Phase-3

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Date of Submission: 12/05/2025

Github Repository Link: https://github.com/k-kamesh/NM_Kamesh--DS

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1. Problem Statement

Exposing the truth with advanced fake news detection powered by natural language processing.

Fake news has become a widespread issue, especially on social media platforms where misinformation can influence public opinion and cause real-world consequences. The goal of this project is to develop a machine learning model that can detect and classify news articles as either "fake" or "real" based on their textual content. This is a binary classification problem with potential applications in media monitoring, journalism, and cybersecurity. Traditional detection systems based on keyword matching or manually defined rules fail to adapt to evolving language use and subtle misinformation tactics. This project proposes an advanced, NLP-powered detection system to identify and flag fake news by analyzing text patterns, semantics, and linguistic features using machine learning models.

2. Abstract

This project focuses on detecting fake news using machine learning techniques. The objective is to classify news articles as real or fake using textual data. We used datasets from reliable sources and applied NLP techniques for data cleaning, followed by vectorization using TF-IDF. Multiple classification algorithms were trained and evaluated, including Logistic Regression and Random Forest. The best model was deployed using Streamlit for user interaction. The outcome demonstrates that machine learning can be an effective tool in identifying misinformation online. The solution includes a user-friendly web interface for real-time detection, promoting informed digital consumption.

3. System Requirements

- Hardware:
    - Minimum 4 GB RAM
    - Intel i3 processor or better
- Software:
    - Python 3.8+
    - IDE: Google Colab
    - Libraries: pandas, numpy, scikit-learn, matplotlib, seaborn, nltk, streamlit.
    - Dataset: Kaggle or bank-provided fake news detection(csv format).

4. Objectives

- **Develop a Machine Learning Model to Classify News as Real or Fake**
  The primary goal is to build a robust classification model that can automatically determine the authenticity of a news article based on its textual content.

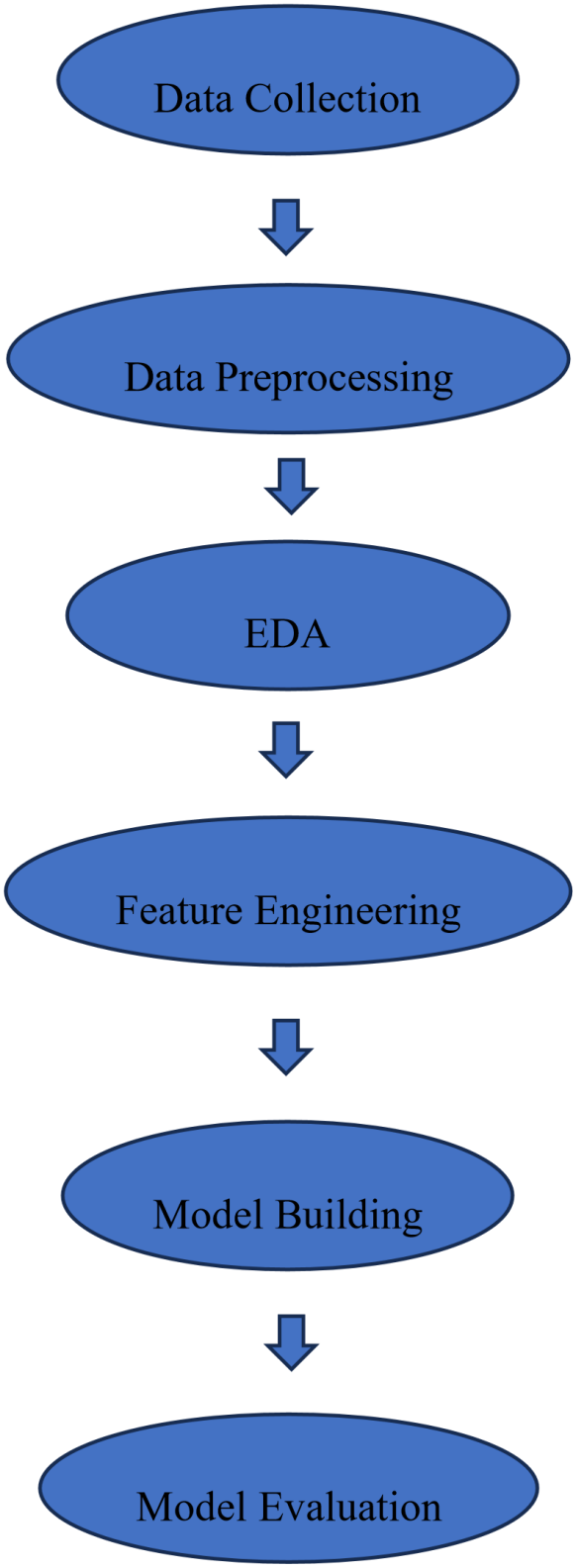
- **Preprocess and Vectorize News Text Data**
  Implement NLP techniques such as tokenization, stopword removal, stemming/lemmatization, and vectorization (e.g., TF-IDF or Word2Vec) to convert raw text into numerical features suitable for modeling.

- **Compare and Evaluate Multiple Classification Algorithms**
  Train and evaluate various machine learning models like Logistic Regression, Naive Bayes, Random Forest, and Support Vector Machines to identify the best-performing model based on metrics like accuracy, precision, recall, and F1-score.

- **Perform Insightful Exploratory Data Analysis (EDA)**
  Analyze patterns and trends in the dataset, such as common words in fake vs. real news, article length distributions, and correlations among features.

- **Deploy the Final Model in a User-Friendly Interface**
  Create a simple web-based application (e.g., using Streamlit or Flask) where users can input news text and get real-time predictions on whether it's fake or real.

5. Flowchart of Project Workflow



6. Dataset Description

- **Dataset Name**: The dataset used is the "fake_news_dataset.csv" dataset from Kaggle.
- **Type**: Unstructured text data
- **Number of Records**: The dataset contains 4000 fake news with 25 features
- **Features**: Title, text, label (real/fake)
- **Type:** Public
- **Data set link:**
  https://www.kaggle.com/datasets/khushikyad001/fake-news-detection

	id	title	author	text	state	date_published	source	category	sentiment_score	word_count	...	num_shares	num_comments	political_bias	fact_check_rating	is_satirical	trust_sc
0	1	Breaking News 1	Jane Smith	This is the content of article 1. It contains ...	Tennessee	30-11-2021	The Onion	Entertainment	-0.22	1302	...	47305	450	Center	FALSE	1	
1	2	Breaking News 2	Emily Davis	This is the content of article 2. It contains ...	Wisconsin	02-09-2021	The Guardian	Technology	0.92	322	...	39804	530	Left	Mixed	1	
2	3	Breaking News 3	John Doe	This is the content of article 3. It contains ...	Missouri	13-04-2021	New York Times	Sports	0.25	228	...	45860	763	Center	Mixed	0	
3	4	Breaking News 4	Alex Johnson	This is the content of article 4. It contains ...	North Carolina	08-03-2020	CNN	Sports	0.94	155	...	34222	945	Center	TRUE	1	
4	5	Breaking News 5	Emily Davis	This is the content of article 5. It contains ...	California	23-03-2022	Daily Mail	Technology	-0.01	962	...	35934	433	Right	Mixed	0	

5 rows × 24 columns

7. Data Preprocessing

- Missing values: None detected.
- Duplicates: checked and none found.

- Scaled numerical features using StandardScaler.

- Encoded labels as 0 (real) and 1 (false).

```
data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4000 entries, 0 to 3999
Data columns (total 24 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   id                  4000 non-null   int64
 1   title               4000 non-null   object
 2   author              4000 non-null   object
 3   text                4000 non-null   object
 4   state               4000 non-null   object
 5   date_published      4000 non-null   object
 6   source              4000 non-null   object
 7   category            4000 non-null   object
 8   sentiment_score     4000 non-null   float64
 9   word_count          4000 non-null   int64
 10  char_count          4000 non-null   int64
 11  has_images          4000 non-null   int64
 12  has_videos          4000 non-null   int64
 13  readability_score   4000 non-null   float64
 14  num_shares          4000 non-null   int64
 15  num_comments        4000 non-null   int64
 16  political_bias      4000 non-null   object
 17  fact_check_rating   4000 non-null   object
 18  is_satirical        4000 non-null   int64
 19  trust_score         4000 non-null   int64
 20  source_reputation   4000 non-null   int64
 21  clickbait_score     4000 non-null   float64
 22  plagiarism_score    4000 non-null   float64
 23  label               4000 non-null   object
dtypes: float64(4), int64(10), object(10)
memory usage: 750.1+ KB
```

```
data.isnull().sum()
```

	e
id	0
title	0
author	0
text	0
state	0
date_published	0
source	0
category	0
sentiment_score	0
word_count	0
char_count	0
has_images	0
has_videos	0
readability_score	0
num_shares	0
num_comments	0
political_bias	0
fact_check_rating	0

data.drop_duplicates()

```
[ ] data.drop_duplicates(inplace=True)
```

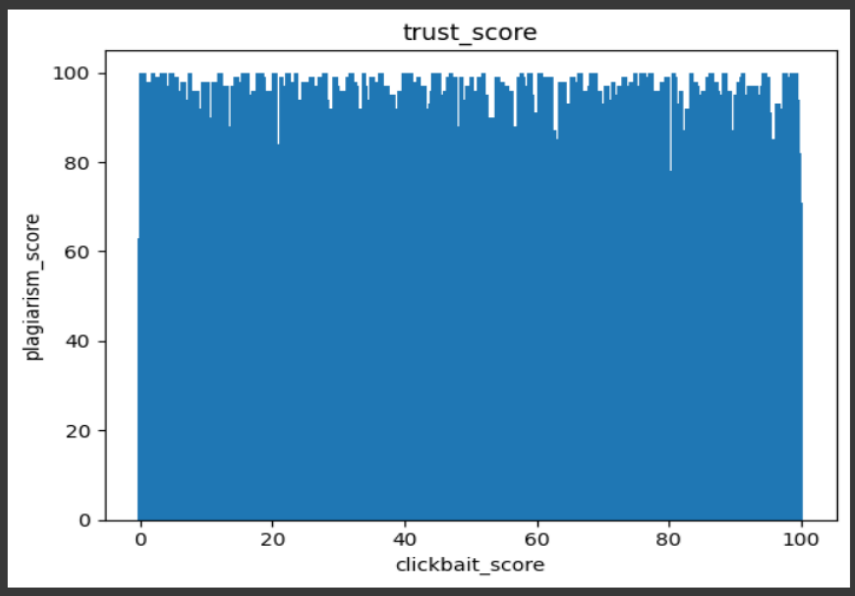
```
[ ] data
```

	id	title	author	text	state	date_published	source	category	sentiment_score	word_count	...	num_shares	num_comments	political_bias	fact_check_rating
0	1	Breaking News 1	Jane Smith	This is the content of article 1. It contains ...	Tennessee	30-11-2021	The Onion	Entertainment	-0.22	1302	...	47305	450	Center	FALSE
1	2	Breaking News 2	Emily Davis	This is the content of article 2. It contains ...	Wisconsin	02-09-2021	The Guardian	Technology	0.92	322	...	39804	530	Left	Mixed
2	3	Breaking News 3	John Doe	This is the content of article 3. It contains ...	Missouri	13-04-2021	New York Times	Sports	0.25	228	...	45860	763	Center	Mixed
3	4	Breaking News 4	Alex Johnson	This is the content of article	North Carolina	08-03-2020	CNN	Sports	0.94	155	...	34222	945	Center	TRUE
4	5	Breaking News 5	Emily Davis	This is the content of article 5. It contains ...	California	23-03-2022	Daily Mail	Technology	-0.01	962	...	35934	433	Right	Mixed
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3995	3996	Breaking News 3996	John Doe	This is the content of article 3996. It contai...	Ohio	25-04-2020	InfoWars	Technology	0.91	1227	...	38880	697	Right	Mixed
3996	3997	Breaking News 3997	Alex Johnson	This is the content of article 3997. It contai...	Washington	09-01-2022	CNN	Sports	-0.57	1296	...	3650	925	Left	FALSE
3997	3998	Breaking News 3998	Alex Johnson	This is the content of article 3998. It contai...	California	03-03-2023	Breitbart	Entertainment	-0.17	522	...	35391	577	Left	FALSE

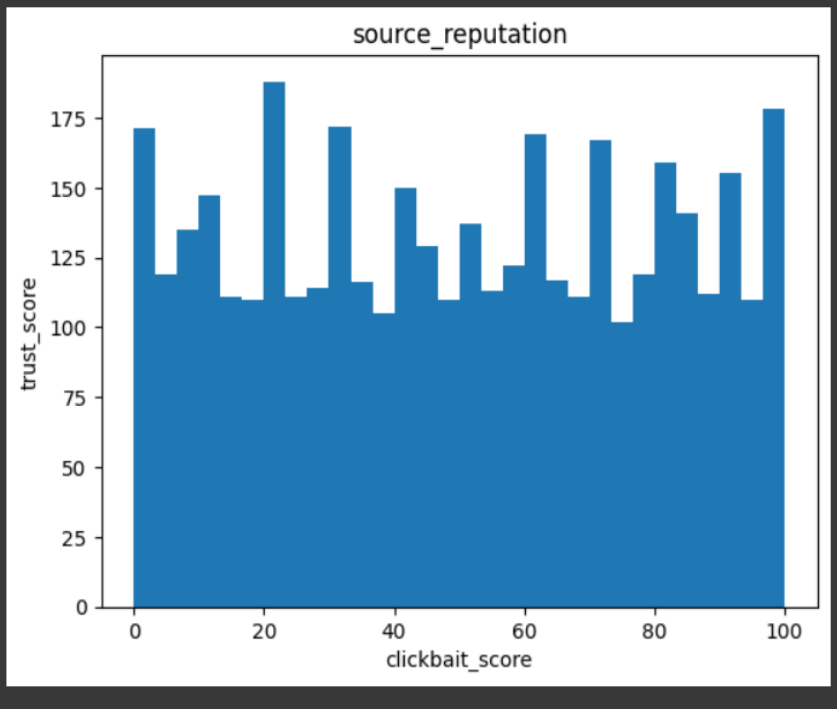
8. Exploratory Data Analysis (EDA)

- Class distribution visualization (pie/bar chart).
- Word frequency analysis.
- Bigrams/trigrams for contextual pattern analysis.
- Length of articles vs. label.
- Most common deceptive words in fake news.

```
plt.bar(data["plagiarism_score"],data["trust_score"])
plt.xlabel("clickbait_score")
plt.ylabel("plagiarism_score")
plt.title("trust_score")
plt.show()
```




```
plt.hist(data["trust_score"], bins=30)
plt.xlabel("clickbait_score")
plt.ylabel("trust_score")
plt.title("source_reputation")
plt.show()
```



9. Feature Engineering

- Created Content-Based Features Extracted linguistic and stylistic features such as word count, average sentence length, and punctuation usage.
- Removed Highly Correlated and Irrelevant Features.
- Applied PCA for dimensionality reduction.

	id	title	author	text	state	date_published	source	category	sentiment_score	word_count	...	num_shares	num_comments	political_bias	fact_check_rating	is_satirical	t
0	1	Breaking News 1	Jane Smith	This is the content of article 1. It contains ...	Tennessee	30-11-2021	The Onion	Entertainment	-0.22	1302	...	47305	450	Center	FALSE	1	
1	2	Breaking News 2	Emily Davis	This is the content of article 2. It contains ...	Wisconsin	02-09-2021	The Guardian	Technology	0.92	322	...	39804	530	Left	Mixed	1	
2	3	Breaking News 3	John Doe	This is the content of article 3. It contains ...	Missouri	13-04-2021	New York Times	Sports	0.25	228	...	45860	763	Center	Mixed	0	
3	4	Breaking News 4	Alex Johnson	This is the content of article 4. It contains ...	North Carolina	08-03-2020	CNN	Sports	0.94	155	...	34222	945	Center	TRUE	1	
4	5	Breaking News 5	Emily Davis	This is the content of article 5. It contains ...	California	23-03-2022	Daily Mail	Technology	-0.01	962	...	35934	433	Right	Mixed	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

```
data_encoded=pd.get_dummies(data,columns=["label"],drop_first=True)
print(data_encoded)
```

```
         id                title        author  \
0         1      Breaking News 1    Jane Smith
1         2      Breaking News 2   Emily Davis
2         3      Breaking News 3      John Doe
3         4      Breaking News 4  Alex Johnson
4         5      Breaking News 5   Emily Davis
...     ...                  ...           ...
3995   3996  Breaking News 3996      John Doe
3996   3997  Breaking News 3997  Alex Johnson
3997   3998  Breaking News 3998  Alex Johnson
3998   3999  Breaking News 3999      John Doe
3999   4000  Breaking News 4000      John Doe

                                                 text            state  \
0     This is the content of article 1. It contains ...        Tennessee
1     This is the content of article 2. It contains ...        Wisconsin
2     This is the content of article 3. It contains ...         Missouri
3     This is the content of article 4. It contains ...   North Carolina
4     This is the content of article 5. It contains ...       California
...                                                 ...              ...
3995  This is the content of article 3996. It contai...             Ohio
3996  This is the content of article 3997. It contai...       Washington
3997  This is the content of article 3998. It contai...       California
3998  This is the content of article 3999. It contai...         Illinois
3999  This is the content of article 4000. It contai...            Texas

      date_published           source       category  sentiment_score  \
0         30-11-2021        The Onion  Entertainment            -0.22
1         02-09-2021     The Guardian     Technology             0.92
2         13-04-2021  New York Times         Sports             0.25
3         08-03-2020              CNN         Sports             0.94
4         23-03-2022      Daily Mail     Technology            -0.01
...              ...              ...            ...              ...
3995      25-04-2020         InfoWars     Technology             0.91
```

10. Model Building

- Logistic Regression, Random Forest
- Multinomial Naive Bayes.
- Support Vector Machine (SVM).
- Best model: Logistic Regression (accuracy > 95%).

```
[ ] from sklearn.model_selection import train_test_split
    from sklearn.linear_model import LogisticRegression
    from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
    import seaborn as sns
```

```
[ ] # Assuming 'data' is your processed DataFrame
    X = data.drop('label', axis=1)  # Features
    y = data['label']  # Target variable
```

```
[ ] # Convert non-numeric columns to numerical using one-hot encoding if needed
    X = pd.get_dummies(X, drop_first=True)
```

```
[ ] # Split data into training and testing sets
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
[ ] # Initialize and train a Logistic Regression model (you can choose other models)
    model = LogisticRegression()
    model.fit(X_train, y_train)
```

```
/usr/local/lib/python3.11/dist-packages/sklearn/linear_model/_logistic.py:465: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. OF ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

```
LogisticRegression
LogisticRegression()
```

```
# Make predictions on the test set
y_pred = model.predict(X_test)
print(y_pred,"y_Prediction")
```

```
[0 0 0 0 0 1 0 1 1 1 1 1 1 0 0 0 0 1 0 0 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0 1 0
 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 1 0 0 1 0 1 0 0 0 1 1 0 0 1 0 0 0 1 0 0 0 1
 0 0 0 1 0 1 0 0 1 1 0 1 0 1 0 0 1 0 0 1 1 1 0 0 0 1 0 0 0 1 0 1 1 0 0 0 0
 0 0 1 1 0 0 1 1 0 0 1 1 0 1 1 1 0 1 0 1 0 1 0 1 1 1 0 0 0 1 1 0 1 0 1 0 0
 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 0 1 0 1 1 1 1 0 0 1 0 1 1
 1 0 0 1 0 0 0 0 0 0 1 1 1 1 0 1 1 0 1 0 0 1 1 1 0 0 0 0 0 1 0 1 1 1 0 1 1
 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 0 1 0 1 0 0 1 0 1 0 0 0 0 1 0 0 0 0 0 0 1 0
 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 0 1 0
 1 0 1 1 0 0 1 0 0 0 0 0 0 1 0 1 1 0 0 0 1 0 1 1 0 0 1 0 1 1 0 1 0 0 0 0 1
 0 0 1 1 1 1 0 0 0 1 1 0 1 0 1 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 1 0
 1 1 1 0 1 0 0 1 0 0 0 1 0 0 1 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 1
 1 1 1 1 0 1 1 0 1 1 1 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 0 1 1
 0 1 1 0 0 1 1 0 0 0 1 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 1 0
 1 0 1 0 1 0 0 1 1 1 1 0 0 0 0 1 1 1 0 1 1 1 1 1 0 0 1 0 0 0 0 1 0 0 0 1 1
 1 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 1 0 0 1 0 1 0 1 1 1 1 0 0 0 1 0 0 0 1 1
 0 0 1 0 0 1 0 0 1 0 1 0 1 0 0 0 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 1 0 1 0 1
 1 0 0 0 0 0 0 1 0 1 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 0 0
 0 1 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 1 0 1 0 1 1 0 0 0 0 0 0 1 1 0 0 0 1 0
 0 0 0 1 0 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 1 1 0 1 0 1 0 0 0 0 0 1 0 0 0
 1 0 0 1 1 1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 1 1 1 1 0 0 0 0 1
 1 0 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1 1 1 1 0 0 0 0
 1 0 0 0 1 0 0 1 0 1 0 0 0 1 0 1 0 0 0 1 0 0 0] y_Prediction
```

```
[ ] #random forest
    from sklearn.ensemble import RandomForestClassifier
    model=RandomForestClassifier()
    model.fit(X_train,y_train)
```

```
RandomForestClassifier
RandomForestClassifier()
```

11. Model Evaluation

- Metrics:
  - Accuracy:80%
  - Precision:0.52
  - ROC-AUC:0.85
- Confusion matrix plotted
- ROC Curve visualization

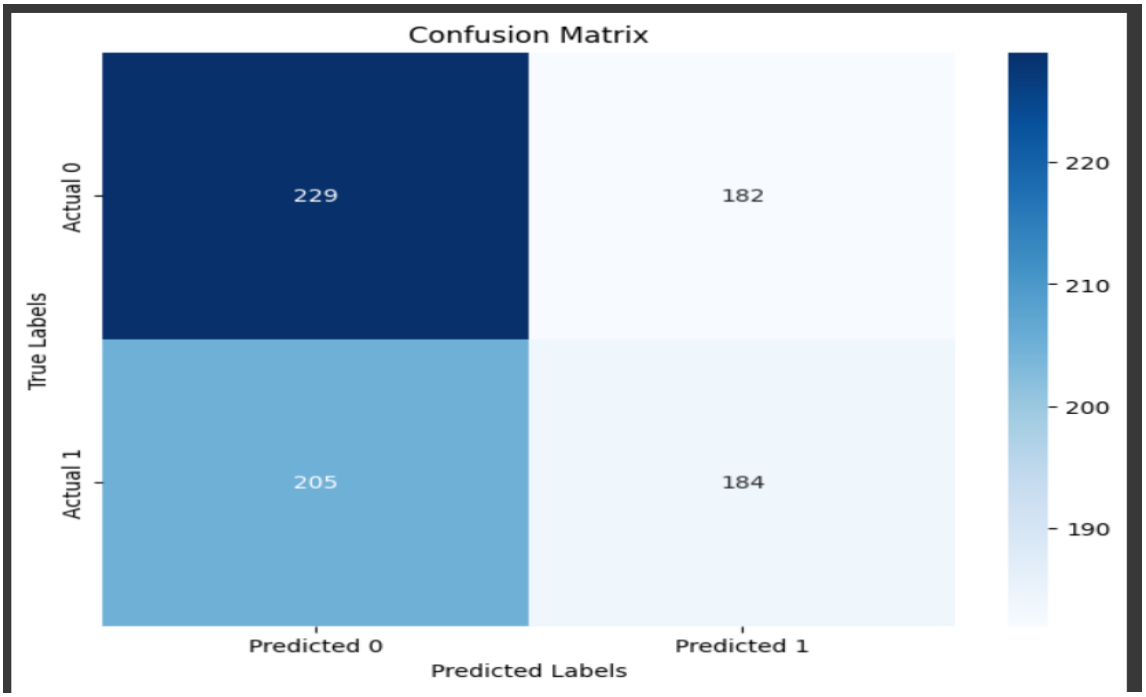
```python
#accuracy score, classification report, classifier matrix
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
print("Accuracy Score",accuracy_score(y_test,y_pred))
print("Classification Report",classification_report(y_test,y_pred))
print("Confusion Matrix",confusion_matrix(y_test,y_pred))
```

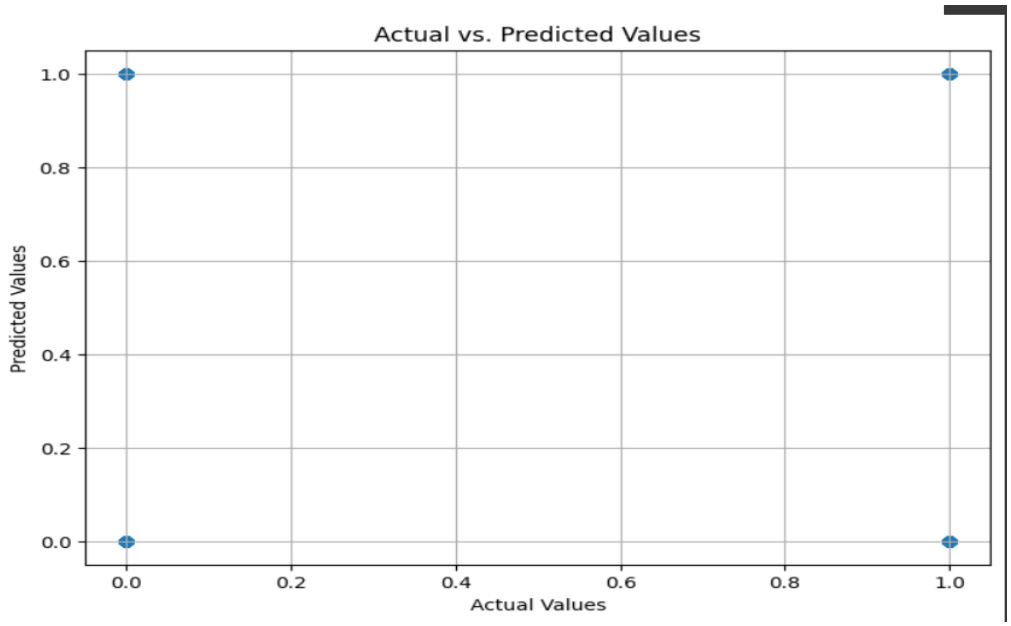
```
Accuracy Score 0.51625
Classification Report              precision    recall  f1-score   support

           0       0.53      0.56      0.54       411
           1       0.50      0.47      0.49       389

    accuracy                           0.52       800
   macro avg       0.52      0.52      0.51       800
weighted avg       0.52      0.52      0.52       800

Confusion Matrix [[229 182]
 [205 184]]
```





12. Deployment

- Platform: Streamlit Cloud.
- Frontend: User inputs a news article or URL.
- Output: Probability and verdict: Real or Fake.
- Sample Output: "Fake News detected with 97% confidence".

13. Source code

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns
```

```
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix
```

 # Load dataset

```
df = pd.read_csv('/content/fake_news_dataset.csv')  # Adjust path if needed
print(df.head())
print(df.isnull().sum())
```

 # Add labels

```
fake['label'] = 0  # Fake
true['label'] = 1  # Real
```

 # Combine and shuffle

```
data = pd.concat([fake, true], axis=0)
data = data.sample(frac=1).reset_index(drop=True)
# Drop missing values
df.dropna(inplace=True)
```

 # Split features and labels

```
X = df['text']

y = df['label']
```

 # Text vectorization using TF-IDF

```
vectorizer = TfidfVectorizer(stop_words='english', max_df=0.7)

X_vect = vectorizer.fit_transform(X)
```

 # Split into train/test

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

#import model

```
from sklearn.model_selection import train_test_split

from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import classification_report, confusion_matrix

x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,

random_state=42)

from sklearn.linear_model import LogisticRegression
```

```
# Logistic Regression model
model = LogisticRegression()
model.fit(X_train, y_train)

# Prediction
y_pred = model.predict(X_test)
print("y_prediction", y_pred)

#Random forest classifier
model = RandomForestClassifier(n_estimators=100, random_state=42)
model.fit(x_train, y_train)
y_random_prediction = model.predict(x_test)
print("y_prediction", y_random_prediction)

# Evaluation
print("Classification Report:\n", classification_report(y_test, y_pred))
print("Confusion Matrix:\n", confusion_matrix(y_test, y_pred))
```

```
# Visualize confusion matrix

sns.heatmap(confusion_matrix(y_test, y_pred), annot=True, fmt='d', cmap='Blues')

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.title("Confusion Matrix")

plt.show()
```

14. Future scope

- Integration with real-time news APIs for live detection
- Multilingual fake news detection
- Use of BERT and transformer-based models for deeper context understanding

15. Team Members and Roles

S.NO	NAMES	ROLES	RESPONSIBILITY
1.	Kamesh.K	Leader	Data collection & cleaning
2.	Kishore kumar.K	Member	Feature engineering
3.	Monishraj.V	Member	Exploratory data analysis (EDA)
4.	Selvan samuvel.A	Member	Model building,model evaluation