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Research

An NLP-Based Approach for Fake News Classification Using Supervised Machine Learning Algorithms

Dr.M.Venkateswara Rao1, Sellamuthu Ashwitha 2, Konakala Lalitha 3, Kondameeda Abhinash 4

#1 Professor ,Information Technology Department,NRI Institute of Technology,Agiripalli
#2#3#4 B.Tech with Specialization of Information Technology in NRI Institute Of Technology,Agiripalli

Abstract: The rapid spread of misinformation through social media and online news platforms has made fake news detection an important research problem. This project proposes a Natural Language Processing (NLP) based approach to classify news articles as real or fake using supervised machine learning algorithms. The system performs text preprocessing and feature extraction using techniques such as TF-IDF to convert textual data into numerical representations. Several classification models including Logistic Regression, Support Vector Machine, Random Forest, and Decision Tree are used to train and evaluate the dataset. The performance of the models is measured using accuracy, precision, recall, and F1-score to ensure reliable prediction. The proposed system helps users identify misleading information and supports the prevention of misinformation spread in digital media.

Index terms *- Fake News Detection, Natural Language Processing (NLP), Machine Learning, TF-IDF, Logistic Regression, Support Vector Machine (SVM), Random Forest, Text Classification, Supervised Learning.*

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1. INTRODUCTION

The rapid expansion of the internet and social media platforms has significantly changed the way people access and share news. Platforms such as online news websites, blogs, and social networking sites enable information to spread quickly to a large audience. However, this convenience has also led to the widespread circulation of fake news, which contains misleading or intentionally false information presented as legitimate news. Fake news can influence public opinion, create social conflicts, and negatively impact political, economic, and social stability. Therefore, identifying and controlling the spread of misinformation has become an important research challenge.

Traditional methods of detecting fake news rely heavily on manual verification by journalists or fact-checking organizations. While effective, these approaches are time-consuming and cannot handle the massive volume of information generated daily on digital platforms. As a result, automated solutions using Artificial Intelligence (AI) and Natural Language Processing (NLP) have gained significant attention. NLP techniques allow computers to understand, analyze, and process textual information, making them suitable for identifying linguistic patterns and suspicious content in news articles.

In recent years, machine learning techniques have been widely applied to classify news content based on textual features. By converting textual data into numerical representations using feature extraction methods such as Term Frequency–Inverse Document Frequency (TF-IDF), machine learning algorithms can analyze patterns within news articles and predict whether the content is real or fake. Supervised learning models including Logistic Regression, Support Vector Machine (SVM), Random Forest, and Decision Tree are commonly used for such classification tasks due to their efficiency and reliability.

This project proposes a fake news detection system based on Natural Language Processing and supervised machine learning algorithms. The system performs text preprocessing to clean and normalize

news articles, followed by feature extraction to transform textual data into structured numerical features. Multiple machine learning models are trained and evaluated using labeled datasets to identify fake news accurately. The developed system aims to assist users, researchers, and media organizations in verifying the authenticity of news articles and reducing the spread of misinformation in digital media platforms.

2. LITERATURE SURVEY

1. Simple approach for fake news detection using naive Bayes classifier

This method was put into practice as a software solution and evaluated using a collection of Facebook news posts. They were gathered from three sizable mainstream political news pages (Politico, CNN, and ABC News) and three sizable Facebook pages on the right and left, respectively. A classification accuracy of almost 74% was attained. Fake news classification accuracy is marginally worse. The dataset's skewness—just 4.9% of it is bogus news—could be the reason for this.

2. A framework based on different machine learning approach that deals with various problems including accuracy shortage

First, 400,000 tweets were gathered from the HSpam14 dataset. The 150,000 spam and 250,000 non-spam tweets are then further described. Along with the Top-30 terms that offer the greatest information gain, they also extracted a few lightweight features from the Bag-of-Words model. 4. They outperformed the current solution by almost 18% with an accuracy of 91.65%.

3. A novel ML fake news detection method which, by combining news content and social context features

The accuracy is increased to 78.8%, outperforming current techniques in the literature. Second, they used their technique to a Facebook Messenger Chabot and tested it on a real-world application, achieving an accuracy of 81.7% in detecting fake news. They outlined the datasets they used for their test, then showed the content-based strategy they employed and the way they suggested combining it with a social-based approach that was already available in the literature. Their objective was to determine whether a news item was authentic or fraudulent. The final dataset consists of 15,500 postings from 32 pages (18 scientific pages and 14 conspiracy pages), with over 2,300,000 likes from over 900,000 individuals. There are 6,577 (42.4%) posts that are not hoaxes and 8,923 (57.6%) that are.

4. A method for automating fake news detection on Twitter by learning to predict accuracy assessments in two credibility-focused Twitter datasets.

PHEME, a collection of possible rumors on Twitter and journalistic evaluations of their veracity, and crowdsourced datasets of accuracy judgments for events on Twitter. They use BuzzFeed's fake news dataset as a source for their Twitter content. The most predictive features for crowd-sourced and journalistic accuracy evaluations are found by a feature analysis, and the findings are in line with earlier research. The usefulness of this work is limited to the collection of popular tweets because they rely on finding highly retweeted conversation threads and classifying tales based on the characteristics of these threads. This approach can only be applied to a small percentage of Twitter conversation threads because most tweets are rarely retweeted.

5. To present an insight of characterization of news story in the modern diaspora combined with the differential content types of news story and its impact on readers.

We then present prominent fake news datasets and delve into current methods for detecting fake news that mainly rely on text-based analysis. In order to direct future research, we identify four major open research problems at the end of the work. This theoretical approach analyzes psychological aspects to provide examples of detecting fake news.

3. METHODOLOGY

i) Proposed Work:

The proposed system focuses on detecting fake news articles using Natural Language Processing (NLP) and supervised machine learning techniques. Initially, a dataset containing both real and fake news articles is collected and processed. The textual data undergoes preprocessing steps such as tokenization, removal of stopwords, punctuation cleaning, and text normalization to improve data quality. After preprocessing, feature extraction techniques such as TF-IDF are applied to convert textual information into numerical feature vectors that can be understood by machine learning models. These features represent the important words and patterns present in the news articles.

Once the features are generated, several supervised machine learning algorithms including Logistic Regression, Support Vector Machine (SVM), Decision Tree, and Random Forest are trained using the labeled dataset. The trained models learn the linguistic patterns and structural differences between real and fake news articles. During testing, the system analyzes new news content uploaded by the user and classifies it as either fake or real based on the learned patterns. The performance of the system is evaluated using metrics such as accuracy, precision, recall, and F1-score to ensure reliable prediction and effective detection of misinformation.

ii) System Architecture:

The system architecture for fake news detection is designed to process news articles through multiple stages including data collection, preprocessing, feature extraction, model training, and prediction. Initially, the system collects datasets containing both real and fake news articles stored in CSV format. The collected data is passed to the preprocessing module where the textual content is cleaned by removing stop words, punctuation, special characters, and performing tokenization and normalization. This step improves the quality of the textual data and prepares it for further analysis. After preprocessing, feature extraction techniques such as TF-IDF are applied to convert the cleaned textual data into numerical feature vectors that can be processed by machine learning algorithms.

Once the features are generated, the processed data is divided into training and testing datasets. Supervised machine learning models such as Logistic Regression, Support Vector Machine (SVM), Random Forest, and Decision Tree are trained using the training data to learn the patterns that differentiate real news from fake news. The trained model is then integrated with the Streamlit-based user interface, where users can input a news article for analysis. The system processes the input text, applies the trained model, and predicts whether the article is real or fake. The results are displayed through the web interface, providing users with an easy and efficient way to verify the authenticity of news content.

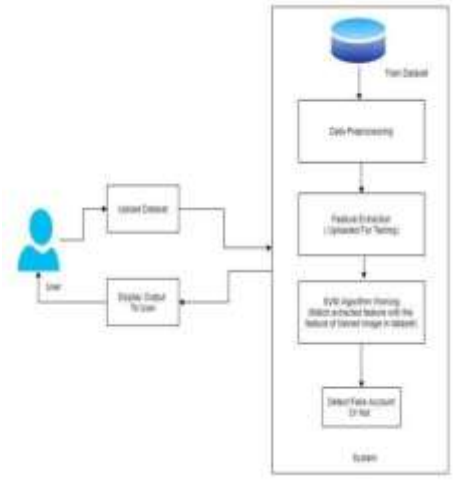

Fig.1. Proposed Architecture

iii) MODULES:

1. Data Collection

The data collection module is responsible for gathering the dataset required for training and testing the fake news detection system. In this project, datasets containing both real and fake news articles are collected and stored in CSV format. These datasets include various news headlines and article contents labeled as real or fake. Collecting a large and balanced dataset helps the machine learning models learn the differences between genuine and misleading information, improving the overall accuracy of the system.

2. Data Pre-processing

Data preprocessing is an important step that prepares the raw textual data for machine learning analysis. In this module, the collected news articles are cleaned and normalized using Natural Language Processing (NLP) techniques. The preprocessing steps include removing punctuation, stopwords, and special characters, as well as converting text into lowercase and performing tokenization. These steps help in reducing noise in the dataset and improving the quality of textual data before feature extraction and model training.

3. Train and Test Modelling

In this module, the processed dataset is divided into training and testing sets to build and evaluate the machine learning models. Feature extraction techniques such as TF-IDF are applied to convert textual data into numerical form that machine learning

algorithms can understand. Supervised learning algorithms such as Logistic Regression, Support Vector Machine (SVM), Decision Tree, and Random Forest are then trained using the training data. The trained models learn patterns and relationships within the data that help distinguish fake news from real news.

4. Predicting Output

The prediction module is responsible for classifying new news articles as either fake or real. When a user inputs a news article through the Streamlit interface, the system processes the text using the same preprocessing and feature extraction techniques used during training. The trained machine learning model then analyzes the processed text and predicts whether the article contains fake news or genuine information. The final prediction result is displayed to the user through the web application interface..

iv) ALGORITHMS:

1. Logistic Regression

Logistic Regression is a supervised machine learning algorithm used for binary classification problems. In this project, it is used to classify news articles as either real or fake based on the textual features extracted from the dataset. The algorithm applies a sigmoid function to convert input values into probability scores between 0 and 1, which helps in determining the class label. Logistic Regression works effectively with TF-IDF feature vectors and provides fast and reliable predictions for text classification tasks such as fake news detection.

2. Support Vector Machine (SVM)

Support Vector Machine is a powerful supervised learning algorithm used for classification and pattern recognition. It works by finding the optimal hyperplane that separates different classes in the feature space. In the fake news detection system, SVM analyzes the textual feature vectors generated through NLP techniques and determines the boundary that best separates fake news from real news. SVM is highly effective for high-dimensional data such as text data and is widely used in Natural Language Processing applications.

3. Decision Tree

Decision Tree is a supervised learning algorithm that classifies data by creating a tree-like structure of decisions based on feature values. In this project, the Decision Tree algorithm analyzes different textual features extracted from news articles and makes decisions step-by-step to determine whether the article is fake or real. Each internal node represents a feature, each branch represents a decision rule, and each leaf node represents the final classification result. Decision Trees are easy to interpret and help understand the decision-making process of the model.

4. Random Forest

Random Forest is an ensemble learning algorithm that combines multiple decision trees to improve classification accuracy and reduce overfitting. Instead of relying on a single decision tree, Random Forest creates multiple trees during training and combines their predictions to produce the final result. In the fake news detection system, Random Forest analyzes various textual features of news articles and uses the collective output of multiple trees to classify the article as fake or real. This approach increases the reliability and robustness of the prediction model.

4. EXPERIMENTAL RESULTS

The experimental results demonstrate the effectiveness of the proposed fake news detection system developed using Natural Language Processing and supervised machine learning algorithms. The system is implemented using a Streamlit-based web interface where users can enter a news article for verification. After entering the news content and clicking the “Check News” button, the system processes the text using preprocessing and TF-IDF feature extraction techniques. The trained machine learning model then analyzes the textual patterns and predicts whether the news article is real or fake. The result is displayed on the interface along with a confidence score indicating the reliability of the prediction.

From the experimental outputs, the system successfully identifies both real and fake news articles. In one example, the model classified the news article as real with a confidence score of 97.07%, indicating strong prediction accuracy. In another test case, the system detected the news article as fake with a confidence score of 93.42%. These results show that the trained model can effectively analyze linguistic patterns in news articles and distinguish between genuine and misleading content. The interactive Streamlit interface also makes the system user-friendly and suitable for real-time fake news verification.

Accuracy: The ability of a test to differentiate between healthy and sick instances is a measure of its accuracy. Find the proportion of analysed cases with true positives and true negatives to get a sense of the test's accuracy. Based on the calculations:

Accuracy = TP + TN /(TP + TN + FP + FN)

$$Accuracy = \frac{(TN + TP)}{T}$$

Precision: The accuracy rate of a classification or number of positive cases is known as precision. Accuracy is determined by applying the following formula:

Precision = True positives/ (True positives + False positives) = TP/(TP + FP)

$$\Pr e\,cision = \frac{TP}{(TP + FP)}$$

Recall: The recall of a model is a measure of its capacity to identify all occurrences of a relevant machine learning class. A model's ability to detect class instances is shown by the ratio of correctly predicted positive observations to the total number of positives.

$$Recall = \frac{TP}{(FN + TP)}$$

F1-Score: A high F1 score indicates that a machine learning model is accurate. Improving model accuracy by integrating recall and precision. How often a model gets a dataset prediction right is measured by the accuracy statistic..

$$F1 = 2 \cdot \frac{(Recall \cdot \Pr e\,cision)}{(Recall + \Pr e\,cision)}$$

Figure 2: Web Page

Fig2 shows us the web page, here we have to give our article for test in the text area given as “Enter test article for prediction” and submit. after submitting we will get the output weather the article is real or fake.

Fig3 Choose The Article From Dataset

Fig:3 After uploading the article for test and submitting it .wewill get the output as real or fake . In the above figure the predicted output is that the given test article is fake/true

Fig4 Article Into Webpage

Fig: 5. Analyzing and predicting

Fig 4 shows us the web page, here we have to give our article for test in the text area given as “Enter test article for prediction” and submit. after submitting we will get the output weather the article is real or fake.

Fig 6: Prediction Result

This figure Displays The News Article is True

Fig 7: Prediction Result
This figure Displays The News Article is False

5. CONCLUSION

In this project, a fake news detection system was developed using Natural Language Processing (NLP) and supervised machine learning algorithms. The system processes news articles through text preprocessing and feature extraction techniques such as TF-IDF, which convert textual data into numerical representations suitable for machine learning models. Several algorithms including Logistic Regression, Support Vector Machine (SVM), Decision Tree, and Random Forest were used to train the model for accurate classification of news articles as real or fake. The experimental results demonstrate that the proposed system can effectively identify misleading information with high prediction confidence. The integration of a Streamlit-based web interface allows users to easily input news content and obtain classification results in real time. Overall, the system provides a reliable and efficient solution for detecting fake news and can help reduce the spread of misinformation across digital platforms. In the future, the system can be further improved by incorporating deep learning models, multilingual support, and real-time social media data analysis.

6. FUTURE SCOPE

The fake news detection system can be further improved by integrating advanced deep learning models such as Long Short-Term Memory (LSTM), Bidirectional RNN, and Transformer-based models like BERT to achieve higher accuracy and better understanding of contextual information in news articles. These models can capture complex linguistic patterns and semantic relationships within the text, which can enhance the performance of fake news classification systems.

In the future, the system can also be extended to support real-time fake news detection from social media platforms such as Twitter, Facebook, and online news websites. Multilingual support can be added to detect fake news in multiple languages, making the system more useful globally. Additionally, integrating explainable AI techniques can help users understand why a particular news article is classified as fake or real, improving transparency and trust in the system.

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