

Project Report: Fake News Detection using Machine Learning

Project Objective

The primary objective of this project is to build a machine learning model that can automatically classify news articles as **Fake** or **True**. In an era of widespread misinformation, this tool serves as a filter to identify fabricated stories using computational logic rather than human intuition.

Technologies and Libraries Used

The project is implemented using the **Python** programming language and the following key libraries:

- **Pandas & NumPy:** For data manipulation, merging datasets, and handling numerical operations.
- **Matplotlib & Seaborn:** For data visualization (graphs and charts).
- **Scikit-learn (Sklearn):** For implementing machine learning models, splitting data, and evaluating performance.
- **RE (Regular Expression) & String:** For advanced text cleaning and preprocessing.

Dataset Description

The project utilizes two distinct datasets:

- **Fake.csv:** Contains a collection of news articles labeled as misinformation.
 - **True.csv:** Contains articles from verified and legitimate news sources.
- Each article includes the Title, Text, Subject, and the Date of publication.

Step-by-Step Methodology

Step 1: Data Labeling and Merging

To train a supervised model, we first assigned labels:

- Articles in the Fake dataset were labeled as **0**.
 - Articles in the True dataset were labeled as **1**.
- After labeling, the two datasets were merged into a single dataframe for processing.

Step 2: Text Preprocessing (Data Cleaning)

Raw text data contains noise that can confuse a model. We created a custom function called `wordopt` to clean the text by:

- Converting all text to **lowercase**.
- Removing **brackets, special characters, and punctuation**.
- Eliminating **URLs and HTML tags**.
- Removing **numbers/digits**, ensuring the model focuses only on the linguistic patterns of words.

Step 3: Feature Extraction (Vectorization)

Machine Learning models cannot read text directly. We used the **TF-IDF Vectorizer** (Term Frequency-Inverse Document Frequency). This technique converts words into numerical vectors based on their importance and frequency, allowing the algorithms to perform mathematical calculations on the text.

Step 4: Model Training and Selection

To ensure high accuracy, we trained and compared four different machine learning algorithms:

1. **Logistic Regression:** A baseline model used for binary classification.
2. **Decision Tree Classifier:** Uses a tree-like structure to make decisions based on word patterns.
3. **Gradient Boosting Classifier:** An advanced ensemble technique that corrects errors from previous iterations.
4. **Random Forest Classifier:** Combines multiple decision trees to provide a more robust and accurate prediction.

Step 5: Evaluation

The models were evaluated using a test dataset (25% of the total data). We used **Accuracy Scores** and **Classification Reports** (Precision, Recall, F1-Score) to determine which model performed best in identifying fake news.

Manual Testing System

A unique feature of this project is the **Manual Testing Function**. It allows a user to input any news headline or article text. The system then cleans the text, vectorizes it, and runs it through all four trained models to provide a real-time prediction of whether the news is Fake or True.

Conclusion

This project demonstrates the power of **Natural Language Processing (NLP)**. By analyzing the writing style and vocabulary of known fake and true news, the models learn to distinguish between the two with high precision. This system can be integrated into web applications or social media platforms to flag suspicious content automatically.