Advanced International Journal for Research (AIJFR)
E-ISSN: 3048-7641 ● Website: www.aijfr.com ● Email: editor@aijfr.com

Fake News Detection Using Machine Learning Techniques

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Abstract

The rapid growth of digital media and social networking platforms has significantly increased the spread of misinformation and fake news. Fake news can manipulate public opinion, create social unrest, and negatively impact decision-making processes. Manual fact-checking mechanisms are insufficient to handle the massive volume of online content generated every day. Therefore, automated fake news detection systems have become a critical research area.

This paper presents a machine learning-based approach for detecting fake news using Natural Language Processing (NLP) techniques. The proposed system preprocesses textual news data and applies TF-IDF feature extraction to convert text into numerical form. Multiple machine learning classifiers, including Logistic Regression, Naïve Bayes, Random Forest, and Support Vector Machine (SVM), were trained and evaluated on a benchmark dataset. Experimental results show that the Random Forest classifier achieved the highest accuracy of 91.3%, demonstrating the effectiveness of classical machine learning models in fake news detection. The proposed approach provides a reliable and computationally efficient solution to combat misinformation in digital media.

Keywords: Fake News Detection, Machine Learning, Natural Language Processing, TF-IDF, Classification

1. Introduction

The widespread use of the internet and social media platforms has transformed the way information is shared and consumed. Online platforms such as news websites, blogs, and social media enable instant dissemination of information to a global audience. However, this ease of information sharing has also led to a rapid increase in fake news, which refers to false or misleading information presented as legitimate news.

Fake news can be politically motivated, financially driven, or created to mislead the public intentionally. Its uncontrolled spread can cause serious consequences, including influencing elections, spreading panic during crises, and damaging public trust. Traditional fact-checking methods rely on human experts, which are time-consuming and cannot scale with the speed of online content generation.

Recent advancements in machine learning and NLP have enabled automated analysis of textual data. By identifying linguistic patterns and semantic features, machine learning models can effectively classify

news articles as fake or real. This research focuses on applying classical machine learning algorithms to detect fake news efficiently and accurately.

2. Literature Review

Several studies have explored fake news detection using machine learning and deep learning techniques. Shu et al. proposed a data mining-based framework that analyzed both content and social context features to detect fake news. Ahmed et al. demonstrated that N-gram-based features combined with Naïve Bayes and SVM classifiers can achieve high accuracy in detecting fake news.

Ruchansky et al. introduced a hybrid deep learning model that combined textual analysis with user behavior modeling, resulting in improved accuracy but increased computational complexity. Kaliyar et al. applied deep learning models such as LSTM and CNN for fake news detection and reported better performance compared to traditional methods, though requiring large datasets and higher training time.

From existing literature, it is evident that classical machine learning techniques remain effective due to their simplicity, efficiency, and lower computational requirements. This study focuses on evaluating classical ML models for fake news detection.

3. Methodology

3.1 Dataset Description

The dataset used in this study was obtained from the Kaggle Fake News Dataset. It consists of 20,800 English news articles, evenly distributed between fake and real labels. Each record contains news content and its corresponding label.

3.2 Data Preprocessing

Text preprocessing was performed to clean and normalize the data. The preprocessing steps included converting text to lowercase, removing punctuation and special characters, eliminating stopwords, tokenization, and lemmatization.

3.3 Feature Extraction

TF-IDF (Term Frequency–Inverse Document Frequency) was used to convert textual data into numerical feature vectors. This technique helps in emphasizing important words while reducing the influence of commonly occurring terms.

3.4 Model Training

The dataset was split into 80% training data and 20% testing data. The following machine learning classifiers were trained:

- Logistic Regression
- Naïve Bayes
- Random Forest
- Support Vector Machine

4. Result & Discussion

The performance of each classifier was evaluated using Accuracy, Precision, Recall, and F1-Score. The comparative results are shown in Table 1

Table 1: Performance Comparison of Models

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Logistic Regression	89.2	0.89	0.88	0.88
Naïve Bayes	86.4	0.85	0.86	0.85
Random Forest	**91.3**	0.91	0.90	0.90
Support Vector Machine	90.1	0.90	0.89	0.89

The results indicate that Random Forest achieved the highest accuracy of 91.3%, making it the most effective classifier among the evaluated models. Logistic Regression and SVM also demonstrated competitive performance, confirming the suitability of classical machine learning approaches for fake news detection.

5. Conclusion

This paper presented a machine learning-based approach for fake news detection using NLP techniques and TF-IDF feature extraction. Multiple classifiers were trained and evaluated on a benchmark dataset. Experimental results demonstrated that the Random Forest classifier outperformed other models, achieving an accuracy of 91.3%.
The study confirms that classical machine learning models can effectively detect fake news with high accuracy and lower computational cost, making them suitable for real-world applications.

6. Future Work

Future work may include the integration of deep learning models such as LSTM, CNN, and BERT to improve contextual understanding. Additionally, multilingual fake news detection and real-time deployment on social media platforms can be explored.

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