A MAJOR PROJECT REPORT

on

# FAKE NEWS DETECTION

Submitted in partial fulfillment of the requirements for the award of the degree

**BACHELOR OF TECHNLOGY**

**In**

**COMPUTER SCIENCE AND ENGINEERING**

Submitted by

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**COMPUTER SCIENCE AND ENGINEERING**

**RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES**

**ONGOLE CAMPUS**

**2024-2025**

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## CERTIFICATE

This is to certify the project entitled **“Fake News Detection”** being submitted by **A.Pavani (O190278), P.Meghana Sri Naga Sowmya(O191041), G.Prasanna Babu(O190847),S.Madhurima(O190862)** in partial requirement of the award of the degree of Bachelor of Technologies in Computer Science and Engineering to **Rajiv Gandhi University of Knowledge Technologies** is a record of bonafide work carried out by them under my guidance and supervision from July 2024 to November 2024.

The results presented in this project have been verified and found to be satisfactory. The results embodied in this project report have not been submitted to any other university for the award of any other degree.

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Date: *11/*2024

Place: ONGOLE

# APPROVAL SHEET

This report entitled “Fake News Detection” by A.Pavani (O190278),P.M.S.N Sowmya(O191041),G.Prasanna Babu(O190847),S.Madhurima(O190862) under supervision of Mr.B.Sampath Babu,Assistant Professor(c) is approved for Major Project and for the degree of Bachelor of Technology in Computer Science and Engineering at Rajiv Gandhi University of Knowledge Technologies-AP.,ONGOLE CAMPUS.

**Examiner(s)** ______________________

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**Supervisor(s)** ______________________

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**Date: /*11*/2024**

**Place: ONGOLE**

# DECLARATION

We hereby declare that the project work entitled "Fake News Detection" submitted to Rajiv Gandhi University of Knowledge Technologies-AP., ONGOLE CAMPUS for Major Project during Fourth Year Semester-I and in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology(B.Tech) in Computer Science and Engineering is a record of an original work done by us under the guidance of **Mr.B.Sampath Babu** and this project work have not been submitted to any other university for the award of any other degree.

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## ABSTRACT

The rapid growth of social media platforms has led to an unprecedented spread of misinformation, commonly referred to as "fake news." This phenomenon, driven by various commercial and political motivations, has significant real-world consequences as users unwittingly consume and share misleading content. The challenge of maintaining information integrity in the digital age has become a pressing concern, particularly given the vast scale of data circulating on these networks.

This study explores innovative approaches to detect and mitigate the spread of fake news in online social environments. We examine cutting-edge principles, methodologies, and algorithms designed to identify fraudulent articles, their creators, and the subjects they discuss. Our research focuses on developing efficient systems to evaluate the credibility of information shared on social platforms.

Specifically, we propose a novel method for fake news detection, with a case study application on Facebook, one of the world's leading social media networks. Our approach leverages the Naive Bayes classification model to assess the authenticity of Facebook posts, categorizing them as either genuine or fabricated. We discuss potential enhancements to this method and evaluate its performance in real-world scenarios.

The findings of this study suggest that machine learning techniques offer promising solutions to the complex challenge of fake news detection. By advancing these technologies, we aim to contribute to the ongoing efforts to improve the trustworthiness and reliability of information in our increasingly interconnected digital world.

# CONTENT

# 1.INTRODUCTION

In the digital age, the rapid spread of misinformation and fake news has emerged as a critical societal issue, often influencing public opinion, spreading fear, and undermining trust in credible sources. To address this growing concern, this project introduces a **Fake News Detection App**, an interactive web-based application designed to classify news articles as either real or fake using machine learning techniques. By leveraging **natural language processing (NLP)** and supervised learning algorithms, this app provides users with an easy-to-use tool to evaluate the credibility of online content.

The app is built using **Streamlit**, a Python framework for creating intuitive and data-driven web applications, and integrates **TF-IDF vectorization** to extract meaningful textual features from news articles. These features are fed into a **Logistic Regression model**, a widely adopted algorithm for binary classification tasks, to predict the authenticity of the provided news text. The app allows users to input text directly for prediction or upload custom datasets to train the model on new data, offering flexibility and personalization.

Additionally, the app provides detailed insights into the model's performance through metrics such as accuracy, precision, recall, and a confusion matrix. These visualizations help users understand how well the model distinguishes between real and fake news. By combining modern machine learning methods with a user-friendly interface, the Fake News Detection App aims to empower users—be it journalists, researchers, or the general public—to critically evaluate news content and mitigate the effects of misinformation in society.

## 1.1 MOTIVATION

The motivation for developing the **Fake News Detection App** lies in the urgent need to combat the pervasive issue of misinformation in today's digital world. The advent of the internet and the widespread use of social media have revolutionized how information is disseminated, but they have also created an environment where fake news can spread rapidly, often with severe consequences. Misinformation has the potential to manipulate public opinion, influence elections, undermine trust in institutions, and even incite social unrest.

The challenge is compounded by the sheer volume of online content, making it nearly impossible for individuals to verify the authenticity of every piece of information they encounter. Fact-checking processes, while effective, are time-consuming and cannot keep pace with the speed at which fake news is generated and shared. This underscores the need for automated tools that can quickly and reliably assess the credibility of news articles.

This project seeks to bridge this gap by leveraging machine learning and natural language processing techniques to create a scalable, efficient, and accessible solution for fake news detection. The goal is to empower users with a tool that not only identifies fake news but also educates them about the indicators of misinformation, fostering a more informed and critical approach to consuming digital content. By providing a reliable mechanism to detect fake news, this project aims to contribute to the larger effort of reducing the harmful effects of misinformation on individuals and society as a whole.

## 1.2 OBJECTIVE

- The primary objective of the **Fake News Detection App** is to provide an efficient, reliable, and user-friendly tool to classify news articles as either "REAL" or "FAKE" using advanced machine learning techniques. By automating the process of fake news detection, the app aims to assist users in evaluating the credibility of news content, thereby mitigating the spread of misinformation in the digital space.

The app is designed to achieve several specific goals. It leverages **natural language processing (NLP)** for extracting meaningful features from text, using techniques like **TF-IDF vectorization** to represent textual data numerically. This data is then processed by a **Logistic Regression model**, which is trained to identify patterns indicative of fake or real news. Another key objective is to provide users with detailed performance metrics, such as accuracy, precision, recall, and a confusion matrix, enabling them to assess the reliability of the model's predictions.

Additionally, the app allows for customization and scalability by enabling users to upload their own datasets, making it adaptable to new and evolving patterns of misinformation. This feature ensures the app remains effective across different contexts, topics, and types of news content. Ultimately, the objective is to contribute to a more informed society by providing a scalable technological solution that aids in the fight against fake news while promoting critical thinking and trust in credible information sources.

# 2. LITERATURE SURVEY

Fake news detection has gained significant attention due to its societal impact. Research primarily treats it as a text classification problem, leveraging machine learning models like **Logistic Regression**, **SVM**, and **Naive Bayes**. More advanced approaches use deep learning models such as **RNNs**, **CNNs**, and **Transformer-based models (e.g., BERT)** for higher accuracy.

Feature extraction techniques like **TF-IDF** are widely used for converting text into numerical representations. Modern methods, such as word embeddings (Word2Vec, GloVe, BERT), provide richer contextual understanding but require more computational resources.

Datasets such as the **LIAR Dataset**, **Kaggle's Fake News Dataset**, and the **ISOT Dataset** are commonly used for training and evaluation. These datasets contain labeled news articles, enabling binary classification of content as real or fake.

Challenges include **dataset imbalance**, where real news dominates fake news, and the dynamic nature of fake news patterns. Solutions like oversampling and advanced contextual models help address these issues, improving the robustness of detection systems.

# 3. ANALYSIS

## 3.1 EXISTED SYSTEM

The existing systems for fake news detection rely on a combination of manual fact-checking and automated machine learning models. Platforms like **FactCheck.org**, **Snopes**, and **PolitiFact** use human experts to verify news articles and claims, offering high accuracy but limited scalability due to the time and effort required. Automated systems employ traditional machine learning models such as **Naive Bayes**, **SVM**, and **Logistic Regression** or deep learning architectures like **RNNs** and **CNNs**. While these systems can process large volumes of data, their effectiveness often depends on the quality and diversity of the training datasets. Challenges such as dataset imbalance, limited contextual understanding, and evolving misinformation patterns hinder the performance of these systems. Moreover, many existing tools lack user interactivity, flexibility, or real-time evaluation capabilities.

## 3.2 PROPOSED SYSTEM

The proposed system addresses the limitations of existing systems by combining scalability, accuracy, and user-friendliness. It utilizes a **TF-IDF vectorization** technique to extract meaningful textual features from news articles and a **Logistic Regression model** for binary classification, offering a balance between interpretability and computational efficiency. The app integrates **Streamlit** to provide an interactive interface, enabling users to input articles for real-time analysis or upload custom datasets for personalized model training.
Additionally, the proposed system emphasizes transparency by providing detailed performance metrics such as accuracy, precision, recall, and a confusion matrix. These insights allow users to evaluate the model's reliability. The app also supports customization and adaptability, enabling it to train on new datasets and adapt to evolving misinformation trends. By offering an efficient, scalable, and interactive solution, the proposed system aims to empower users to combat fake news effectively, promoting informed decision-making in a digital-first world.

## 3.3 ADVANTAGES

**Scalability**: The system can process large datasets efficiently, making it suitable for high-volume fake news detection.

- **User-Friendly Interface**: With an intuitive **Streamlit**-powered interface, users can interact easily with the app, inputting articles or uploading datasets without requiring technical expertise.
- **Real-Time Analysis**: The app allows users to instantly classify news articles as "REAL" or "FAKE," ensuring quick and reliable feedback.
- **Customizability**: Users can upload their own datasets to retrain the model, making it adaptable to specific domains or evolving patterns of misinformation.
- **Performance Insights**: Detailed evaluation metrics such as accuracy, precision, recall, and confusion matrices provide transparency and help users understand the model effectiveness.

- **Efficient Feature Extraction**: The use of **TF-IDF vectorization** ensures meaningful representation of text data, leading to better classification performance.
- **Lightweight and Cost-Effective**: The use of a **Logistic Regression model** strikes a balance between computational efficiency and accuracy, making the system lightweight and suitable for deployment on limited hardware resources.
- **Educational Value**: By empowering users to detect fake news and understand the indicators of misinformation, the system contributes to fostering media literacy and critical thinking.
- **Flexibility Across Contexts**: The system's ability to adapt to different datasets makes it useful across various languages, domains, and topics.
- **Automation and Speed**: Automating fake news detection saves time compared to manual fact-checking methods, enabling faster and more consistent results.

## 3.4 DISADVANTAGES:

- **Dependence on Training Data:** The accuracy of the system heavily relies on the quality, size, and diversity of the training dataset. Biases or limitations in the dataset may affect predictions**.**
- **Limited Contextual Understanding**: While the system uses **TF-IDF vectorization** for feature extraction, it may not fully capture deep semantic meanings or complex contextual relationships in text, which advanced models like BERT handle better.
- **Imbalanced Datasets**: If the dataset used for training has a significant imbalance between real and fake news, the model may exhibit biased performance.
- **Evolving Patterns of Fake News**: The system may struggle to detect novel forms of misinformation or articles crafted to exploit its weaknesses, as fake news patterns constantly evolve.
- **Binary Classification Limitation**: The system classifies news as either "REAL" or "FAKE" and does not provide a nuanced understanding, such as identifying partially true or misleading content.
- **Domain-Specific Limitations**: The model may perform poorly when applied to news topics, languages, or contexts outside the scope of its training data.
- **Overfitting Risk with Small Datasets**: When trained on small datasets, the model might overfit, reducing its generalizability to unseen data.
- **No Multimedia Analysis**: The system only processes textual data, ignoring other forms of content like images, videos, or metadata, which are increasingly used in fake news dissemination.
- **Limited User Expertise**: Non-technical users may misinterpret the provided metrics or over-rely on the predictions without critically evaluating the content.
- **Resource Limitations**: While lightweight, the model may still require significant computational resources if retrained frequently on large or complex datasets.

## 3.5 SOFTWARE REQUIREMENT SPECIFICATION

### Software Requirements

**1. Operating System**

- **Supported Platforms**:
  - Windows 10 or higher
  - macOS (Catalina or higher)
  - Linux (Ubuntu 18.04 or higher)

**2. Programming Language**

- **Python 3.8 or higher**

**3. Development Environment**

- **Code Editor/IDE**:
  - Visual Studio Code
  - PyCharm Community/Professional Edition
  - Jupyter Notebook (optional for exploratory data analysis)

**4. Libraries and Frameworks**

- **Web Framework**:
  - **Streamlit**: For building the interactive user interface.
- **Data Handling and Processing**:
  - pandas: For data manipulation and preprocessing.
  - numpy: For numerical operations.
- **Machine Learning**:
  - scikit-learn: For model building, evaluation, and data vectorization.
- **Visualization**:
  - matplotlib: For generating performance plots and charts.
  - seaborn: For enhanced visualizations (e.g., confusion matrix).

**5. Dataset**

- A CSV file with labeled news data:
  - Columns: text (news content), label (REAL or FAKE).
  - Example datasets: Kaggle’s Fake News Dataset, LIAR Dataset, ISOT Dataset.

**6. Runtime Environment**

- Python Package Manager: pip or conda for library installations.
- Web Browser: Latest versions of Chrome, Firefox, Safari, or Edge for running and accessing the Streamlit app.

**7. Deployment Environment**

- **Local Deployment**:
    - Streamlit's local server.
- **Cloud Deployment (Optional)**:
    - **Platforms**: AWS (EC2), Google Cloud Platform (App Engine), or Heroku.
    - **Containerization**: Docker (optional) for creating deployment-ready containers.

**8. Version Control**

- **Git**: For source code management.
- **GitHub/GitLab/Bitbucket**: For repository hosting and collaboration.

**9. Additional Tools**

- **Browser Compatibility**: Google Chrome or Firefox for testing and user interaction.
- **CSV File Upload**: Support for local file uploads within the app.
- **Terminal/Command Line**: For running Streamlit and Python commands.

**10. Security Tools (Optional for advanced versions)**

- SSL/TLS for securing user uploads and communications if deployed online.
- Token-based authentication for access control in multi-user environments.

**Hardware Requirements**

1. **Processor**:
    - Minimum: Dual-core processor (Intel Core i3 or AMD equivalent).
    - Recommended: Quad-core processor (Intel Core i5 or AMD Ryzen 5 or higher).

2. **RAM**:
    - Minimum: 4 GB (for basic dataset processing).
    - Recommended: 8 GB or more (for smoother performance and larger datasets).

3. **Storage**:
    - Minimum: 1 GB of free disk space for Python environment, libraries, and dataset storage.
4. **Graphics** (optional):
    - Integrated graphics are sufficient unless GPU-accelerated machine learning is required for other tasks.
5. **Display**:
    - A monitor with a minimum resolution of 1366x768.

### 3.5.1 PURPOSE

The purpose of the Fake News Detection system is to combat the spread of misinformation by leveraging machine learning techniques to classify news articles as either real or fake. This system helps users, organizations, and social platforms identify potentially misleading content, ensuring better-informed decision-making and reducing the societal impact of fake news. It provides an automated solution to efficiently analyze news articles and verify their authenticity.

### 3.5.2 SCOPE

The **Fake News Detection App** uses machine learning to classify news articles as **REAL** or **FAKE**. The system leverages a **Logistic Regression model** with **TF-IDF vectorization** to analyze text data. Users can upload their own datasets to train the model, allowing customization for specific topics or domains. The app provides real-time predictions, performance metrics (accuracy, precision, recall), and visualizations like confusion matrices to assess model effectiveness.
Built using **Streamlit**, the app offers an intuitive interface for journalists, researchers, and general users to verify news content. Future updates will include multi-language support and advanced machine learning models for enhanced accuracy.

### 3.5.3 OVERALL DESCRIPRTION

The **Fake News Detection App** is a web-based platform designed to help users identify and classify news articles as either **REAL** or **FAKE** using machine learning techniques. The app aims to address the growing issue of misinformation by leveraging the power of **Natural Language Processing (NLP)** and machine learning to analyze and evaluate news content quickly and efficiently.
The core functionality of the app revolves around the use of a **Logistic Regression model** trained on news articles. **TF-IDF vectorization** is used to convert text data into numerical features, enabling the model to make predictions about the authenticity of the news. The app allows users to enter a news article’s text and receive an instant classification, helping them to quickly assess whether a piece of news is real or potentially misleading.

Additionally, the app offers functionality for users to upload their own datasets, which the system can use to train the model on custom data. This makes the app adaptable to specific domains, allowing users to tailor the fake news detection process to their unique needs. The app also provides a feature to evaluate the model’s performance, displaying metrics such as accuracy, precision, recall, and confusion matrix for a deeper understanding of how well the model performs.

Built using **Streamlit**, the app provides a simple, interactive user interface, ensuring that users can navigate the system without technical expertise. The app is designed to be scalable, with future potential for adding more advanced models (like BERT or Transformer models) to improve accuracy and expand functionality, including the ability to handle multimedia content like images and videos.

## TECHNOLOGIES

1. **Python**:
    - The core programming language used to implement the application’s logic, machine learning model, and data processing functions.
    - Python is chosen for its simplicity, readability, and the availability of powerful libraries for machine learning and data manipulation.
2. **Streamlit**:
    - A web framework for building interactive, user-friendly web applications.
    - Streamlit is used to create the front-end interface of the app, allowing users to interact with the model by inputting news articles, uploading datasets, and viewing predictions and performance metrics.
3. **scikit-learn**:
    - A Python library for machine learning that provides easy-to-use tools for training and evaluating models.
    - The app uses **Logistic Regression** for the classification task and **TF-IDF Vectorizer** for text data preprocessing.
4. **pandas**:
    - A powerful data manipulation and analysis library for Python.
    - pandas is used for handling and processing datasets, including reading CSV files, data cleaning, and managing the text and labels in the news dataset.
5. **numpy**:
    - A library for numerical computations in Python, particularly for handling arrays and performing vectorized operations.
    - numpy is used in conjunction with other libraries to efficiently process large datasets and perform mathematical operations.
6. **matplotlib** and **seaborn**:
    - These libraries are used for visualizing model performance, including generating plots for accuracy, confusion matrices, and other evaluation metrics.
    - **matplotlib** is used for basic plotting, while **seaborn** provides enhanced, aesthetically pleasing visualizations, particularly for confusion matrices.
7. **Jupyter Notebooks** (Optional for development phase):
    - A web-based interactive development environment used for prototyping and testing machine learning models.
    - Jupyter notebooks are useful for running exploratory data analysis (EDA) and testing model performance before integrating the code into the main app.
8. **TF-IDF (Term Frequency-Inverse Document Frequency)**:
    - A technique used for text vectorization, which converts textual data into numerical form that can be understood by machine learning models.
    - TF-IDF helps to weigh the importance of each word in a document relative to the entire dataset, improving the model’s ability to classify news articles accurately.

9. **Logistic Regression**:
    - A classification algorithm used to predict the probability that a given input belongs to a particular class (REAL or FAKE).
    - It is chosen for its simplicity and effectiveness in binary classification tasks, making it ideal for fake news detection.

# 4.DESIGN

## 4.1 UML DIAGRAM

A UML Diagram is based on UML(Unified Modelling Language)with the purpose of visually representing a system along with its main actors, roles, actions, artifacts or classes in order to better understand, alter, maintain, or document information about the system. The UML diagrams are divided into Structural and Behavioural UML Diagrams.

### STRUCTURAL UML DIAGRAMS:

Structural diagrams depict a static view of a structure of a system. It is widely used in the Documentation of software architecture. The Structural UML Diagrams involves 7 diagrams They are:

- Class Diagram
- Object Diagram
- Component Diagram
- Composite Structure Diagram
- Deployment Diagram
- Package Diagram
- Profile Diagram

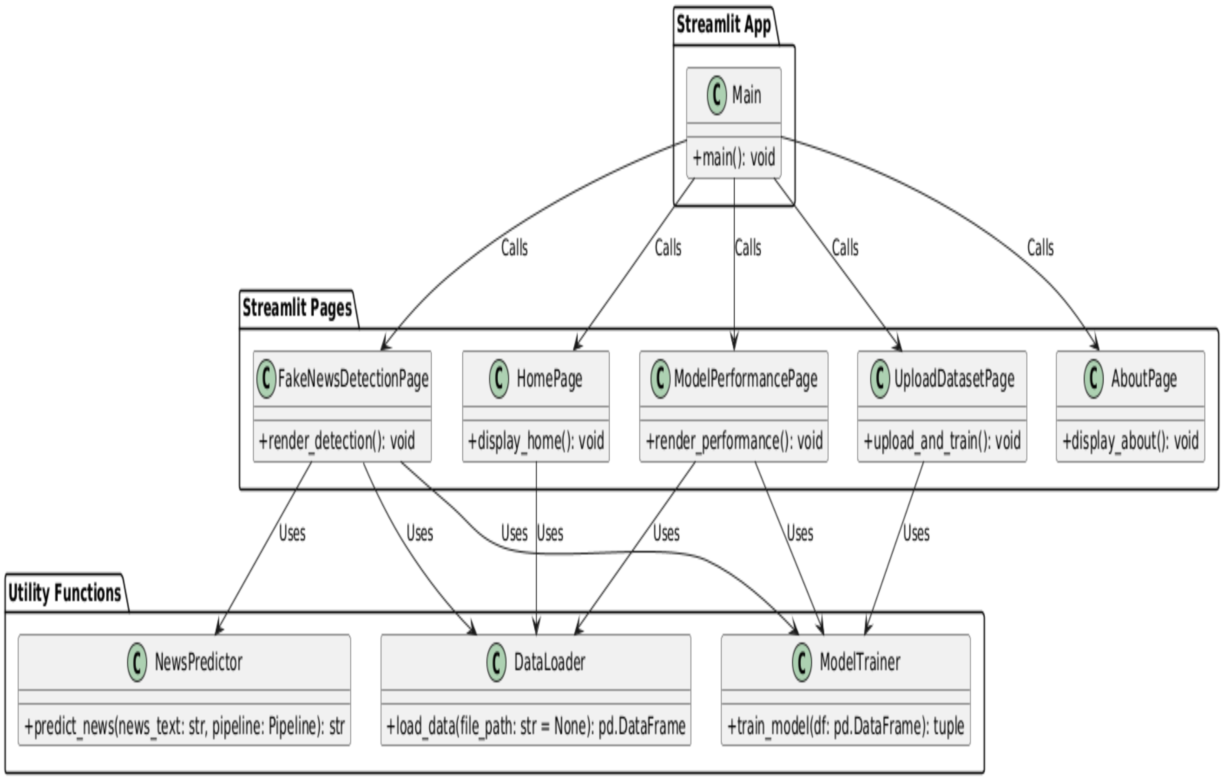
### BEHAVIOURAL UML DIAGRAMS:

Behavioural diagrams portray a dynamic view of a system or the behaviour of a system, which describes the functioning the system. It involves 7 diagrams They are:

- State Machine Diagram
- Use Case Diagram
- Activity Diagram
- Sequence Diagram
- Communication Diagram
- Interaction Overview Diagram
- Timing Diagram

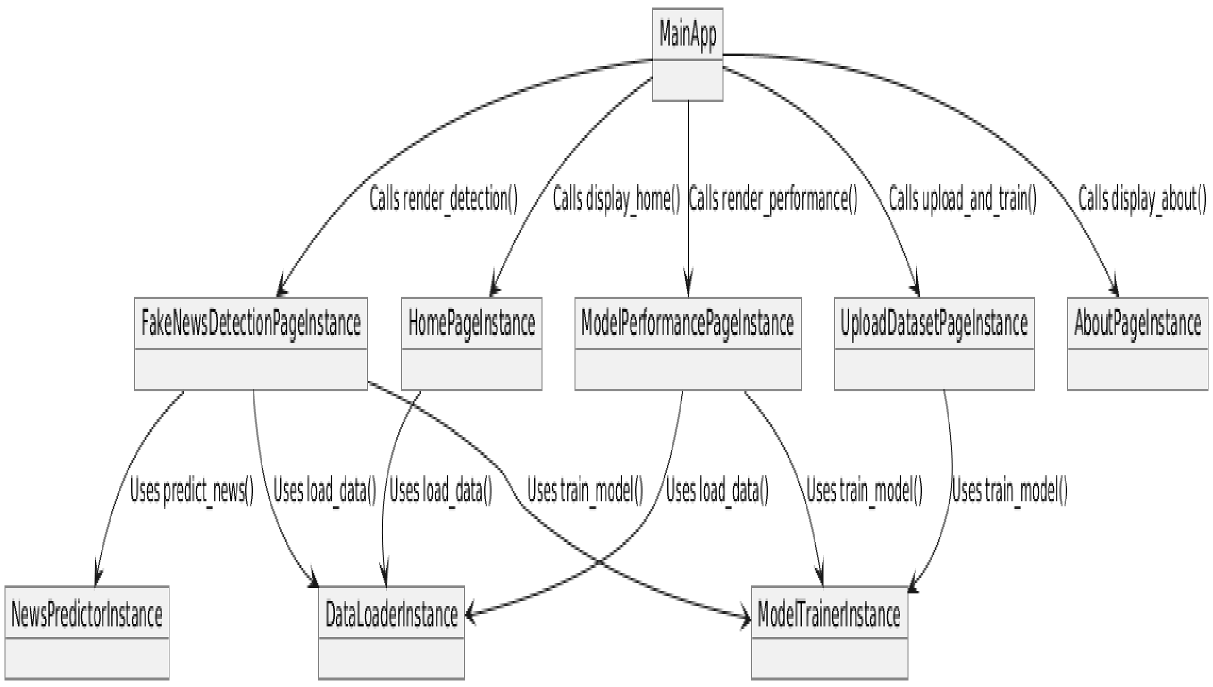
## CLASS DIAGRAM

A class diagram provides a structural view of the system by representing classes, their attributes, methods, and the relationships between them.



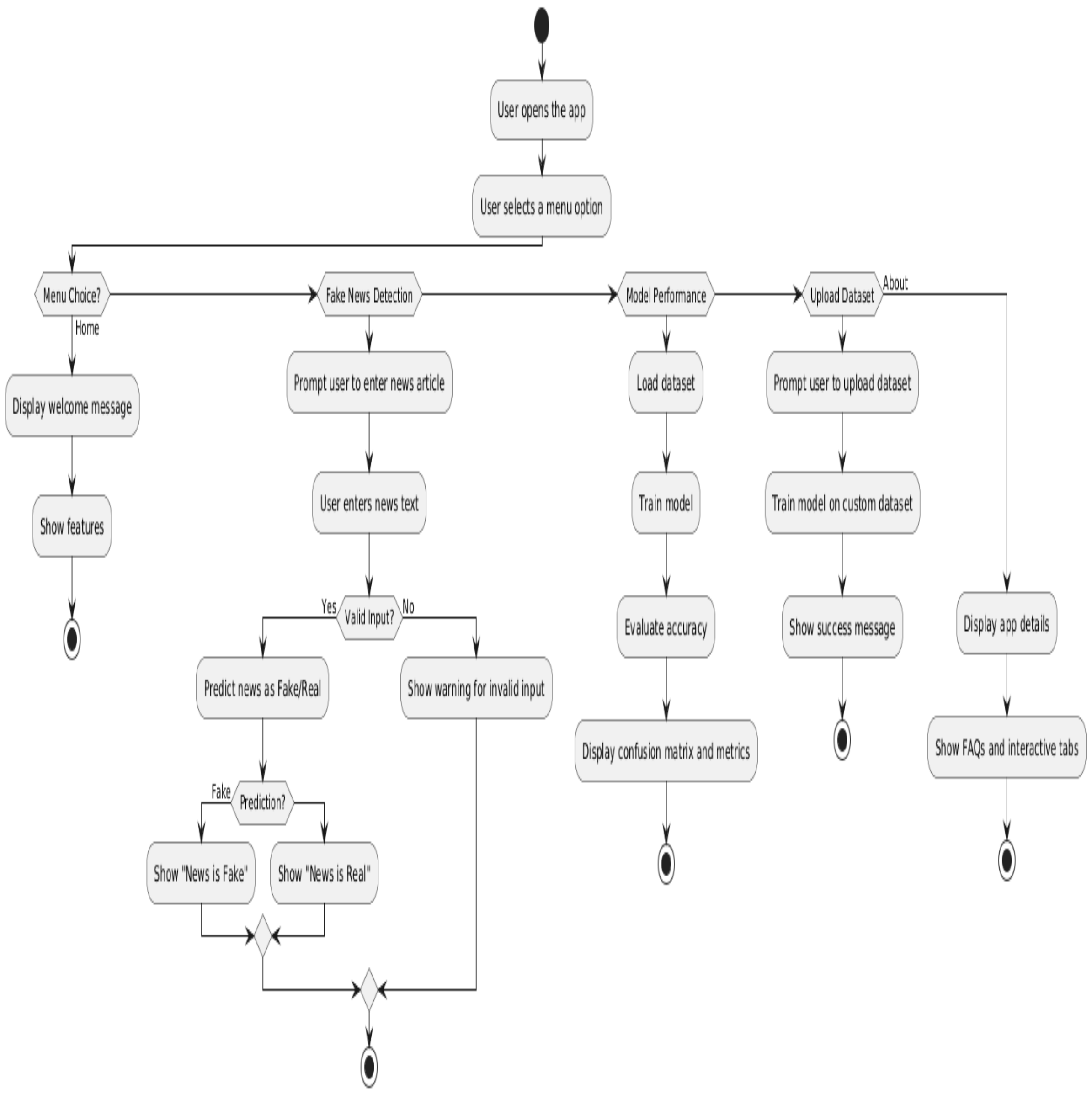
## OBJECT DIAGRAM

Object diagram describes the static structure of a system at a particular point in time. It can be used to test the accuracy of class diagrams. It represents distinct instances of classes and the relationship between them at a time.



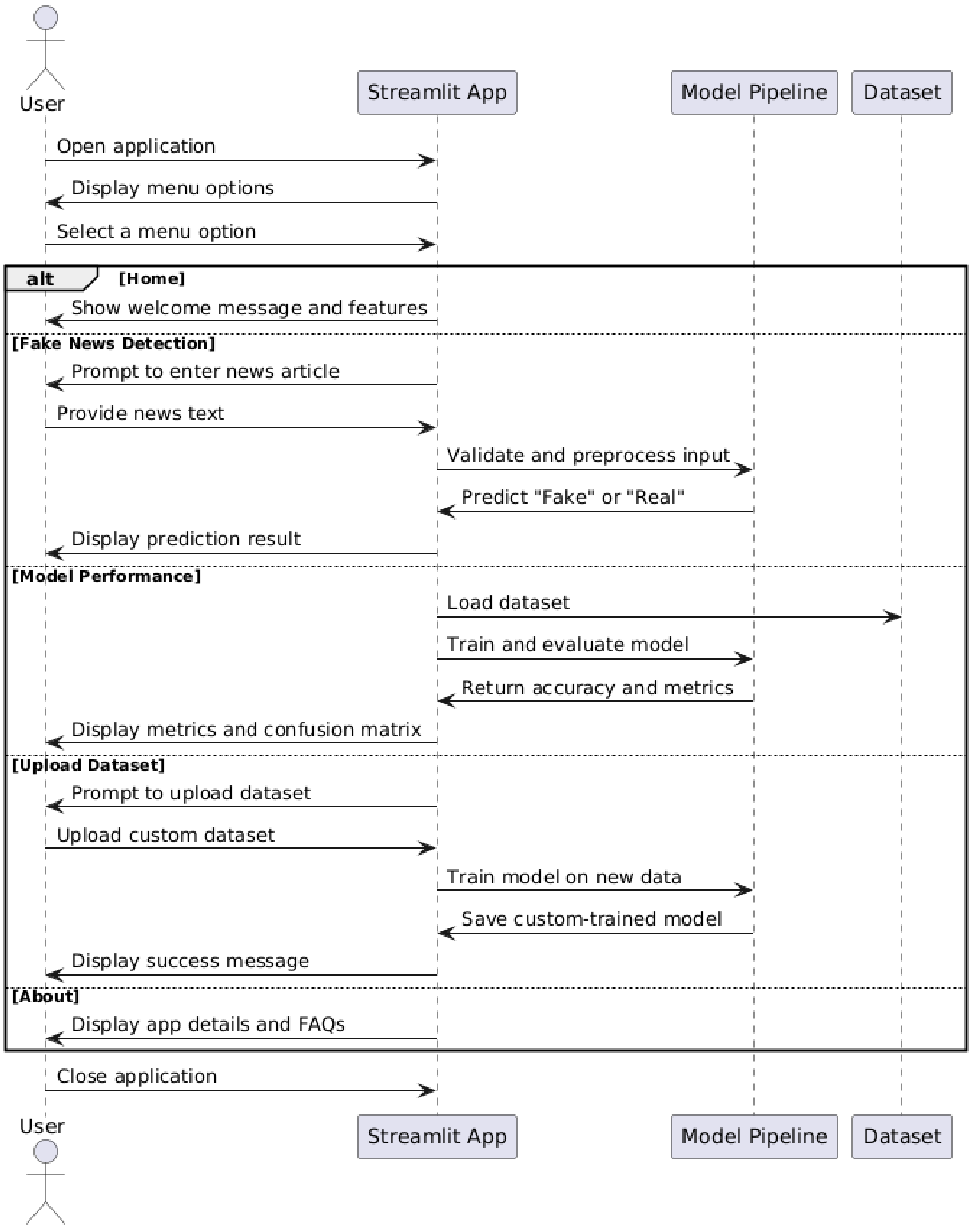
## ACTIVITY DIAGRAM

Activity diagram is another important diagram in UML to describe the dynamic aspects of the system. Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system.



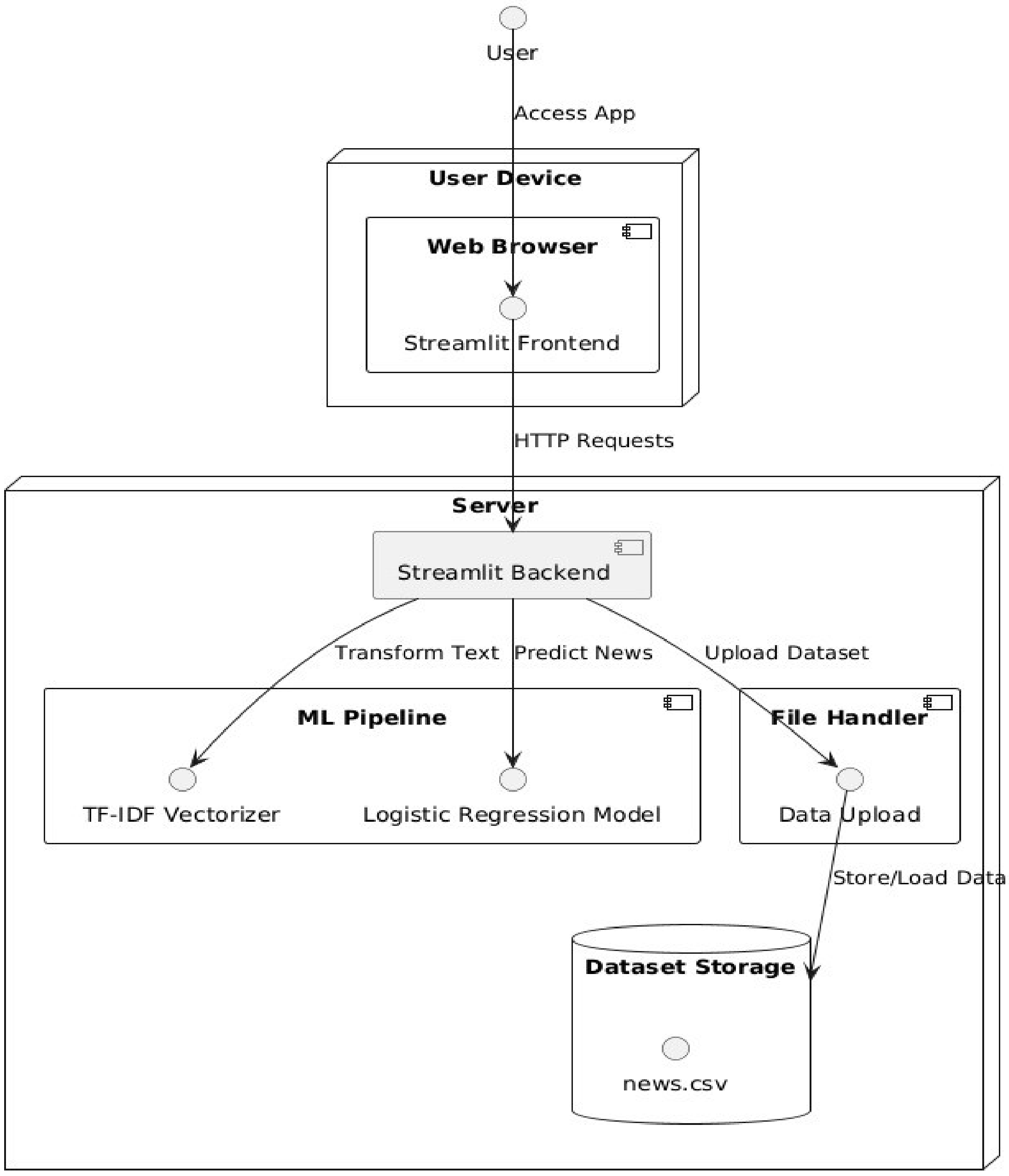
## SEQUENCE DIAGRAM

A sequence diagram is a type of interaction diagram because it describes how and in what order a group of objects works together. These diagrams are used by software developers and business professionals to understand requirements for a new system or to document an existing process.



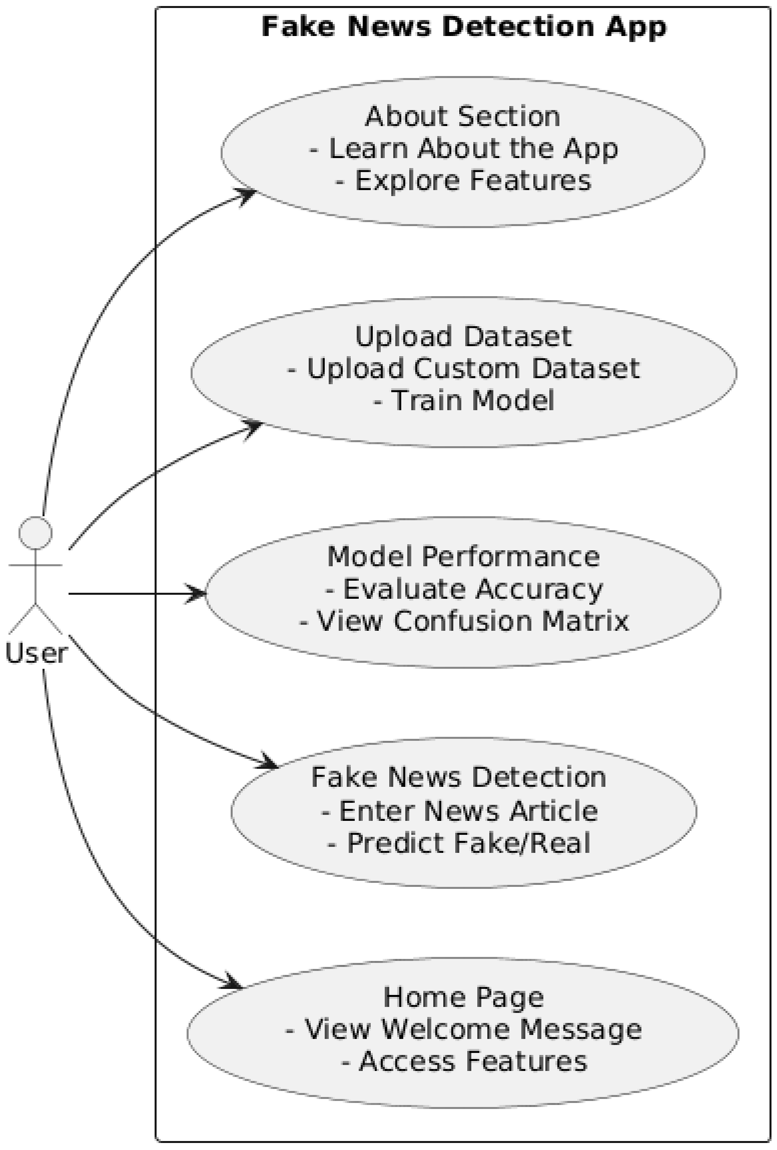
## DEPLOYMENT DIAGRAM

A deployment diagram is used to visualize the physical deployment of artifacts (such as software components, databases, and servers) on hardware nodes. It represents the system's architecture and how different components interact with each other in a real-world environment.



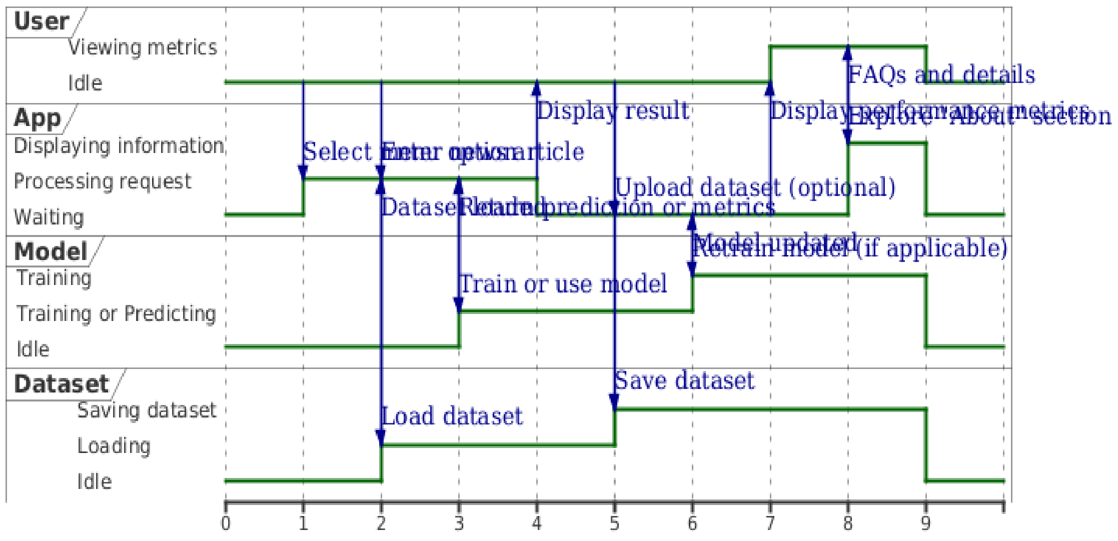
## USECASE DIAGRAM

In UML, use-case diagrams model the behaviour of a system and help to capture the requirements of the system. Use-case diagrams describe the high-level functions and scope of a system. These diagrams also identify the interactions between the system and its actors.



## TIMING DIAGRAM

A timing diagram represents the time progression of various events in a system, showing how system components interact over time. In the context of your Fake News Detection system, the timing diagram will represent the sequence of actions as the user interacts with the system, from providing input to receiving the classification result.



# 5. IMPLEMENTATION

## 5.1 MODULES

1.A Data Loading

1.B Preprocessing and vectorization

1.C Model Training

1.D Model Prediction

1.E Model Evaluation and Performance

1.F User Interface and Custom dataset

1.G Visualization

1.H CSS Styling and Customization

## 5.2 MODULES DESCRIPTION

1. **Data Loading Module**
   - **Description**: This module is responsible for loading the dataset into the application. It either loads a default dataset or allows users to upload their own CSV file containing news articles and corresponding labels. The data is then processed for further use in the model.
   - **Key Features**:
     - Load default or custom datasets.
     - Handle file upload errors or invalid data formats.
     - Ensure the dataset contains the required columns: text and label.
   - **Libraries Used**: pandas

2. **Preprocessing and Vectorization Module**
   - **Description**: The preprocessing and vectorization module handles the cleaning and transformation of the text data into a format suitable for machine learning models. It uses **TF-IDF** (Term Frequency-Inverse Document Frequency) to convert the text into numerical features that the model can process.
   - **Key Features**:
     - Text data cleaning, including removing stop words and special characters.
     - Transforming raw text into numerical vectors using **TF-IDF**.
     - Helps in reducing the dimensionality of the dataset and focuses on the most important terms.
   - **Libraries Used**: sklearn.feature_extraction.text.TfidfVectorizer

3. **Model Training Module**
   - **Description**: This module is responsible for training the machine learning model. It splits the data into training and testing sets and uses **Logistic Regression** to train a classification model on the dataset. The model is then saved and can be used for making predictions.

- **Key Features**:
    - Splits the dataset into training and testing subsets.
    - Trains a **Logistic Regression** model on the training data.
    - Returns the trained model, which is then used for prediction and evaluation.
- **Libraries Used**: sklearn.linear_model.LogisticRegression, sklearn.model_selection.train_test_split

**4. Model Prediction Module**

- **Description**: This module accepts a user-provided news article and uses the trained model to predict whether the article is **REAL** or **FAKE**. The module uses the previously trained logistic regression model for classification.
- **Key Features**:
    - Accepts news articles as input (either via typing or pasting).
    - Uses the trained model to predict the article's classification (REAL/FAKE).
    - Provides real-time feedback to the user on whether the article is authentic or not.
- **Libraries Used**: sklearn.pipeline.Pipeline

**5. Model Evaluation and Performance Module**

- **Description**: This module evaluates the performance of the machine learning model. It calculates key metrics such as **accuracy**, **precision**, **recall**, and **F1-score**. It also generates a **confusion matrix**, which is visualized to show how well the model is performing.
- **Key Features**:
    - Calculates and displays performance metrics like accuracy, precision, and recall.
    - Visualizes a confusion matrix to provide a deeper understanding of the model's classification results.
    - Helps to assess if the model is making accurate predictions or needs improvement.
- **Libraries Used**: sklearn.metrics, matplotlib, seaborn

**6. User Interface Module (Streamlit)**

- **Description**: This is the main interface module, responsible for presenting a simple and intuitive user interface (UI) for the application. Using **Streamlit**, it provides interactive elements such as text boxes, buttons, and file uploaders that allow users to interact with the app.
- **Key Features**:
    - Displays input areas for entering news articles and uploading datasets.
    - Allows users to submit text for prediction and view results.
    - Provides sections to evaluate the model and view performance metrics.
- **Libraries Used**: streamlit

**7. Custom Dataset Module**

- **Description**: This module allows users to upload and use their custom datasets to train the model. Users can provide their own CSV files, and the module ensures the format is correct before training the model with the new data.

- **Key Features**:
    - Upload custom datasets with required text and label columns.
    - Preprocess and train the model with the newly uploaded data.
    - Allows real-time model retraining with user-provided datasets.
- **Libraries Used**: pandas

**8. Visualization Module**

- **Description**: This module handles the graphical representation of the model's evaluation metrics. It provides a visual analysis of performance, including accuracy graphs and confusion matrix heatmaps, to help users understand the effectiveness of the model.
- **Key Features**:
    - Generates visualizations such as confusion matrices and accuracy plots.
    - Displays graphs to help users interpret model performance in an easy-to-understand way.
    - Uses color-coded heatmaps for confusion matrices to represent classification results visually.
- **Libraries Used**: matplotlib, seaborn

**9. CSS Styling and Customization Module**

- **Description**: This module is responsible for styling the app's UI, ensuring it is visually appealing and user-friendly. Using **HTML** and **CSS** through **Streamlit's markdown capabilities**, it customizes buttons, text, and layout to provide an attractive user experience.
- **Key Features**:
    - Custom styling for buttons, inputs, and other UI elements.
    - Ensures the layout is intuitive and responsive, making the app user-friendly.
    - Provides a polished look and feel to the overall user interface.
- **Libraries Used**: Custom HTML, CSS in st.markdown

## 5.3 SAMPLE CODE

```
 import streamlit as st
 from streamlit_option_menu import option_menu
 import pandas as pd
 import numpy as np
 import matplotlib.pyplot as plt
 from sklearn.feature_extraction.text import TfidfVectorizer
 from sklearn.linear_model import LogisticRegression
 from sklearn.model_selection import train_test_split
 from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
 from sklearn.pipeline import Pipeline
 import seaborn as sns
# Inject CSS for styling
 st.markdown(    """
     <style>
     body {
         font-family: Arial, sans-serif;
         background-color: #f0f0f0;
         margin: 0;
         padding: 0;
     }
     .container {
         max-width: 800px;
         margin: 20px auto;
         padding: 20px;
         background-color: #fff;
         border-radius: 8px;
         box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
     }
</style>
    """,
    unsafe_allow_html=True
)


@st.cache_resource
def load_data(file_path=None):
    """Load the dataset from a default path or user-uploaded file."""
    try:
        if file_path:
            df = pd.read_csv(file_path)
        else:
            df = pd.read_csv("news.csv")  # Replace with the actual path
        return df
    except Exception as e:
        st.error("Error loading data: " + str(e))
        return None


@st.cache_resource
def train_model(df):
    """Train the model and return the trained pipeline."""
    # Check dataset validity
    if "text" not in df.columns or "label" not in df.columns:
        st.error("Dataset must contain 'text' and 'label' columns.")
        return None


    # Split the data
    X = df["text"]
    y = df["label"]
```

```
 X_train, X_test, y_train, y_test = train_test_split(
        X, y, test_size=0.2, random_state=42, stratify=y
    )

    # Create the pipeline
    pipeline = Pipeline([
        ('tfidf', TfidfVectorizer(stop_words='english', max_df=0.7)),
        ('model', LogisticRegression(max_iter=1000, random_state=42))
    ])

    # Train the model
    pipeline.fit(X_train, y_train)

    return pipeline, X_train, X_test, y_train, y_test

def main():
    """Main Streamlit app."""
    st.title("Fake News Detection")

    # Sidebar navigation
    menu = ["Home", "Fake News Detection", "Model Performance", "Upload Dataset",
"About"]
    with st.sidebar:
        choice = option_menu(
            "News Detector",
            menu,
            icons=['house', 'search', 'chart-bar', 'upload', 'info-circle'],
            menu_icon="cast",
            default_index=0
        )
    if choice == "Home":
        st.markdown("## Welcome to the Fake News Detection App!")
        st.write("This app leverages machine learning to classify news as real or fake. Explore the features to get started.")
        st.markdown("""
        <div style='text-align: center;'>
            <h3>Explore Our Features:</h3>
            <ul style='list-style-type: none; padding: 0;'>
                <li style='margin: 10px 0;'><button id='traffic-button' style='padding: 10px 20px; font-size: 16px; background-color: #4CAF50; color: white; border: none; border-radius: 5px;'>Fake News Detection</button></li>
                <li style='margin: 10px 0;'><button id='data-button' style='padding: 10px 20px; font-size: 16px; background-color: #008CBA; color: white; border: none; border-radius: 5px;'>Model Performance</button></li>
            </ul>
        </div>
        """, unsafe_allow_html=True)

        st.markdown("""
        <script>
        document.getElementById('traffic-button').onclick = function() {
            alert('Redirecting to Lane Detection...');
        };
        document.getElementById('data-button').onclick = function() {
            alert('Redirecting to Object Detection...');
        };
        </script>
        """, unsafe_allow_html=True)
elif choice == "Fake News Detection":
        st.header("Enter a News Article:")
        news_text = st.text_area("Type or paste the news article text:")
    df = load_data()
    if df is not None:
        pipeline, _, _, _, _ = train_model(df)

        if st.button("Check"):
            if news_text.strip():
                prediction = predict_news(news_text, pipeline)
                st.subheader("Prediction:")
                if prediction == "FAKE":
                    st.error("This news article is likely Fake.")
                else:
                    st.success("This news article is likely Real.")
            else:
                st.warning("Please enter a news article.")

elif choice == "Model Performance":
    st.header("Model Performance Evaluation")
    df = load_data()
    if df is not None:
        pipeline, _, X_test, _, y_test = train_model(df)

        # Evaluate the model
        y_pred = pipeline.predict(X_test)
        accuracy = accuracy_score(y_test, y_pred)
        st.write(f"Model Accuracy: {accuracy * 100:.2f}%")

        # Classification report
        st.write("Classification Report:")
        st.text(classification_report(y_test, y_pred))
        # Confusion Matrix
        cm = confusion_matrix(y_test, y_pred, labels=["REAL", "FAKE"])
        fig, ax = plt.subplots(figsize=(6, 4))
        sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=["REAL", "FAKE"], yticklabels=["REAL", "FAKE"])
        plt.title("Confusion Matrix")
        plt.ylabel("Actual")
        plt.xlabel("Predicted")
        st.pyplot(fig)

    elif choice == "Upload Dataset":
        st.header("Upload Your Own Dataset")
        uploaded_file = st.file_uploader("Upload a CSV file with 'text' and 'label' columns:", type="csv")
        if uploaded_file:
            custom_df = pd.read_csv(uploaded_file)
            st.success("File uploaded successfully!")
            st.write(custom_df.head())
            pipeline, _, _, _, _ = train_model(custom_df)
            st.write("Model trained on uploaded dataset!")

    elif choice == "About":
        st.header("About")
        st.markdown("""
        Welcome to the *Fake News Detection App*! This app leverages cutting-edge machine learning technologies to help identify whether a news article is real or fake. Here's what makes this app special:
        """)

        st.markdown("### Explore Our Features:")
        tab1, tab2, tab3 = st.tabs(["Overview", "Technology", "How It Works"])
    with tab1:
        st.subheader("Overview")
        st.markdown("""
            - *Purpose*: Combat misinformation by providing an easy-to-use fake news detection tool.
        - *Audience*: Journalists, researchers, and anyone who consumes online content.
        - *Features*:
          1. Upload custom datasets for personalized predictions.
          2. Visualize model performance metrics like confusion matrices.
          3. Accurate predictions using a pre-trained machine learning pipeline.
        """)

    with tab2:
        st.subheader("Technology Stack")
        st.markdown("""
        This app is built using:
        - *Streamlit*: For creating the interactive web application.
        - *Python*: Core programming language for logic and data handling.
        - *Machine Learning*:
          - *Logistic Regression*: A powerful classification model.
          - *TF-IDF Vectorization*: Converts text into meaningful numerical data.
        - *Visualization Libraries*:
          - *Matplotlib* and *Seaborn* for graphs and heatmaps.""")

    with tab3:
        st.subheader("How It Works")
        st.markdown("""
        The process involves:
1. *Preprocessing*: Cleaning and transforming raw text data.
```

```
        2. *Vectorization*: Using TF-IDF to convert text into numerical features.

        3. *Model Prediction*: Leveraging logistic regression for binary classification.

        4. *Evaluation*: Displaying performance metrics like accuracy and confusion matrix.

        """)


    st.markdown("### Frequently Asked Questions (FAQ)")

    faq_expander = st.expander("Why is detecting fake news important?")

    faq_expander.write("Misinformation can spread quickly and cause harm to individuals, communities, and societies. Tools like this help combat the spread of false information.")


    faq_expander = st.expander("Can I trust the model predictions?")

    faq_expander.write("While the model is trained on a high-quality dataset, no model is 100% accurate. Use the predictions as a guide, not an absolute truth.")


    faq_expander = st.expander("Can I use my own dataset?")

    faq_expander.write("Yes! Navigate to the 'Upload Dataset' section and upload your CSV file to train the model on your custom data.")


    st.markdown("""

    Thank you for exploring the app! Feel free to reach out if you have suggestions or questions.

    """)


def predict_news(news_text, pipeline):

    """Predict whether the given news article is real or fake."""

    prediction = pipeline.predict([news_text])[0]

    return prediction

if _name_ == "_main_":

    main()
```

# 6. TEST CASES

## 1. Data Loading Test Cases

### Test Case 1: Load Default Dataset

- **Objective**: Test if the app can load the default dataset correctly.
- **Steps**:
    1. Open the app.
    2. Check if the default dataset is loaded (e.g., a CSV file).
    3. Verify that the data contains the correct columns: text and label.
- **Expected Result**: The app should successfully load the default dataset and display the first few rows of data.

### Test Case 2: Upload Custom Dataset

- **Objective**: Verify if the app allows users to upload their own dataset.
- **Steps**:
    1. Navigate to the "Upload Dataset" section.
    2. Upload a custom CSV file with text and label columns.
    3. Check if the dataset is loaded successfully and displayed.
- **Expected Result**: The custom dataset should be uploaded successfully, and the preview should display the first few rows.

### Test Case 3: Invalid Dataset Format

- **Objective**: Test if the app handles invalid dataset formats.
- **Steps**:
    1. Upload a CSV file without text or label columns.
    2. Observe the error handling response.
- **Expected Result**: The app should show an error message indicating that the dataset format is invalid.

## 2. Model Training Test Cases

### Test Case 4: Train Model with Default Dataset

- **Objective**: Verify if the model trains successfully on the default dataset.
- **Steps**:
    1. Load the default dataset.
    2. Start the model training process.
    3. Wait for the training to complete.
- **Expected Result**: The model should be trained successfully without any errors, and the trained model should be ready for use.

### Test Case 5: Train Model with Custom Dataset

- **Objective**: Test if the model can be trained with a custom dataset uploaded by the user.

- **Steps**:
    1. Upload a custom dataset with text and label columns.
    2. Start the training process.
    3. Verify that the model is trained successfully with the custom dataset.
- **Expected Result**: The model should train successfully with the custom dataset, and predictions should be ready.

### 3. Model Prediction Test Cases

#### Test Case 6: Predict Fake News

- **Objective**: Verify if the model can correctly predict a fake news article.
- **Steps**:
    1. Enter a fake news article into the prediction text area.
    2. Click the "Check" button.
    3. Observe the prediction result.
- **Expected Result**: The model should predict "FAKE" with an appropriate message (e.g., "This news article is likely Fake.").

#### Test Case 7: Predict Real News

- **Objective**: Verify if the model can correctly predict a real news article.
- **Steps**:
    1. Enter a real news article into the prediction text area.
    2. Click the "Check" button.
    3. Observe the prediction result.
- **Expected Result**: The model should predict "REAL" with an appropriate message (e.g., "This news article is likely Real.").

#### Test Case 8: Empty Input

- **Objective**: Ensure the app handles empty text input gracefully.
- **Steps**:
    1. Leave the prediction text area empty.
    2. Click the "Check" button.
    3. Observe the response.
- **Expected Result**: The app should show a warning message asking the user to enter a news article.

### 4. Model Evaluation Test Cases

#### Test Case 9: Display Model Performance Metrics

- **Objective**: Verify that the model evaluation metrics are displayed correctly after training.
- **Steps: 1.**Train the model on a dataset.
  2.Navigate to the "Model Performance" section.
  3. Check if the accuracy, precision, recall, and F1-score are displayed correctly.
- **Expected Result**: The app should display the correct performance metrics.

**Test Case 10: Display Confusion Matrix**

- **Objective**: Verify that the confusion matrix is displayed correctly.
- **Steps**:
    1. Train the model.
    2. Navigate to the "Model Performance" section.
    3. Check if the confusion matrix is visualized properly.
- **Expected Result**: A confusion matrix heatmap should be displayed, showing the true positive, false positive, true negative, and false negative values.

**5. User Interface Test Cases**

**Test Case 11: UI Responsiveness**

- **Objective**: Ensure that the app's user interface is responsive on different screen sizes.
- **Steps**:
    1. Access the app on different devices (e.g., desktop, tablet, mobile).
    2. Check if all UI components (buttons, text areas, images) are properly aligned and functional.
- **Expected Result**: The app should be responsive and maintain its functionality across different devices.

**Test Case 12: Button Functionality**

- **Objective**: Test if the buttons (e.g., "Check", "Upload Dataset") function correctly.
- **Steps**:
    1. Click on the "Check" button after entering a news article.
    2. Click on the "Upload Dataset" button and upload a file.
    3. Verify that both buttons trigger the correct actions.
- **Expected Result**: The buttons should trigger the appropriate actions (e.g., prediction, file upload).

**6. Custom Dataset Test Cases**

**Test Case 13: Upload and Train with Custom Dataset**

- **Objective**: Test if the app allows the user to upload a custom dataset and retrain the model.
- **Steps**:
    1. Upload a CSV file containing news articles and labels.
    2. Train the model with this dataset.
    3. Verify that the model can make predictions using the custom dataset.
- **Expected Result**: The app should allow the user to upload a custom dataset, train the model, and make predictions based on the custom dataset.

**Test Case 14: Invalid Dataset (No text or label Columns)**

- **Objective**: Verify how the app handles invalid custom datasets.
- **Steps**:
    1. Upload a CSV file that lacks text or label columns.
    2. Observe the response from the app.

- **Expected Result**: The app should display an error message indicating that the dataset is not valid due to missing columns.

**7. Error Handling Test Cases**

**Test Case 15: Error in Model Training**

- **Objective**: Ensure that the app handles errors during model training.
- **Steps**:
  1. Force an error by providing a dataset with issues (e.g., missing labels).
  2. Attempt to train the model.
  3. Observe how the app handles the error.
- **Expected Result**: The app should show an appropriate error message informing the user of the issue.

**8. Visualizations Test Cases**

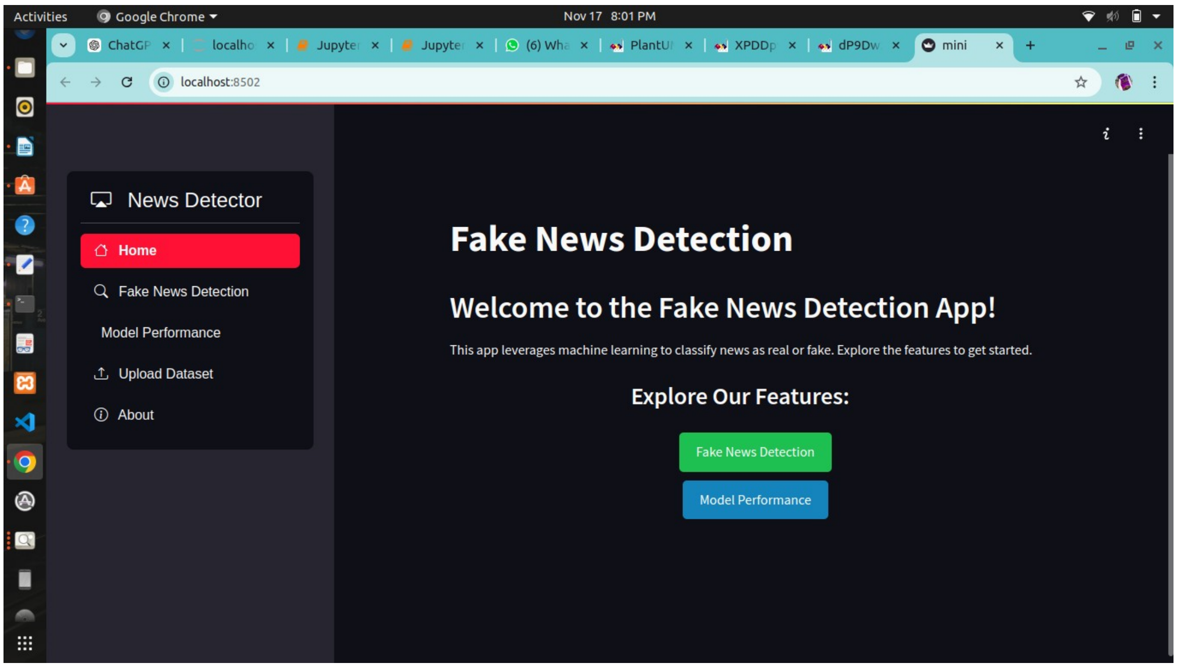
**Test Case 16: Display Accuracy Graph**

- **Objective**: Test if the app can display an accuracy graph after model evaluation.
- **Steps**:
  1. Train the model and evaluate it.
  2. Check if the accuracy graph is displayed.
- **Expected Result**: An accuracy graph should be displayed showing the model's accuracy over time or based on the dataset used.

**Test Case 17: Display Confusion Matrix Visualization**

- **Objective**: Verify that the confusion matrix is visualized correctly as a heatmap.
- **Steps**:
  1. Train the model.
  2. Navigate to the performance section and verify that the confusion matrix is visualized properly.
- **Expected Result**: The confusion matrix should appear as a heatmap with color-coded values.

# 7.SCREENSHOTS

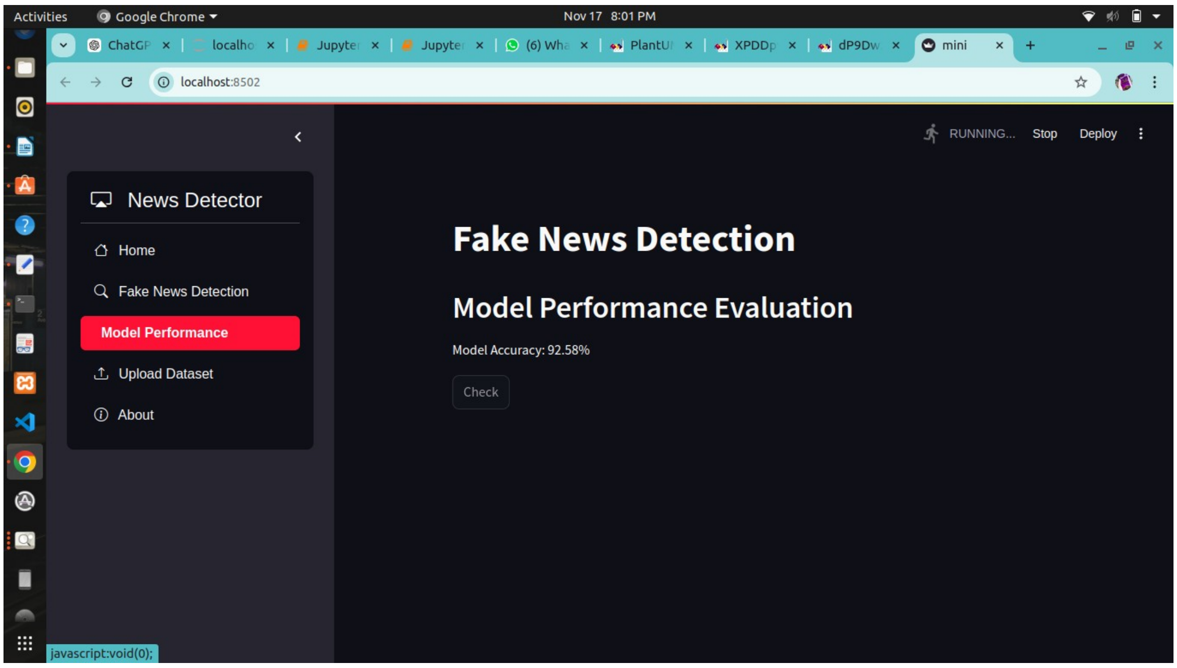


Fake News Detection

Welcome to the Fake News Detection App!

This app leverages machine learning to classify news as real or fake. Explore the features to get started.

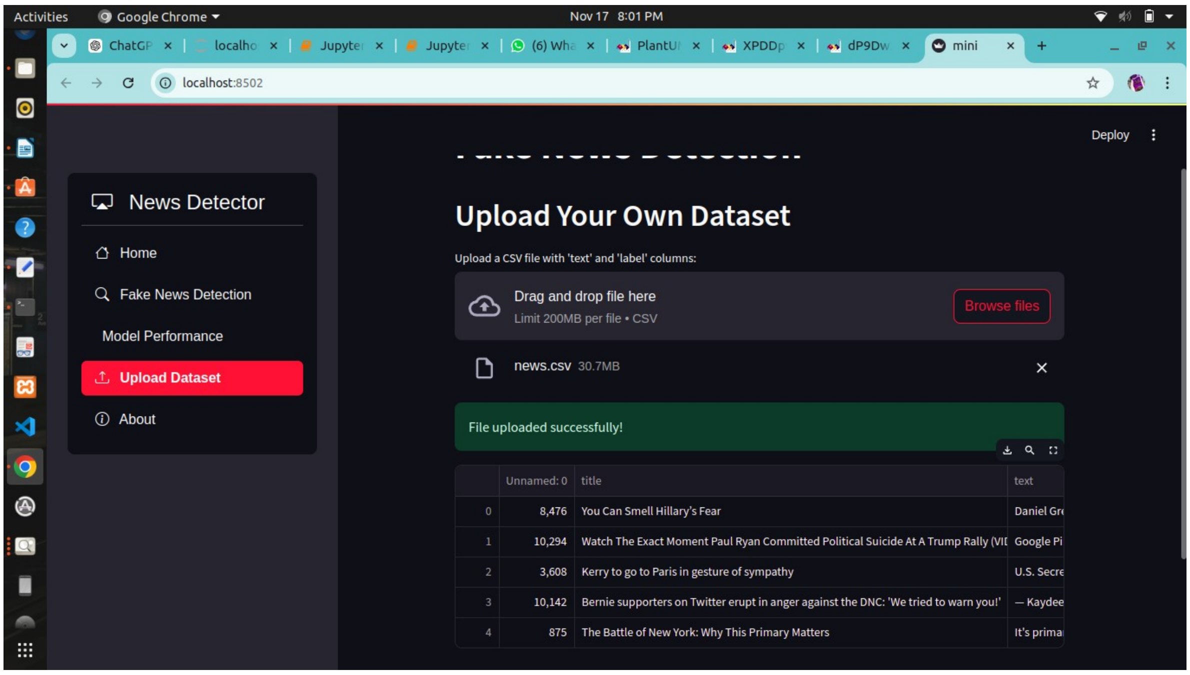
Explore Our Features:



Fake News Detection

Model Performance Evaluation

Model Accuracy: 92.58%



## Upload Your Own Dataset

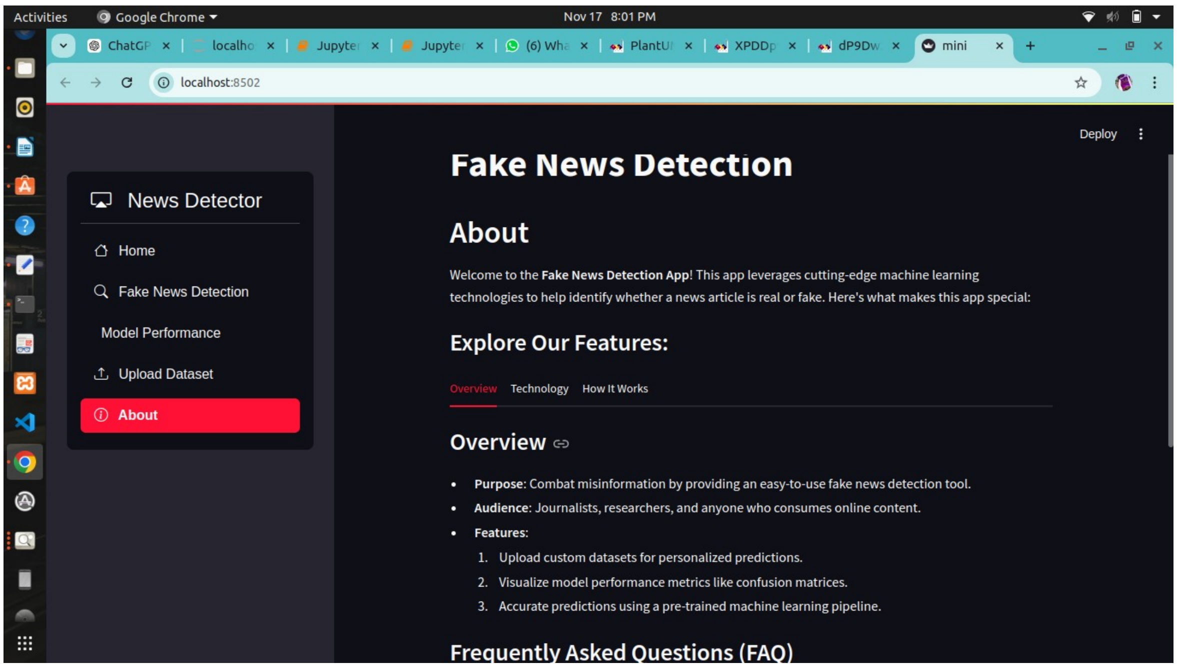
Upload a CSV file with 'text' and 'label' columns:

Drag and drop file here
Limit 200MB per file • CSV

news.csv 30.7MB

File uploaded successfully!

| | Unnamed: 0 | title | text |
|---|---|---|---|
| 0 | 8,476 | You Can Smell Hillary's Fear | Daniel Gre |
| 1 | 10,294 | Watch The Exact Moment Paul Ryan Committed Political Suicide At A Trump Rally (VII | Google Pi |
| 2 | 3,608 | Kerry to go to Paris in gesture of sympathy | U.S. Secre |
| 3 | 10,142 | Bernie supporters on Twitter erupt in anger against the DNC: 'We tried to warn you!' | — Kaydee |
| 4 | 875 | The Battle of New York: Why This Primary Matters | It's prima |



## Fake News Detection

## About

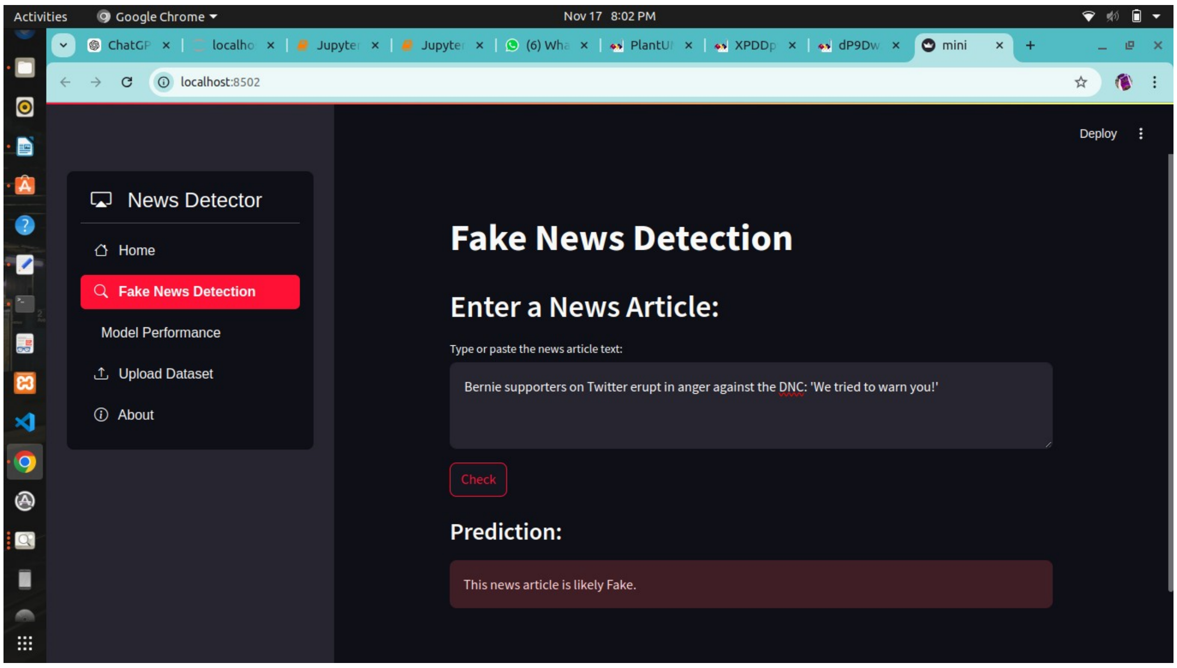
Welcome to the **Fake News Detection App**! This app leverages cutting-edge machine learning technologies to help identify whether a news article is real or fake. Here's what makes this app special:

### Explore Our Features:

### Overview

- **Purpose**: Combat misinformation by providing an easy-to-use fake news detection tool.
- **Audience**: Journalists, researchers, and anyone who consumes online content.
- **Features**:
  1. Upload custom datasets for personalized predictions.
  2. Visualize model performance metrics like confusion matrices.
  3. Accurate predictions using a pre-trained machine learning pipeline.

### Frequently Asked Questions (FAQ)



Fake News Detection

Enter a News Article:

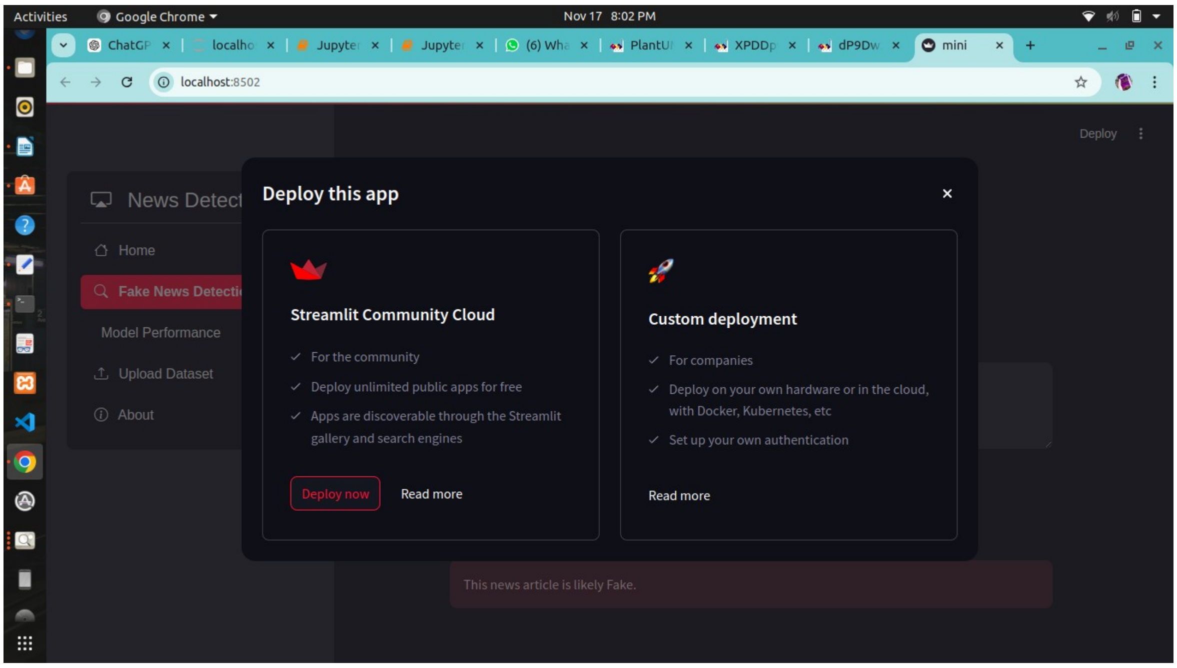
Type or paste the news article text:

Bernie supporters on Twitter erupt in anger against the DNC: 'We tried to warn you!'

Check

Prediction:

This news article is likely Fake.


Deploy this app

Streamlit Community Cloud

- For the community
- Deploy unlimited public apps for free
- Apps are discoverable through the Streamlit gallery and search engines

Deploy now Read more

Custom deployment

- For companies
- Deploy on your own hardware or in the cloud, with Docker, Kubernetes, etc
- Set up your own authentication

Read more

# 8. CONCLUSION

The Fake News Detection App is an innovative and essential tool designed to combat the spread of misinformation in the digital age. By leveraging machine learning techniques such as TF-IDF Vectorization and Logistic Regression, the app efficiently classifies news articles as either real or fake based on their content. With a user-friendly interface powered by Streamlit, users can easily upload datasets, train models, and evaluate their performance using visualizations like confusion matrices and accuracy scores.

The system provides a reliable solution for individuals, journalists, and researchers looking to verify the authenticity of news articles. The ability to upload custom datasets and retrain the model makes the app adaptable to various domains and real-world use cases. Moreover, the integration of performance metrics and visualizations ensures that users can gain deep insights into the effectiveness of the model, helping them make informed decisions.

While the app is highly accurate and efficient, it is important to recognize the inherent limitations of machine learning models, including the potential for misclassification in certain cases. Nevertheless, this tool serves as a powerful aid in the ongoing battle against fake news, promoting a more informed and responsible digital ecosystem.

In conclusion, the **Fake News Detection App** is a valuable resource that combines advanced machine learning techniques with an accessible user interface to tackle the widespread issue of fake news. By offering an intuitive and customizable platform, the app contributes to enhancing trust in the media and empowering users to verify news sources effectively.

# 9. FUTURE ENHANCEMENTS

### 1. Incorporating Deep Learning Models

Currently, the app uses **Logistic Regression** for text classification. A significant enhancement would be to integrate more advanced deep learning models such as **Convolutional Neural Networks (CNNs)** or **Recurrent Neural Networks (RNNs)**, including **LSTM (Long Short-Term Memory)** or **BERT (Bidirectional Encoder Representations from Transformers)**. These models have shown superior performance in natural language processing tasks and can potentially increase the accuracy and reliability of the fake news detection system.

### 2. Multi-Language Support

At present, the app primarily handles English text. A future enhancement could involve incorporating multi-language support, enabling the detection of fake news in different languages such as Spanish, French, Chinese, and Arabic. This would increase the app's usability on a global scale, allowing it to cater to a wider audience and handle a broader range of news sources.

### 3. Real-Time Data Collection and Detection

Integrating the app with real-time news sources, such as news APIs or social media platforms (e.g., Twitter, Reddit), could provide users with up-to-date analysis of breaking news articles. By implementing real-time data collection, the app could classify and verify news as it is published, helping users stay informed and make quick decisions about the authenticity of the information.

### 4. Improved User Interface and Experience

Enhancing the user interface (UI) can further improve the overall user experience. Some potential improvements include:

- **Dashboard View**: A more interactive and visually appealing dashboard that displays real-time statistics, recent predictions, and overall model performance.
- **News Article Comparison**: Allow users to compare multiple articles side by side and get a confidence score for each prediction, aiding users in better understanding the app's classification process.
- **Feedback Mechanism**: Users could have the option to provide feedback on the predictions, helping improve the model over time through crowd-sourced validation.

### 5. Source Credibility Scoring

In addition to detecting fake news, the app could incorporate a **source credibility** scoring system. By analyzing the credibility of the source (e.g., news outlet, author), the app could provide a more comprehensive assessment of the news article's authenticity. This could involve scraping metadata from reputable news websites, verifying author credentials, and cross-checking news articles with trusted fact-checking organizations.

### 6. Use of External Fact-Checking Databases

Integrating external fact-checking databases like **PolitiFact**, **Snopes**, or **FactCheck.org** could enhance the app's accuracy. By cross-referencing news articles with these trusted sources, the app could provide users with verified facts and provide a higher level of certainty about the authenticity of the news content.

**7. Customizable Training for Users**

Offering more customization for users to fine-tune the model to their specific needs could be a valuable enhancement. For example, users could:

- Upload their own labeled data and retrain the model on specific topics or domains (e.g., political news, health news).
- Use different algorithms or model configurations, giving them flexibility in choosing the approach that best suits their needs.

**8. Enhanced Performance Metrics**

Incorporating more advanced performance metrics and visualizations could help users better understand the model's effectiveness. For example:

- **Precision-Recall Curves**: This could provide insights into the trade-off between precision and recall, especially in imbalanced datasets.
- **ROC Curve**: Users could benefit from seeing how well the model distinguishes between classes (real vs. fake news) by visualizing the Receiver Operating Characteristic curve.

**9. Mobile Application Development**

To extend the reach of the app, a mobile version for both **iOS** and **Android** could be developed. This would allow users to access fake news detection capabilities on-the-go, making it easier for them to verify news articles as they come across them on their smartphones.

**10. Collaboration with News Organizations**

Establishing collaborations with trusted news organizations or platforms could help validate the app's predictions and provide a more authoritative source of truth. These collaborations could lead to partnerships for the wider adoption of the app, helping tackle fake news at a larger scale.

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