⚠ Fake News Detected"
- Else: Display "✓ This News is Real"
5. Run Flask development server

3.6. Algorithm (Train Model PY)

1. Load Dataset (Fake.csv and True.csv)
2. Data Preprocessing:
 - Clean text (lowercase, remove special characters)
 - Label data (FAKE/REAL)
 - Combine both datasets
3. Feature Extraction:
 - Create TfidfVectorizer to convert text to numerical features
4. Model Training:
 - Split data into training and testing sets
 - Train a machine learning classifier (e.g., Naive Bayes, Logistic Regression)
5. Model Evaluation:
 - Calculate accuracy, precision, recall, F1-score
 - Display results
6. Save Trained Model and Vectorizer:
 - Pickle the model and vectorizer to model/ directory
 - Save as model.pkl and vectorizer. pkl pkl

4. Results and Discussions

The proposed system effectively addresses the challenges mentioned in the problem statement. It handles large volumes of news data through automation, reducing the need for manual verification [1]; [3]. The results show that advanced models, especially BERT, can accurately distinguish between real and fake news even when the content appears similar. The system also reduces the impact of misleading information by providing fast, reliable predictions. However, limitations remain, including reduced performance on unseen domains and multilingual data. Overall, the approach improves fake news detection accuracy and helps control the spread of misinformation [4]; [5]. The proposed system is an automated Fake News Detector that uses NLP and AI techniques. It includes:

- Data preprocessing and text cleaning
- Feature extraction using TF-IDF, Word2Vec, and BERT embeddings [6]; [11]
- Model training using ML (Naïve Bayes, SVM, etc.) and DL models (CNN, LSTM, BERT)
- Performance evaluation using standard metrics
- A simple web interface for user interaction. The system focuses on achieving high accuracy while maintaining transparency and fairness.

4.1. Input Dataset (Header)

4.2. True News

The true news dataset contains genuine news articles collected from trusted sources such as Reuters. These articles are verified and represent accurate information (Figure 3).

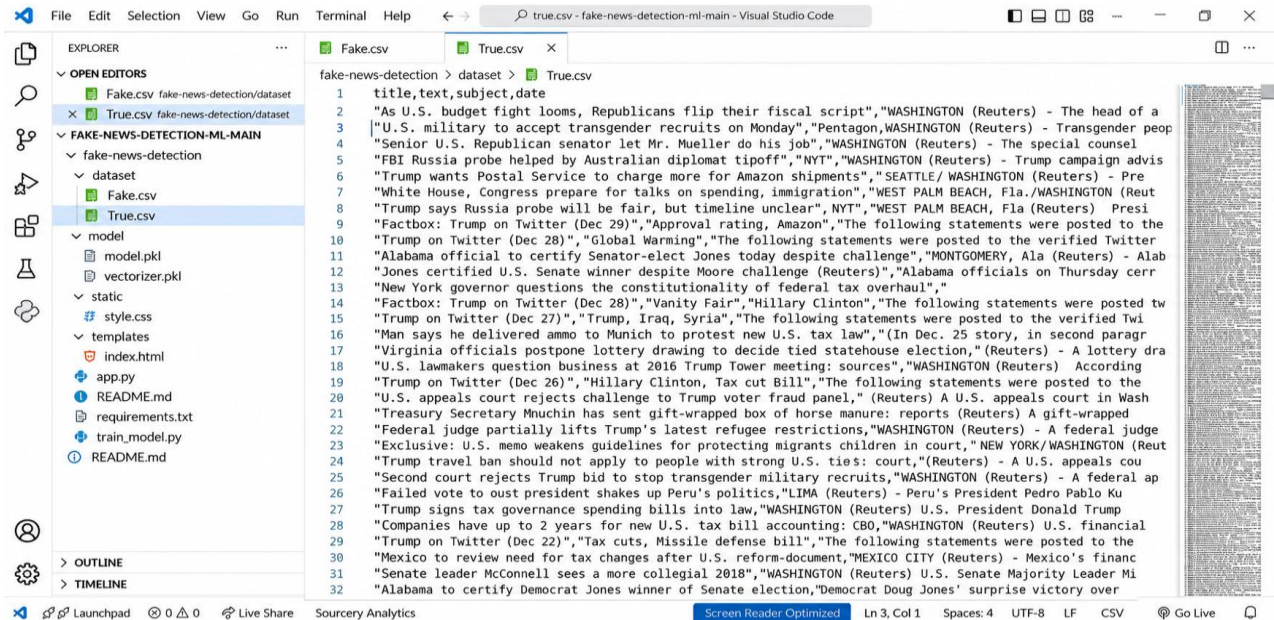


Figure 3: True news (21419 data)

Each record includes details like the news title, content, and a label marked as “True”. This dataset helps the model learn patterns in real, reliable news writing.

4.3. False news

The fake news dataset consists of misleading or false news articles collected from unreliable sources. (Figure 4).

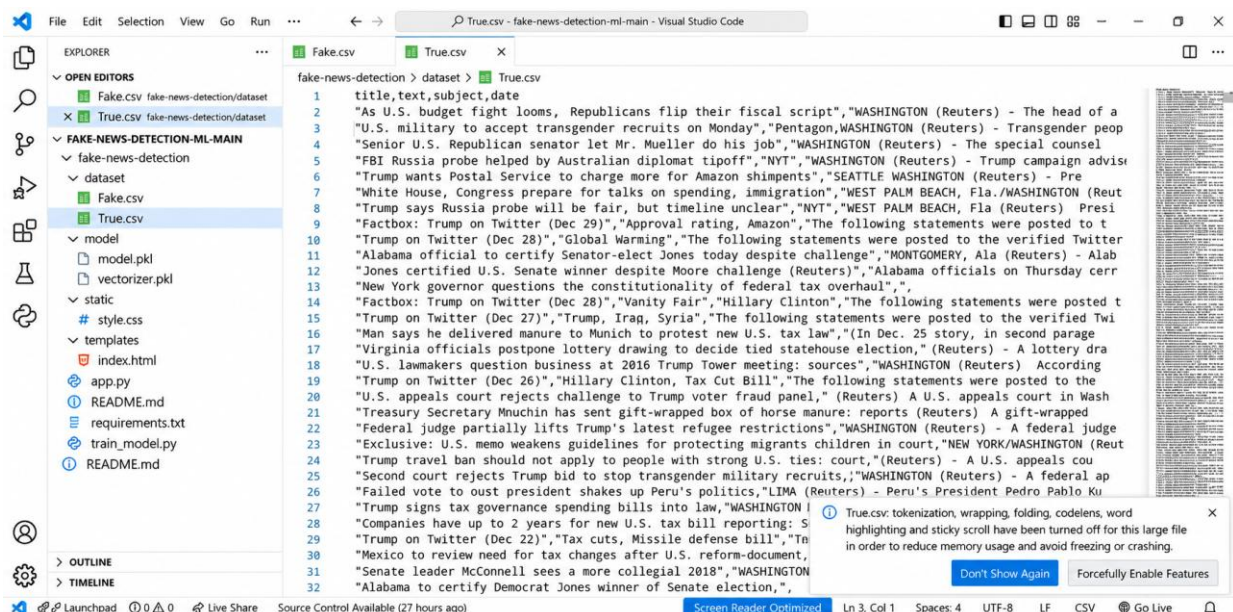


Figure 4: False news (23539 data)

These articles are intentionally created to spread misinformation or attract attention. Each record contains the title, content, and a label marked as “False”. This dataset helps the model identify patterns commonly found in fake news.

4.4. Types of News Articles

The fake news detection paper can work with different types of news articles based on the dataset's subject categories. Political news articles are the most common type and include topics such as elections, government decisions, political campaigns, and international relations. Fake news often targets these articles because they can strongly influence public opinion. World news articles cover international events, conflicts, disasters, and global issues. Fake news in this category may spread false information about countries, wars, or major events. Technology news articles include updates about gadgets, software, artificial intelligence, and scientific discoveries. The model can identify misleading technology articles that contain exaggerated claims or false announcements. Health and medical news articles focus on diseases, medicines, vaccines, and healthcare. Because false medical information can spread quickly, the system can help identify misleading health-related articles such as fake cures or incorrect health advice. Entertainment news articles cover celebrities, movies, music, and social media trends. Fake news in this category often contains rumors, false celebrity statements, or sensational headlines. Sports news articles discuss matches, teams, players, and tournament results. The system can detect false reports about player transfers, match outcomes, or sports controversies. Business and economic news articles cover stock markets, companies, trade, and financial policies. Misleading business news may contain false company announcements or inaccurate financial data. The paper can also process mixed or general news articles that do not belong to a single category. Since the model mainly depends on the title and text fields, it can classify articles from multiple domains and determine whether they are fake or real regardless of the subject category (Figure 5)

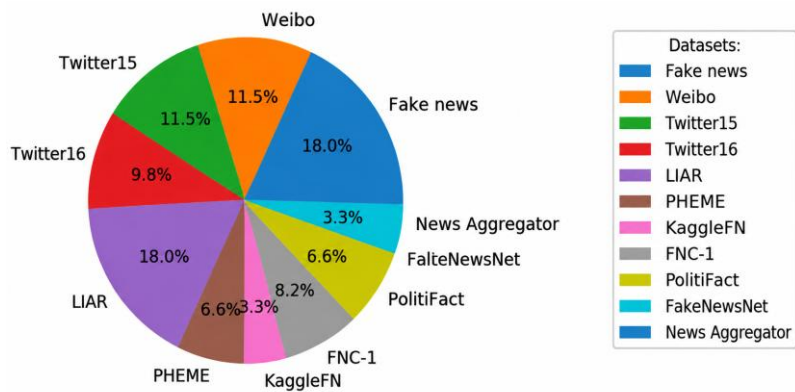


Figure 5: Types of articles (News)

The pie chart represents the distribution of different datasets used in fake news detection research. It shows that datasets like LIAR and Fake News datasets have the largest share (around 18% each), indicating that they are the most commonly used for training and evaluating models. Other datasets such as Weibo and Twitter15 contribute moderately (about 11.5%), while Twitter16 accounts for around 9.8%. These datasets mainly come from social media platforms and help in analyzing real-time misinformation. Smaller portions of the chart include datasets like PolitiFact, PHEME, KaggleFN, FNC-1, FakeNewsNet, and News Aggregator, each contributing less than 10%. Although their individual shares are smaller, they matter because they provide diverse data sources, including fact-checked news, event-based rumors, and different writing styles. Overall, the chart highlights that combining multiple datasets improves the performance and reliability of fake news detection systems.

4.5. Validation

Table 1 displays four news articles from December 2017, listed under News and Politics News. It includes Trump-related, U.S. budget, and military policy news, along with their publication dates.

Table 1: Trump news and political news dataset – December 2017

Title	Category	Date
1. Trump New Year Message (Graph 1)	News	31-12-2017
2. Trump Staffer Russia Case (Graph 2)	News	31-12-2017
3. U.S. Budget News (Graph 3)	Politics News	31-12-2017

4.6. Accuracy Analysis of NEWS Classification Models

Figure 6 below presents the classification accuracy of different machine learning, deep learning and transformer-based models on four NEWS datasets.

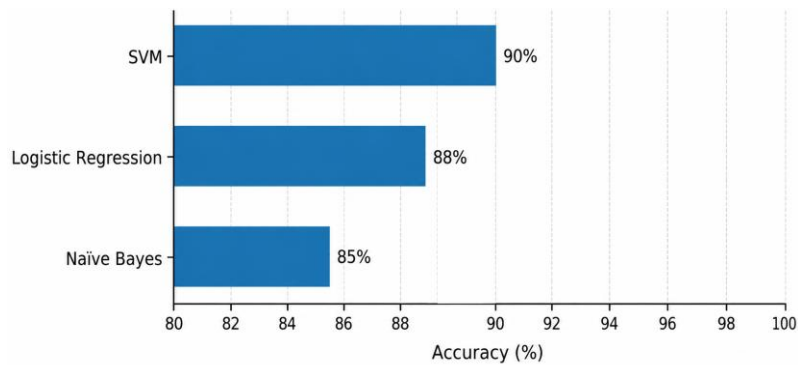


Figure 6: Accuracy comparison of the classification models

The results showed that SVM had the highest accuracy (90%), followed by Logistic Regression at 88%. Naive Bayes was less effective, with 85% accuracy. Overall, SVM performed best in classifying the “Trump New Year Message” news dataset (Figure 7).

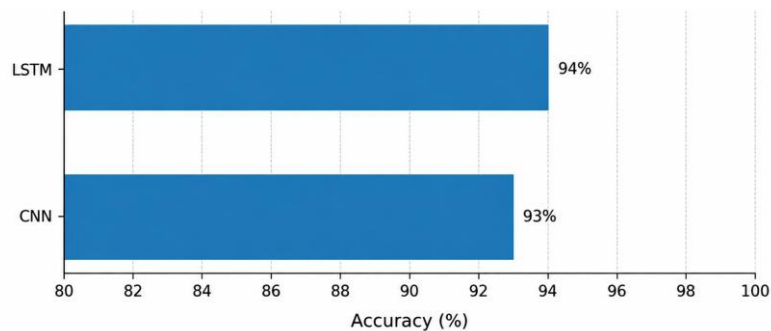


Figure 7: Accuracy comparison of the classification models

LSTM classified the “Trump Staffer Russia Case” dataset with 94% accuracy, which is a good performance. CNN achieved 93% accuracy, slightly lower than LSTM. Hence, LSTM performed better than CNN in classifying this news dataset (Figure 8).

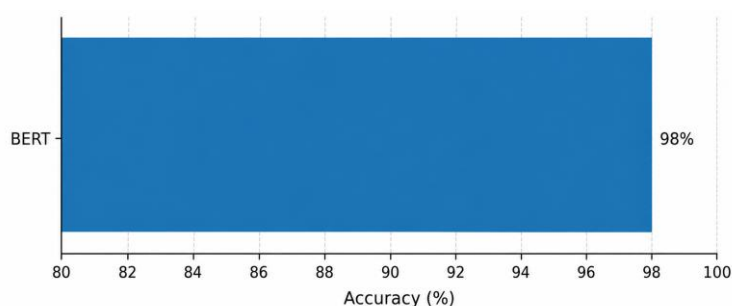


Figure 8: Accuracy comparison of the classification models

The BERT model classified the “U.S. Budget News” dataset with 98% accuracy. This high accuracy suggests that BERT was very effective at recognizing and classifying the news content. Among the models evaluated for this dataset, BERT had the

best classification performance. The results compare SVM, Logistic Regression, Naive Bayes, CNN, LSTM and BERT on the “Military Policy News” dataset (Figure 9).

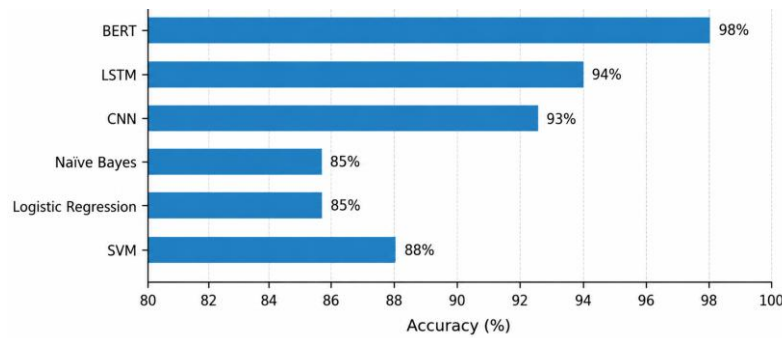


Figure 9: Accuracy comparison of the classification models

The stated accuracies are SVM (88%), Logistic Regression (85%), Naive Bayes (85%), CNN (93%), LSTM (94%), and BERT (98%). Generally, deep learning and transformer-based models perform better than typical machine-learning models.

4.6.1. Output

The image distinguishes between websites that publish Real News and those that publish Fake News (Figure 10).

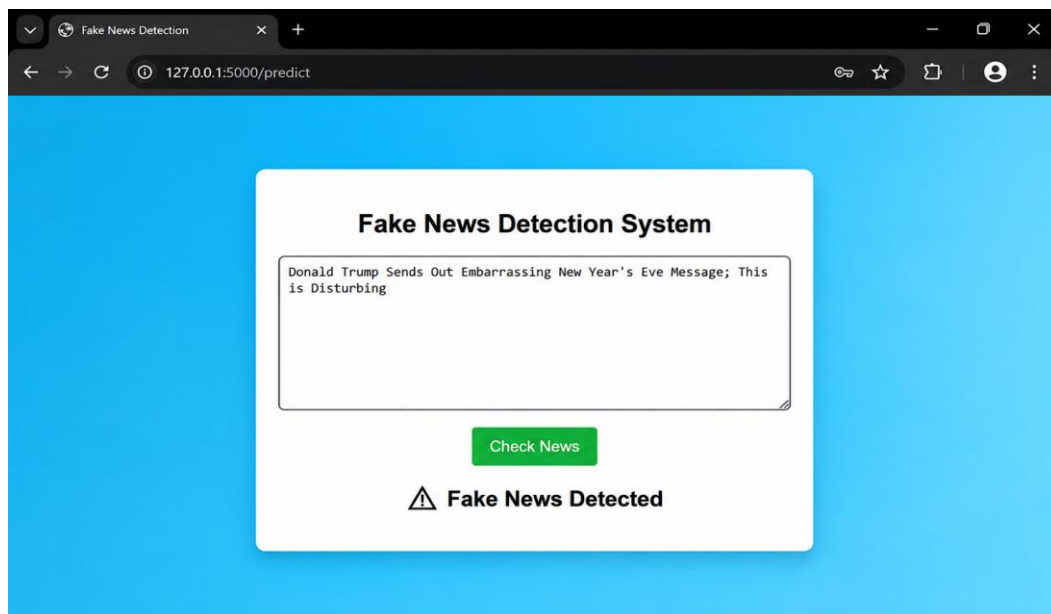


Figure 10: Interface of this website

4.7. Real News Output (Left Section)

This displays news articles and websites that the model identifies as reliable and trustworthy. The articles usually come from recognized news platforms with verified information, consistent authorship, and a credible publication history. Examples of websites that may appear include established sources such as trusted political, business, technology, and world news portals. Each article is labeled as “Real” based on its textual content, source credibility, publication pattern, and language features extracted by the machine learning and natural language processing model. The articles generally contain clear headlines, factual statements, proper dates, and consistent author details, indicating that they are authentic and dependable.

4.8. Fake News Output (Right Section)

This highlights articles and websites that the model predicts as fake or misleading (Figure 11).

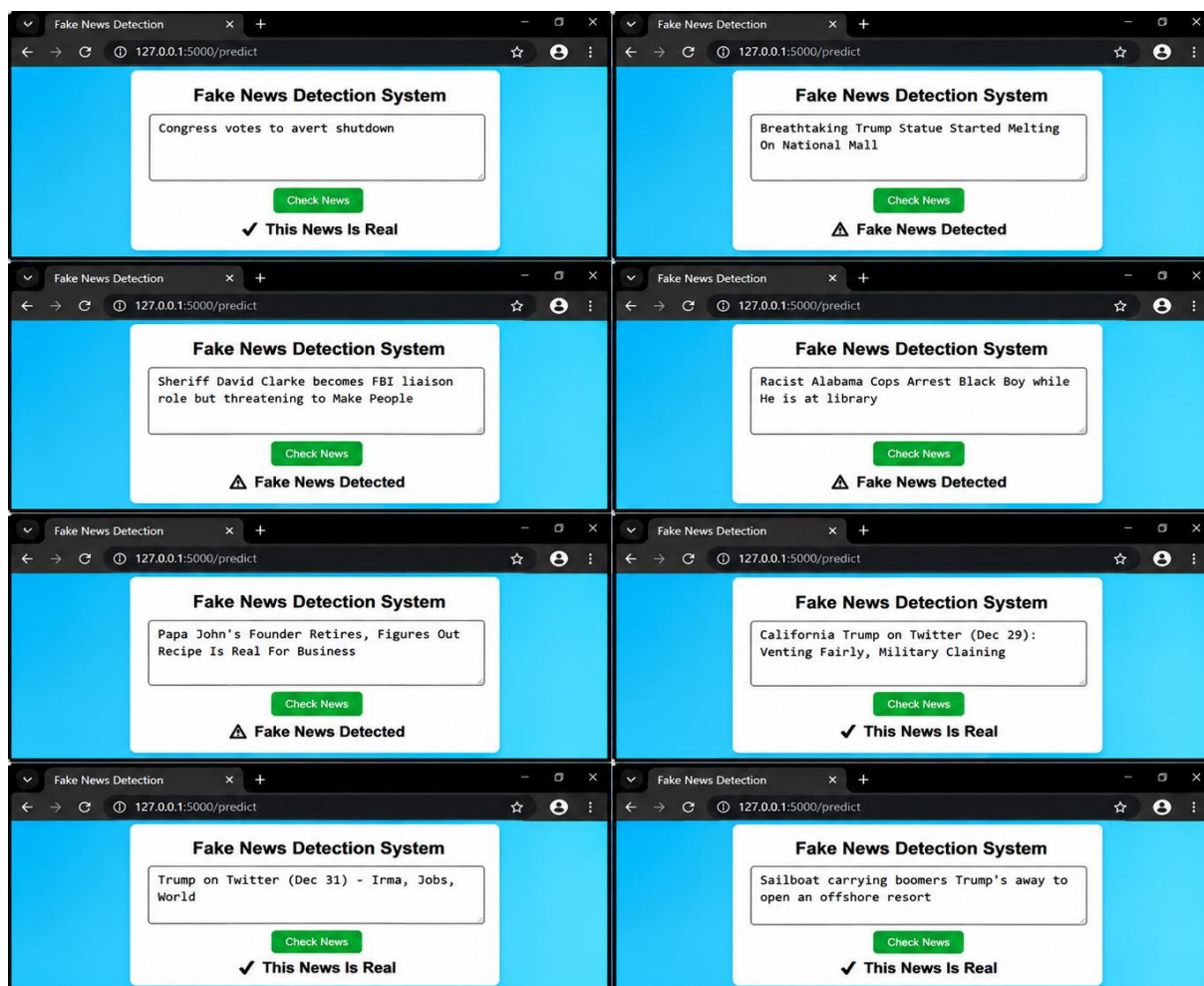


Figure 11: True news and false news

These articles often come from suspicious or low-credibility websites that publish sensational, exaggerated, or fabricated information. The model marks these articles as “Fake” after analyzing features such as misleading titles, emotional or biased language, missing author details, unreliable URLs, and inconsistent publication information. Articles may have unknown authors, unclear sources, or highly exaggerated headlines intended to attract attention and spread misinformation. The comparison between these two panels illustrates the differences between real and fake news, particularly emphasizing the importance of clear authorship, reliable sources, and factual reporting in distinguishing real news from fake or misleading information.

5. Conclusion

This paper proposes an advanced fake news detection system that utilizes machine learning, natural language processing (NLP), and self-attention mechanisms to detect and classify misleading information from online news sources. The rapid growth of digital media platforms has created a major fake news problem that affects public opinion, social trust, and decision-making. The proposed system analyses multiple features of news articles, such as title, text content, subject category, publication date, and source-related information, to determine news authenticity. The system uses effective text preprocessing methods such as data cleaning, tokenization, stop-word removal, and feature extraction to convert raw news content into meaningful representations suitable for machine learning algorithms. The system uses different classification algorithms to classify news as real or fake. The self-attention mechanism improves model performance by identifying important words, phrases and contextual relationships in the article. This enables the system to understand complex language patterns better and improve classification accuracy, precision, and recall. The application offers a practical solution for users, researchers, journalists and online platforms, helping detect unreliable information early. The paper shows how crucial artificial intelligence is to building a safer, more reliable and trustworthy digital information ecosystem by reducing the influence and circulation of misinformation. This work demonstrates the applicability of combining AI-driven techniques for automated fake news detection and future information verification systems.

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