Importing Required Libraries

In this step, necessary Python libraries are imported for data handling, text preprocessing, feature extraction, model training, and evaluation.

In [1]:
```
import pandas as pd
import numpy as np
import re

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, classification_report, confusion_mat

import matplotlib.pyplot as plt
import seaborn as sns
import pickle
```

Dataset Loading

The fake news dataset is loaded using the Pandas library. The dataset contains news statements and corresponding labels indicating whether the news is fake or genuine.

In [2]:
```
# Load dataset (update path if needed)
data = pd.read_csv("train.csv")

# Display first 5 rows
data.head()
```

Out[2]:

	Statement	Label
0	Says the Annies List political group supports ...	False
1	When did the decline of coal start? It started...	True
2	Hillary Clinton agrees with John McCain "by vo...	True
3	Health care reform legislation is likely to ma...	False
4	The economic turnaround started at the end of ...	True

In [4]:
```
# Dataset information
data.info()

# Label distribution
data['Label'].value_counts()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10240 entries, 0 to 10239
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   Statement  10240 non-null  object
 1   Label      10240 non-null  bool  
dtypes: bool(1), object(1)
memory usage: 90.1+ KB
```

Out[4]:
```
Label
True     5752
False    4488
Name: count, dtype: int64
```

Text Preprocessing

This step cleans the news text by removing special characters, converting text to lowercase, and eliminating unnecessary spaces. Text preprocessing improves model accuracy.

In [5]:
```
def preprocess_text(text):
    text = re.sub(r'[^a-zA-Z]', ' ', str(text))
    text = text.lower()
    text = text.split()
    text = ' '.join(text)
    return text
```

In [7]:
```
data['clean_text'] = data['Statement'].apply(preprocess_text)
data[['Statement', 'clean_text']].head()
```

Out[7]:

	Statement	clean_text
0	Says the Annies List political group supports ...	says the annies list political group supports ...
1	When did the decline of coal start? It started...	when did the decline of coal start it started ...
2	Hillary Clinton agrees with John McCain "by vo...	hillary clinton agrees with john mccain by vot...
3	Health care reform legislation is likely to ma...	health care reform legislation is likely to ma...
4	The economic turnaround started at the end of ...	the economic turnaround started at the end of ...

Feature Extraction using TF-IDF

TF-IDF (Term Frequency–Inverse Document Frequency) is used to convert textual data into numerical feature vectors based on word importance.

In [9]:
```
tfidf = TfidfVectorizer(stop_words='english', max_df=0.7)

X = tfidf.fit_transform(data['clean_text'])
```

```
y = data['Label']

print("Feature matrix shape:", X.shape)
```

```
Feature matrix shape: (10240, 11318)
```

Model Training

A Logistic Regression model is trained using TF-IDF features to classify news articles as fake or genuine.

In [10]:
```
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)
```

In [11]:
```
model = LogisticRegression(max_iter=1000)
model.fit(X_train, y_train)
```

Out[11]:

▾ LogisticRegression

▶ Parameters

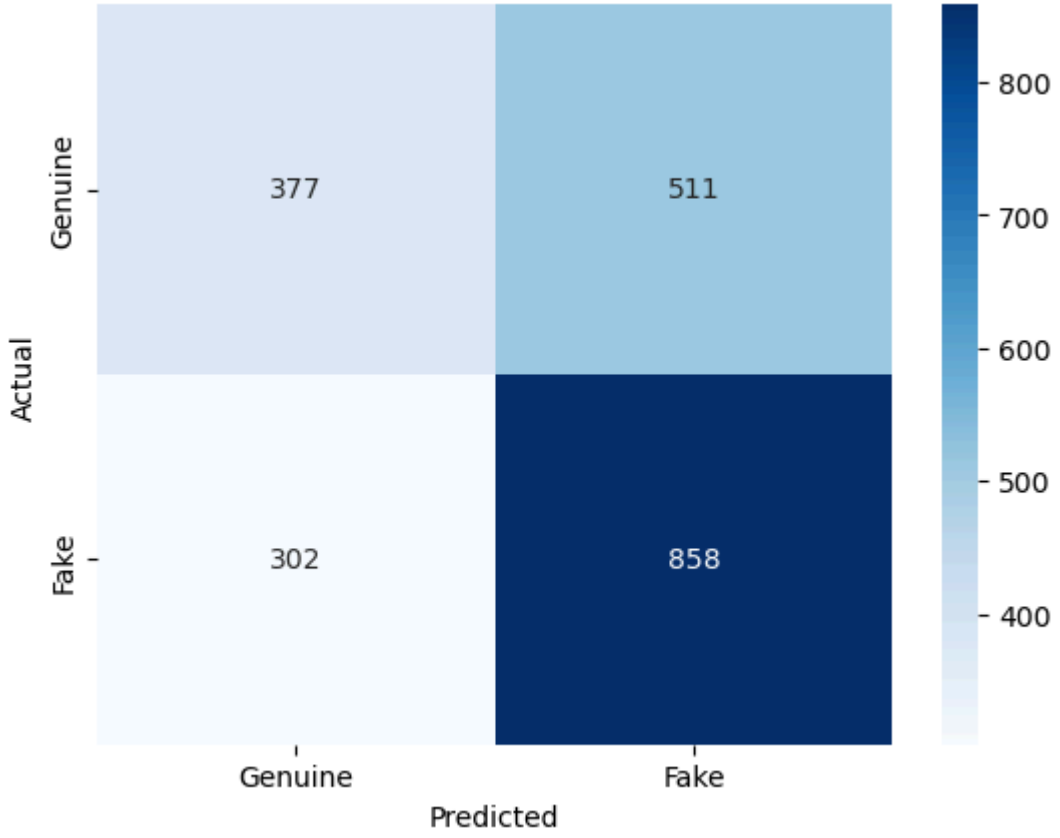
Model Evaluation

The trained model is evaluated using accuracy, precision, recall, F1-score, and confusion matrix to measure classification performance.

In [12]:
```
y_pred = model.predict(X_test)

print("Accuracy:", accuracy_score(y_test, y_pred))
print("\nClassification Report:\n", classification_report(y_test, y_pred))
```

```
Accuracy: 0.60302734375

Classification Report:
              precision    recall  f1-score   support

       False       0.56      0.42      0.48       888
        True       0.63      0.74      0.68      1160

    accuracy                           0.60      2048
   macro avg       0.59      0.58      0.58      2048
weighted avg       0.60      0.60      0.59      2048
```

In [13]:
```
cm = confusion_matrix(y_test, y_pred)

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues',
            xticklabels=['Genuine', 'Fake'],
            yticklabels=['Genuine', 'Fake'])
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.show()
```



Prediction on New Data

The trained model predicts whether a given news statement is fake or genuine based on learned patterns.

In [14]:
```
def predict_news(news_text):
    news_text = preprocess_text(news_text)
    vector = tfidf.transform([news_text])
    prediction = model.predict(vector)
    return "Fake News" if prediction[0] == 1 else "Genuine News"
```

In [15]:
```
sample_news = "Breaking news: Scientists discover a cure for cancer!"
print(predict_news(sample_news))
```

```
Genuine News
```

Saving the Model

The trained model and TF-IDF vectorizer are saved for future use without retraining.

In [16]:
```
with open("final_model.sav", "wb") as model_file:
    pickle.dump(model, model_file)

with open("tfidf_vectorizer.sav", "wb") as vectorizer_file:
    pickle.dump(tfidf, vectorizer_file)

print("Model and Vectorizer saved successfully!")
```

```
Model and Vectorizer saved successfully!
```

In [17]:
```
with open("final_model.sav", "rb") as model_file:
    loaded_model = pickle.load(model_file)

with open("tfidf_vectorizer.sav", "rb") as vectorizer_file:
    loaded_tfidf = pickle.load(vectorizer_file)

test_text = "Government confirms new education policy reforms"
vector = loaded_tfidf.transform([preprocess_text(test_text)])
print("Prediction:", "Fake" if loaded_model.predict(vector)[0] == 1 else "Genuin
```

```
Prediction: Fake
```