FAKE NEWS DETECTION USING MACHINE LEARNING

REPORT

Submitted by

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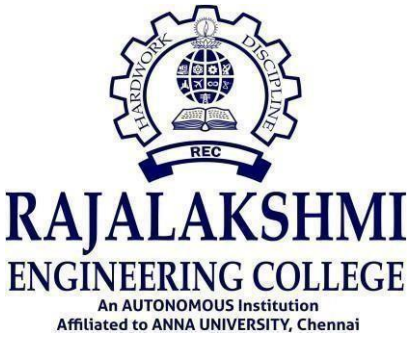

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TABLE OF CONTENT

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ABSTRACT

In today's digital era, the exponential growth of online news platforms and social media has made information easily accessible but also vulnerable to misuse. Fake news, defined as false or misleading information presented as legitimate news, has emerged as a major challenge that can manipulate public opinion, spread misinformation, and disrupt societal harmony. The rapid and unchecked spread of such content necessitates effective mechanisms to detect and counteract its influence.

This project proposes a machine learning-based approach for fake news detection using natural language processing (NLP) techniques. The textual content of news articles is preprocessed through stemming and stopword removal to normalize the data. Important features are extracted using TF-IDF vectorization, transforming text into numerical representations suitable for model training. A Logistic Regression algorithm is then employed to classify news articles as either real or fake based on these features.

The model is trained and evaluated on a labeled dataset containing both genuine and fake news items. Performance metrics such as accuracy demonstrate that the system is capable of making reliable predictions. By automating the detection process, this project offers a scalable and efficient solution to support fact-checking efforts and reduce the impact of misinformation across digital platforms.

LIST OF FIGURES

LIST OF ABBRREVATIONS

S.NO.	ABBREVATION	ACCRONYM
1.	ML	Machine Learning
2.	NLP	Natural Language Processing
3.	TF IDF	Term Frequency-Inverse Document Frequency
4.	LSTM	Long Short-Term Memory
5.	BERT	Bidirectional Encoder Representations from Transformers

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Fake news is a form of misinformation that is deliberately created to deceive readers into believing false information is true. It is often crafted to appear credible, mimicking the tone and style of legitimate journalism. With the advancement of digital media, fake news has found fertile ground on platforms like social media, blogs, and unregulated news websites. These platforms enable rapid dissemination, making it easier for false narratives to go viral before they are even fact-checked.

The ease of access to digital content, combined with the limited regulation of online platforms, has made fake news detection an urgent challenge for both the public and private sectors. Traditional methods such as manual verification and human-based moderation are no longer sufficient due to the sheer volume of data generated every day. Machine learning, particularly when integrated with Natural Language Processing (NLP), provides an efficient and scalable alternative. These technologies enable automated analysis of textual data to detect linguistic and contextual cues associated with misinformation.

1.2 OBJECTIVE:

The main goal of this project is to create a robust fake news detection system using machine learning techniques that can classify news content as real or fake based on its textual characteristics. The model is designed to learn from labeled data, identify patterns, and make intelligent predictions when presented with new, unseen information.

To achieve this, the project is structured around key technical objectives: First, cleaning and preprocessing the text data to remove noise such as punctuation, special characters, and stopwords. Second, converting this cleaned text into a numerical format using TF-IDF vectorization to capture the importance of words. Third, employing a Logistic Regression model to classify the data. Lastly, evaluating the performance using training and test datasets, and enabling real-time prediction to handle live data streams or new input text with accuracy and efficiency.

1.3 EXISTING SYSTEM

Many existing fake news detection systems rely heavily on manual verification, such as human fact-checkers reviewing content to assess its accuracy. While human oversight is critical, this approach is labor-intensive, slow, and not scalable for the vast amount of data generated online every minute. Furthermore, keyword-based or rule-based methods used in traditional systems often fall short when fake news articles evolve in phrasing or context to evade detection.

Some systems also depend on metadata such as the news source or publishing history, which can be unreliable or manipulated. These limitations result in lower detection accuracy, especially when dealing with sophisticated fake content that mimics legitimate news articles. Moreover, the absence of real-time processing capabilities in many traditional systems makes them ineffective in stopping the rapid spread of misinformation across social platforms.

1.4 PROPOSED SYSTEM

To overcome the drawbacks of existing systems, the proposed fake news detection model incorporates machine learning with Natural Language Processing techniques for intelligent text analysis. The system begins by preprocessing the raw text, where unnecessary symbols and words are removed, and stemming is applied to normalize different forms of the same word. This helps in reducing redundancy and improving the model's ability to understand the core meaning of the content.

Once the text is cleaned, TF-IDF (Term Frequency–Inverse Document Frequency) vectorization is used to extract meaningful features from the data. This method highlights the importance of words in a document relative to the entire corpus, making it easier for the classifier to distinguish between real and fake content. The core classification is done using a Logistic Regression model, which is effective for binary classification problems. The result is a highly accurate, efficient, and scalable system that can predict whether a news article is real or fake in real time.

CHAPTER 2

LITERATURE SURVEY

[1]Alghamdi,J.,Lin,Y.,&Luo,S.(2022)

This paper presents a comparative study between traditional machine learning models and deep learning architectures for fake news detection. The authors explore models such as Random Forest, Naïve Bayes, and Support Vector Machines using TF-IDF features. Results show that Random Forest achieved the highest accuracy among traditional models. The paper also evaluates deep learning methods, including LSTM and BERT, which outperform classical models in most scenarios due to their ability to understand contextual relationships in text.

[2]Ahmed,H.,Traore,I.,&Saad,S.(2018)

This study focuses on detecting opinion spam and fake news through text classification methods. The authors use a dataset of real and fake news articles and apply several preprocessing steps such as stemming, tokenization, and vectorization using TF-IDF. They compare the performance of classifiers like Logistic Regression, Decision Trees, and SVMs. The Logistic Regression model demonstrated high accuracy and simplicity, making it suitable for real-time detection systems.

[3]Gautam,S.,&Yadav,D.(2021)

In this review paper, the authors evaluate various deep learning architectures including CNNs, RNNs, LSTMs, and transformers for fake news detection. The paper also discusses challenges like dataset bias, lack of labeled data, and model generalizability. Among the models studied, transformer-based models like BERT and XLNet provided superior results in terms of precision, recall, and F1 score. The authors suggest combining topic modeling with these architectures for further improvement.

[4]Monti,F.,Frasca,F.,Eynard,D.,Mannion,D.,&Bronstein,M.M.(2019)

This work proposes a geometric deep learning approach for fake news detection on social media by analyzing the structure of news propagation networks. The authors utilize graph neural networks (GNNs) to model the relationship between users and news articles. Their model outperforms text-only methods by leveraging the social context in which fake news spreads. It highlights the importance of incorporating social features in improving detection accuracy.

[5] Yuan, C., Ma, Q., Zhou, W., Han, J., & Hu, S. (2020)

The authors introduce a weakly supervised model called Structure-aware Multi-head Attention Network (SMAN) for early detection of fake news. The model integrates textual content, publisher reliability, and user credibility. It uses attention mechanisms to assign dynamic weights to different features, allowing for better prediction even with limited data. Experiments on real-world datasets show that the model can detect fake news within a few hours of it being published.

CHAPTER 3

SYSTEM DESIGN

3.1 GENERAL

Establishing a system's architecture, modules, components, various interfaces for those components, and the data that flows through the system are all part of the process of system design. This gives a general idea of how the system operates.

3.1.1 SYSTEM FLOW DIAGRAM

Fig 3.1 illustrates the complete flow of the fake news detection system. It begins with the user inputting a news article (or a batch of articles) into the system. The data then undergoes preprocessing steps such as removal of null values, text cleaning, stopword removal, and stemming.

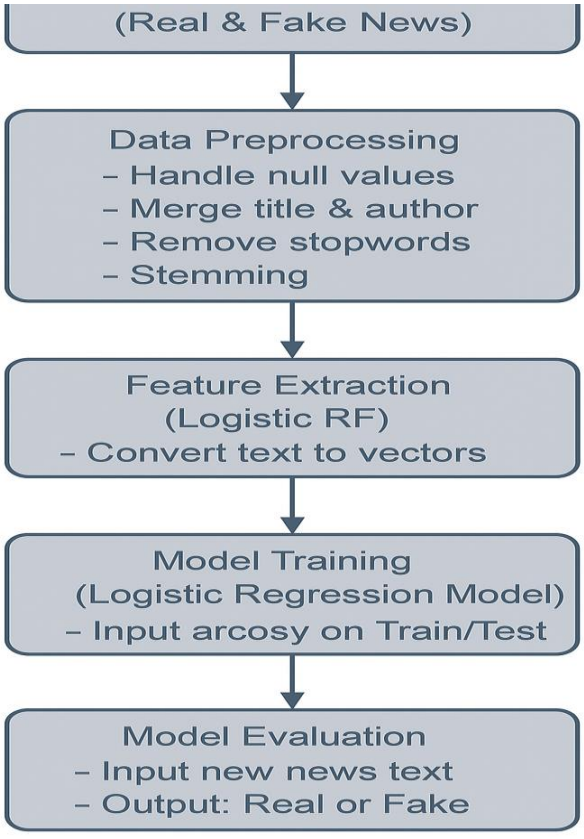

Fig. 3.1 System Flow Diagram

3.1.2 ARCHITECTURE DIAGRAM

Fig 3. showcases the structural design of the system. At the top, the User Interface allows users to input news articles. This input is sent to the Preprocessing Layer, which performs data cleaning and text normalization. The processed data is forwarded to the TF-IDF Feature Extractor, which transforms it into feature vectors. These vectors are passed to the Logistic Regression Model located in the Model Layer, where classification occurs. The result is returned to the Output Layer, indicating whether the news is fake or real. This modular architecture promotes reusability and system scalability.

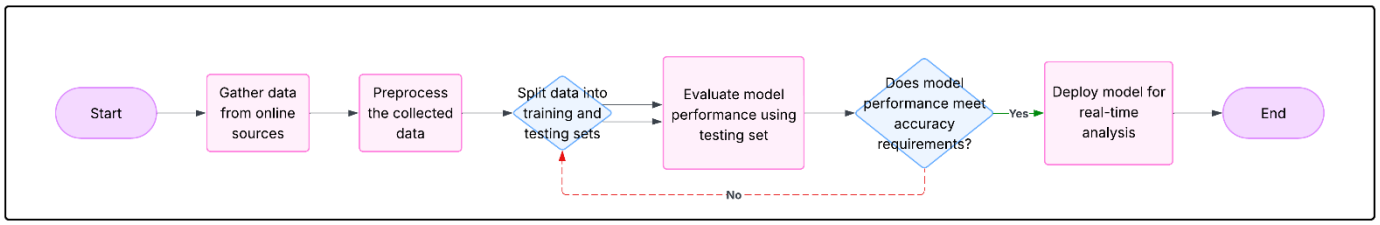

Fig. 3.2 Architecture Diagram

3.1.3 ACTIVITY DIAGRAM

Fig. 3.3 The activity diagram shows the step-by-step operational flow of the fake news detection system. It starts with Loading the Dataset followed by Checking and Handling Missing Data. The process continues with Text Preprocessing, including stopword removal and stemming. Afterward, the activity transitions to TF-IDF Vectorization and then Splitting the Dataset into training and test sets. The next steps involve Model Training and Model Evaluation. Finally, the system reaches the decision node: if the model is accurate, it proceeds to Make Predictions on New Data, otherwise, it loops back for retraining.

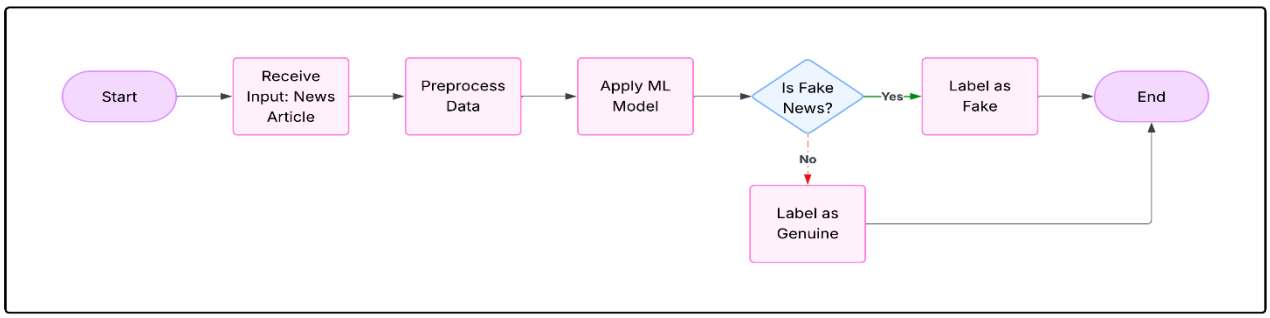

Fig. 3.3 Activity Diagram

3.1.4 SEQUENCE DIAGRAM

Fig. 3.4 The sequence diagram explains the interaction between different components over time. It begins when the user submits a news article. The System Controller receives the input and passes it to the Preprocessing Module, which performs cleaning and transformation. The data is then sent to the TF-IDF Feature Vectorizer, which prepares the data for classification. The processed data is handed to the Classifier Module, which uses the trained Logistic Regression model to predict the label. Finally, the result is returned to the user interface, and the user receives feedback indicating whether the news is real or fake.

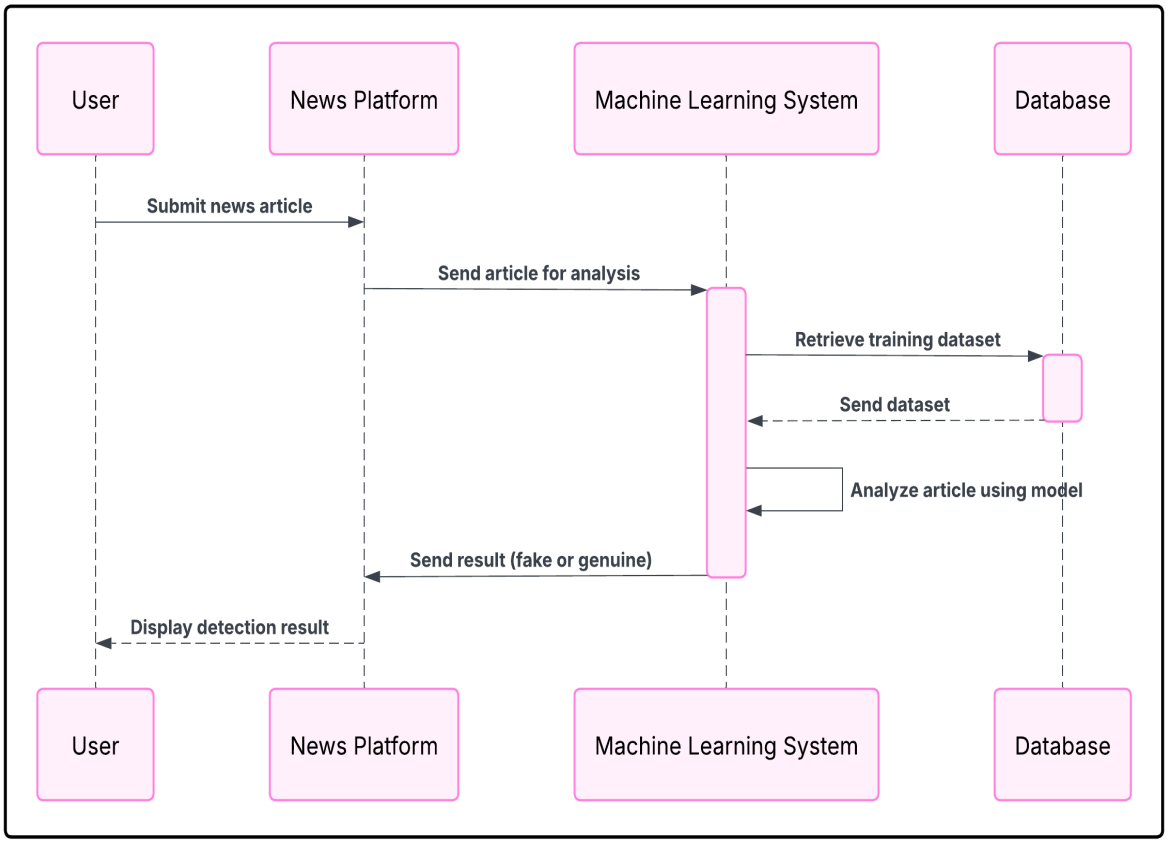

Fig. 3.4 Sequence Diagram

CHAPTER 4

PROJECT DESCRIPTION

This project aims to develop a reliable and automated system for detecting fake news articles using machine learning techniques. The exponential growth of online content, especially through social media platforms, has made it increasingly difficult to distinguish credible information from misleading or intentionally deceptive content. To tackle this, the proposed system uses Natural Language Processing (NLP) and a supervised machine learning approach to analyze the textual content of news articles and classify them as real or fake.

4.1 METHODOLOGIES

This section outlines the methodologies applied in developing the proposed fake news detection system, which combines Natural Language Processing (NLP) and Machine Learning (ML) techniques to classify news articles as real or fake. The system is designed to help users identify misleading or false news content based solely on its textual features, ensuring fast and reliable detection. It utilizes a labeled dataset of news articles, applies various preprocessing techniques, and integrates a Logistic Regression model to provide accurate classifications.

4.1.1 Modules

- Dataset Description
- Text Preprocessing and Cleaning
- Feature Extraction using TF-IDF
- Fake News Classification using Logistic Regression
- System Integration and Real-Time Prediction

4.2. MODULE DESCRIPTION

4.2.1 Dataset Description

The dataset used in this project is a labeled collection of news articles, containing both real and fake news samples. It includes fields such as author name, title, and text content. Missing values are handled, and the author and title columns are combined into a new content column to enrich the dataset. This dataset serves as the foundation for training and evaluating the machine learning model.

id	title	author	text	label
0	House Der	Darrell Luc	House	1
1	FLYNN: Hil	Daniel J. Fl	Ever get th	0
2	Why the Tı	Consortiur	Why the	1
3	15 Civilian:	Jessica Pur	Videos 15	1

Fig. 4.2.1 Real and fake news data

4.2.2 Data Preprocessing

This module handles text normalization tasks such as converting all characters to lowercase, removing punctuation and non-alphabetical characters, eliminating stopwords, and applying stemming using the Porter Stemmer algorithm. This ensures that the textual data is clean, consistent, and ready for feature extraction.

4.2.3 Feature Extraction using TF-IDF

This module converts the cleaned textual data into numerical format using TF-IDF (Term Frequency-Inverse Document Frequency) vectorization. This approach highlights important words while downplaying common ones, enabling the model to focus on discriminative features for classification.

4.2.4 Fake News Classification using Logistic Regression

In this module, the TF-IDF features are used to train a Logistic Regression classifier. The model learns to differentiate between real and fake news articles based on textual patterns. The model is then evaluated using accuracy metrics on both training and testing datasets to ensure its effectiveness.

4.2.5 System Integration and Testing

This final module integrates all previous components into a complete pipeline. It enables users to input new news articles, which are then processed and classified by the trained model. The output provides an instant indication of whether the news is real or fake, making the system useful for practical deployment.

CHAPTER 5

OUTPUT AND SCREENSHOTS

5.1 OUTPUT SCREENSHOTS

The system is designed as a modular pipeline to detect fake news using machine learning and Natural Language Processing (NLP) techniques. The architecture follows a layered approach, where each module performs a specific task that contributes to the overall objective of classifying news as real or fake.

5.1.1 System Design and Implementation

The fake news detection system is built using a machine learning pipeline that processes news text data to classify it as real or fake. It includes text preprocessing, feature extraction, and classification using Logistic Regression. The design emphasizes modularity and automation for accurate and scalable detection.

- **Data Preprocessing:** Combined author and title, cleaned text, removed stopwords, and applied stemming.
- **Feature Extraction:** Converted text data into numerical form using TF-IDF vectorization.
- **Model Training:** Trained a Logistic Regression model on the processed data.
- **Model Evaluation:** Tested model accuracy using training and test datasets.
- **Prediction:** Used the trained model to classify new news articles as real or fake.

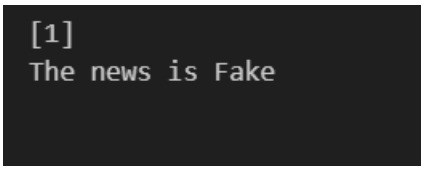

Fig. 5.1.1: **OUTPUT**

	A	B	C	D	E
	id	title	author	text	label
0		House Der	Darrell Luc	House	1
1		FLYNN: Hil	Daniel J. Fl	Ever get th	0
2		Why the Tı	Consortiur	Why the	1
3		15 Civilian:	Jessica Pur	Videos 15	1
4		Iranian wo	Howard Pc	Print	1
5		Jackie Mas	Daniel Nus	In these tr	0
6		Life: Life C	nan	Ever	1
7		BenoÃ®t H	Alissa J. Ru	PARIS â€"	0
8		Excerpts Fı	nan	Donald J. T	0
9		A Back-Ch:	Megan Tw	A week be	0
10		Obamaâ€™	Aaron Klei	Organizing	0
11		BBC Come	Chris Toml	The BBC pı	0
12		Russian Re	Amando Fl	The	1
13		US Official	Jason Ditz	Clinton	1

Fig. 5.1.2: Dataset Overview

The figure showcases a tabular dataset that serves as the foundational input for building a Fake News Detection System. Each row in the dataset represents a unique news article, and includes the following attributes:

- **id**: A unique identifier for each news article. This column is used internally to distinguish one record from another and has no impact on the actual classification task.
- **title**: The headline or title of the news article. It typically gives a concise summary or the main claim of the article and is crucial for extracting key contextual information during the preprocessing and feature extraction stages.
- **author**: This column lists the name of the individual or organization that authored the article. While not always reliable due to potential manipulation, author information can still help in identifying patterns of misinformation associated with certain sources.
- **text**: The main body content of the news article. This is the most significant attribute used for analysis and classification. It undergoes preprocessing steps like tokenization, stopword removal, and stemming before being transformed into numerical features using techniques like TF-IDF.
- **label**: A binary value indicating the truthfulness of the news. A label of 0 typically denotes a **real** news article, whereas a label of 1 represents **fake** news. This is the target variable used for supervised learning in the model.

CHAPTER 6

CONCLUSION AND FUTURE WORK

The increasing spread of fake news on digital platforms presents a serious threat to public trust, societal stability, and information integrity. This project demonstrated the potential of machine learning, particularly logistic regression combined with TF-IDF vectorization, to effectively distinguish between real and fake news. Through text preprocessing techniques such as stemming and stopword removal, the system enhanced its understanding of the linguistic features of the content. The model achieved a strong accuracy score on both training and testing datasets, confirming its reliability for fake news classification tasks.

While the current system performs well with textual features and basic classification algorithms, it still faces limitations. For instance, the model may struggle with highly contextual or sarcastic content where semantics play a larger role. Moreover, it does not incorporate metadata such as the credibility of the source, user engagement patterns, or the spread of news across social networks—all of which can significantly improve prediction accuracy. These limitations highlight the need for a more comprehensive, context-aware system that can adapt to the evolving nature of misinformation tactics.

Future work can explore the integration of deep learning models such as LSTM, BERT, or transformer-based architectures, which are better suited for capturing contextual relationships in text. Additionally, incorporating multi-modal data (e.g., images, video titles, and source credibility) and leveraging social graph information could enhance the detection capability. Real-time deployment and the development of browser extensions or APIs could also turn this research into a practical tool for journalists, content moderators, and the general public.

APPENDIX

SOURCE CODE

```
import numpy as np

import pandas as pd

import re

from nltk.corpus import stopwords

from nltk.stem.porter import PorterStemmer

from sklearn.feature_extraction.text import TfidfVectorizer

from sklearn.model_selection import train_test_split

from sklearn.linear_model import LogisticRegression

from sklearn.metrics import accuracy_score

import nltk

nltk.download('stopwords')

news_dataset=pd.read_csv('/content/train.csv')

news_dataset.shape

news_dataset.isnull().sum()

#replacing the null values with empty string

news_dataset=news_dataset.fillna('')

#merging the author name and news title

news_dataset['content']= news_dataset['author']+' '+news_dataset['title']

X=news_dataset.drop(columns='label',axis=1)

Y=news_dataset['label']
```

```
port_stem = PorterStemmer()

def stemming(content):

  stemmed_content = re.sub('[^a-zA-Z]',' ',content)



  stemmed_content = stemmed_content.lower()

  stemmed_content = stemmed_content.split()

  stemmed_content = [port_stem.stem(word) for word in stemmed_content if not word in stopwords.words('english')]

  stemmed_content =' '.join(stemmed_content)

  return stemmed_content

news_dataset['content'] = news_dataset['content'].apply(stemming)

#separating the data & label

X=news_dataset['content'].values

Y=news_dataset['label'].values

Y.shape

vectorizer = TfidfVectorizer()

vectorizer.fit(X)

X = vectorizer.transform(X)

X_train, X_test, Y_train, Y_test= train_test_split(X,Y,test_size=0.2,stratify=Y,random_state=2)

model=LogisticRegression()

model.fit(X_train, Y_train)

#accuracy score on the training data

X_train_prediction=model.predict(X_train)

training_data_accuracy=accuracy_score(X_train_prediction,Y_train)

#accuracy score on the test data
```

```
X_test_prediction=model.predict(X_test)


test_data_accuracy=accuracy_score(X_test_prediction,Y_test)
X_new=X_test[0]
prediction = model.predict(X_new)
print(prediction)
if(prediction[0]==0):
  print("The news is Real")


else:
  print("The news is Fake")
X_new=X_test[0]
prediction = model.predict(X_new)
print(prediction)
if(prediction[0]==0):
  print("The news is Real")
else:
  print("The news is Fake")
```

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