

# Fake News Detection using Machine Learning Algorithms

**Akash Patra<sup>1</sup>, Tamojit Roy<sup>2</sup>**

<sup>1</sup>*Vellore Institute of Technology, Chennai, India*

<sup>2</sup>*Vellore Institute of Technology, Chennai, India*

<sup>1</sup>E-mail: [akash.patra2019@vitstudent.ac.in](mailto:akash.patra2019@vitstudent.ac.in)

<sup>2</sup>E-mail: [tamojit.roy2019@vitstudent.ac.in](mailto:tamojit.roy2019@vitstudent.ac.in)

## Introduction

In today's Internet world, people rely on different online services / platforms for news. As the use of social media platforms such as Facebook, Twitter, and news websites increases, news spreads rapidly to millions of people in a short period of time. News websites publish news and provide authentication sources. The problem is how to authenticate messages and articles distributed on social media such as WhatsApp groups, Facebook pages, Twitter, other microblogging and social networking sites. Believing in rumors of pretending to be news is bad for society. The spread of fake news has widespread consequences, including the generation of biased opinions that affect the outcome of elections in favor of a particular candidate. In addition, spammers use compelling headlines to monetize their ads through Clickbait. Especially in developing countries like India, it takes time to put an end to rumors and focus on the right certified news articles. This white paper presents models and methods for detecting fake news.

Social media platforms such as Facebook, Instagram, and Twitter provide a cheaper way to deliver news online much faster by spreading the network more easily. It's better than traditional news media, but it's a lot of fake news. News articles contain intentionally false information created online for a variety of purposes for economic and political gain. Therefore, there is an urgent need for a fake news detection system that not only distinguishes between fake news and real news, but also displays the relevant real news articles that are closest to the original.

Since dealing with fake news requires precision and with current advances in machine learning algorithms to detect such fake news, it would be foolish to depend on a single algorithm/method to perform such complex classification. Therefore, it makes much more sense to divide the work into phases to completely separate the work by data mining operations such as data collection, data pre-processing, feature extraction, feature selection and implementation of machine learning models to perform predictions to classify the news as True or False and also predict the probability that the news belongs to the predicted label.

Several machine learning models will be used to classify news as true or false. Each will be evaluated and compared against each other based on metrics like accuracy, f1 score, precision and recall. After the following machine learning models - SVM, Logistic Regression, Naïve Bayes and Random Forest will be trained and adjusted. A voting classifier will be implemented that will combine all the models mentioned above and form a composite classifier that uses all these classifiers to predict class labels and probabilities, and use soft voting to make the final prediction.

A suitable dataset that has been divided into training set, validation set and test set will be used and will be preprocessed to apply feature extraction techniques in the next steps. Models like Random Forest Classifier, Naïve Bayes, Logistic Regression and SVM Classifier will be used to train the dataset. Finally, the different scores for each category will be calculated and compared. Below is a detailed flowchart that summarizes the entire process.



## Literature Survey

This paper presents a model and methodology for detecting fake news. Machine learning and natural language processing were used to aggregate messages, and later attempts were made to use support vector machines to determine if the message was genuine or fake. Results of the proposed model were compared to the existing models. The proposed model was found to be working well and had defined the correctness of results upto 93.6% of accuracy [1].

This work helped to judge the accuracy of the false news by using various different classification techniques. This work presents the solution for the Fake news problem by implementing fake news detection models by using different classification techniques. When resources are taken into consideration, Fake News Detection becomes complicated. Datasets are limited, which are the primary resources. In this model, classification techniques like Support Vector Machine (SVM), Naïve Bayes, and Passive Aggressive Classifier are used. Output of the model uses feature extraction techniques such as Term Frequency-Inverse Document Frequency (TF-IDF) and Support Vector Machine (SVM) as classifier and has accuracy of 95.05% [2].

This paper deals with binary classification of various news articles that are present on the internet with the help of concepts that are related to Artificial Intelligence, Machine Learning and Natural Language Processing. This paper supplies the ability of news classification as false or true and also verifies its source [3].

The importance of machine learning to detect fake news is proved in this research paper. The authors have also discussed how machine learning can be used for detecting false news. Machine learning algorithms that are used to detect false news have been discussed in the research paper [4].

This paper deals with the application of Natural Language Processing techniques to identify when a news source may be producing fake news. Collection of labeled real and fake news articles to build a classifier that can make decisions about information based on the content from the collection has been implemented. A text classification approach, using four different classification models to analyze the results has been implemented. LSTM implementation was the best performing model. The model focused on identifying fake news sources, based on multiple articles originating from a source. High predictions were made when the source was flagged as a producer of fake news that future articles from

this source will also be fake news. As multiple data points come from each source, it broadens the misclassification tolerance of the article [5].

In this paper, authors looked at how Natural Language Processing techniques may be used to detect when a news source is spreading bogus news. To develop a classifier that can make judgments about information based on the content in the corpus, the authors employed a corpus of labeled actual and false news articles. A text classification approach was applied and assessed the outcomes using four distinct classification models. The LSTM implementation produced the best results. Based on many articles originating from a source, the algorithm focuses on identifying fake news sources. It is anticipated with high confidence that any future publications from a source classified as a producer of fake news will also be fake news. Focusing on sources broadens the scope of our article misclassification tolerance, because we then have multiple data points coming from each source [6].

The goal of this paper is to investigate four well-known machine learning algorithms, namely the random forest, the Naïve Bayes, the neural network, and the decision trees, to see how effective they are at detecting fake news. On a widely used public dataset, LIAR, an experiment was performed, and the findings demonstrate that the Naïve Bayes classifier outperforms the other algorithms significantly [7, 12].

This paper deals with the collection of dataset from Kaggle. The information is divided into two categories: true and false news, and then integrated into a single dataset. The machine learning model is trained using this dataset. The authors attempted to develop a machine learning model utilizing four different classifiers and the Tf-idf vectorizer in this project. The goal is to foresee news that would mislead the user and cause pandemonium [8].

The authors extracted and analyzed real-time data from multiple domains across Twitter. The dataset was preprocessed and the user\_verified column played an important role. Next, some machine algorithms were run on the features extracted from the preprocessed dataset. Logistic regression and support vector machines each yielded promising results with an accuracy of over 92%. Naive Bayes and long / short term memory did not achieve the desired accuracy. The model can also be applied to images and videos for better detection of fake news [9].

To distinguish bogus news from genuine news, a deep learning-based technique was applied in this study. The proposed model was created using an LSTM neural network. A gloVe word embedding was employed for vector representation of textual words in addition to the neural network. Tokenization has also been used for feature extraction and vectorization. The concept of N-grams is applied to improve the suggested model. The results of a comparison of several false news detection systems were examined. The suggested model's outcomes were assessed using accuracy measures. The model outperformed with a precision of 99.88 percent [10].

Machine learning is offered as a method for detecting bogus news. Using vectorization of the news title and our dataset to analyze the tokens of words. The dataset that the authors' have worked with is a pre-curated collection of news items that have the property of being false or not. Their goal was to create a model that can determine whether an article is real or false [11].

This research looks into advanced and cutting-edge false news detection systems in depth. The authors started with the negative repercussions of bogus news. Then they talked about the dataset that was used in earlier research and the NLP approaches that were used. To categorize representative methods into several categories, a complete overview of deep learning-based techniques has been presented. The most often used evaluation measures in the detection of false news are also reviewed. Nonetheless, in future research paths, they proposed additional recommendations to improve fake news detection techniques [13].

## Problem Statement

There are many ways to detect fake news and articles using machine learning algorithms. Given today's advances in machine learning and the level of knowledge reached, it is not appropriate to blindly rely on one or two such algorithms to classify fake news. Therefore, instead of collecting more data and extensive training to improve accuracy and comparing accuracy scores for better understanding, a holistic approach for detecting fake news is the need of this crucial moment. Therefore, we decided to take a step-by-step systematic approach to classify fake news using data mining technology. The implementation of data mining operations such as data collection, data preprocessing, feature extraction, feature selection, and machine learning models can be used to make predictions to classify messages as true or false and predict the probability of the news belonging to the predicted level. A set of machine learning models will be implemented to compare the performance of machine learning models based on metrics such as accuracy, f1 value, fit rate, and recall. The primary determinant for assessing model performance can be selected as the f1 score, which takes into account the trade-off between fit and recall. After the following machine learning models (naive Bayes, SVM, logistic regression, random forest) have been trained and tuned, all of the above models are combined to form an ensemble classifier that predicts using all of these classifiers. A voting classifier will be implemented. Label and class probabilities that use the soft voting method to make the final prediction. There are two approaches for machine learning models to gain insights from headings: CountVectorizer and TfidfVectorizer. These models are trained using features extracted from both CountVectorizer and TfidfVectorizer. All models are then hyperparameter adjusted in GridSearchCV with 5 holdout cross-validation sets for all different possible parameters. This hyperparameter adjustment is intended to improve the model's f1 score. After the models have been tuned, they are tested in the test set and the model's evaluation metrics are calculated. The trained and voted models are combined into a voting classifier that uses them all as the basic estimator. When new test data is passed to the voting classifier, all underlying models are built to predict sample specifications. After receiving the labels from all models, the final label of the test sample is predicted using the soft voting mechanism.

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