Task 4: Machine Learning Model - SMS Spam Detection

This notebook demonstrates how to create a predictive model using scikit-learn to classify text messages as spam or not spam. The dataset used is the SMS Spam Collection dataset, and the model is implemented using the Naive Bayes algorithm.

Step 1: Import Required Libraries

We import necessary libraries for data loading, preprocessing, model training, and evaluation.

In [1]:
```
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 CountVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import accuracy_score, classification_report, confusion_mat
```

Step 2: Load and Explore the Dataset

We load the dataset `spam.csv`, remove unnecessary columns, and examine the data.

In [2]:
```
# Load dataset and clean it
df = pd.read_csv("spam.csv.csv", encoding='latin-1')
df = df[['v1', 'v2']]
df.columns = ['label', 'text']
df.head()
```

Out[2]:

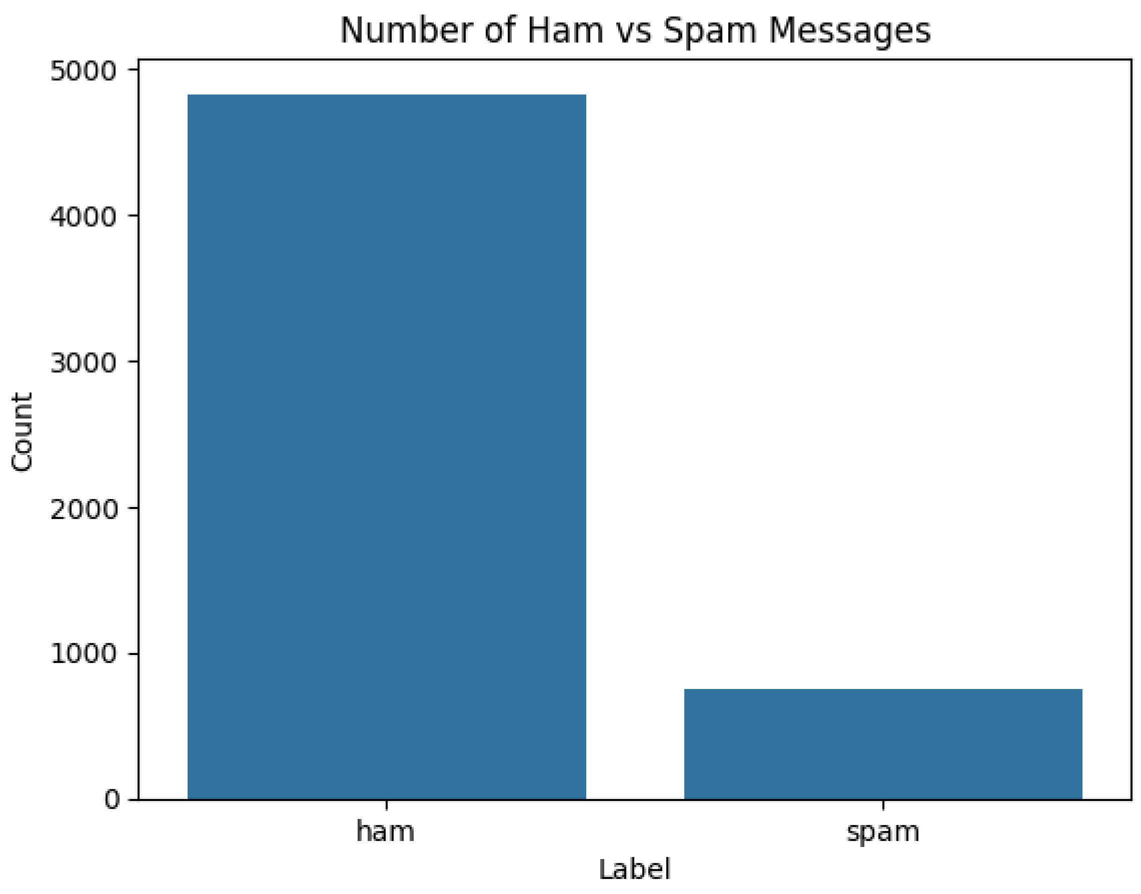
	label	text
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...

Step 3: Visualize Data Distribution

We visualize the number of spam and ham messages in the dataset.

In [3]:
```
# Plot the distribution of classes
sns.countplot(x='label', data=df)
```

```
plt.title('Number of Ham vs Spam Messages')
plt.xlabel('Label')
plt.ylabel('Count')
plt.show()
```



Step 4: Data Preprocessing

Convert the labels to numerical values and split the dataset into training and testing sets.

In [4]:
```
# Convert labels to numeric
df['label'] = df['label'].map({'ham': 0, 'spam': 1})

# Split into training and testing data
X_train, X_test, y_train, y_test = train_test_split(df['text'], df['label'], tes
print(f'Training samples: {len(X_train)}, Testing samples: {len(X_test)}')
```

```
Training samples: 4457, Testing samples: 1115
```

Step 5: Text Vectorization

Use `CountVectorizer` to transform the text data into numerical format for the machine learning model.

In [5]:
```
vectorizer = CountVectorizer()
X_train_vec = vectorizer.fit_transform(X_train)
X_test_vec = vectorizer.transform(X_test)

print(f'Feature matrix shape (training): {X_train_vec.shape}')
```

```
Feature matrix shape (training): (4457, 7735)
```

Step 6: Train the Naive Bayes Model

We train a Naive Bayes classifier using the training data.

In [6]:
```
model = MultinomialNB()
model.fit(X_train_vec, y_train)
```

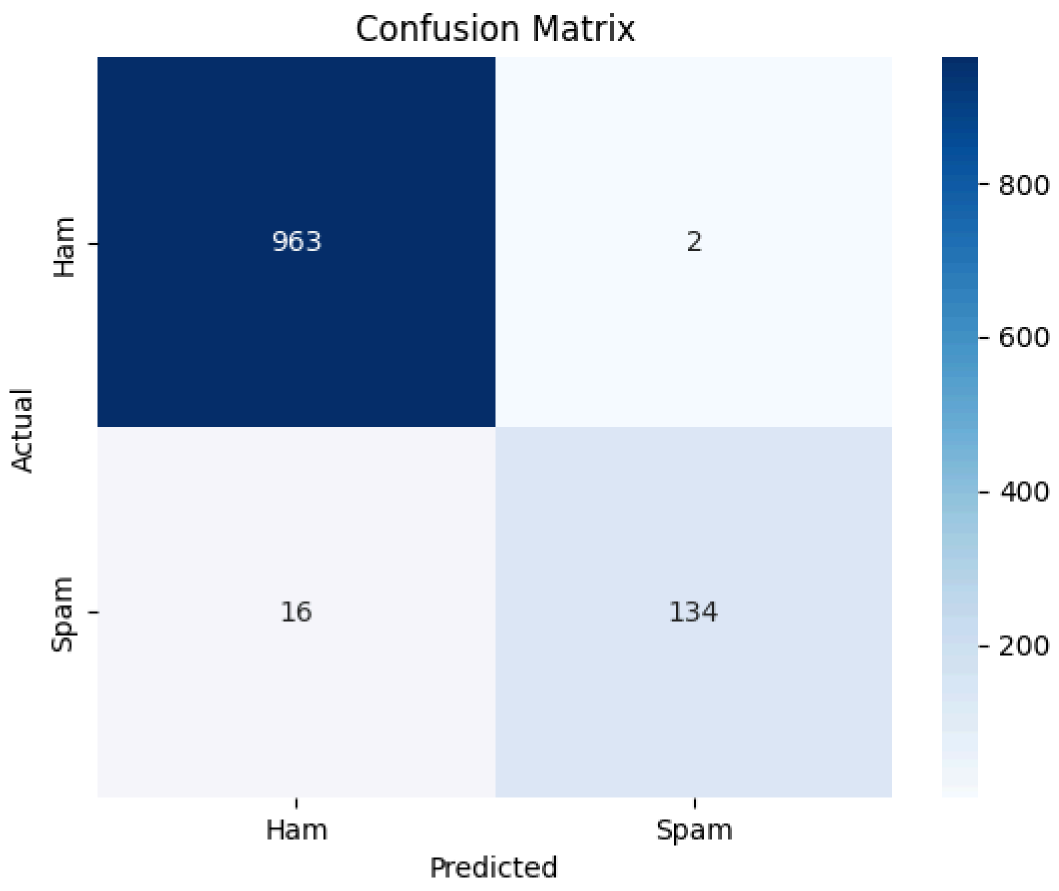
Out[6]:
```
▾ MultinomialNB
MultinomialNB()
```

Step 7: Make Predictions and Evaluate the Model

We evaluate the model using accuracy, classification report, and confusion matrix.

In [7]:
```
# Make predictions
y_pred = model.predict(X_test_vec)

# Accuracy score
acc = accuracy_score(y_test, y_pred)
print("✅ Accuracy:", acc)

# Classification report
print("\n📊 Classification Report:")
print(classification_report(y_test, y_pred))

# Confusion matrix
cm = confusion_matrix(y_test, y_pred)
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=['Ham', 'Spam'],
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```

```
✅ Accuracy: 0.9838565022421525

📊 Classification Report:
              precision    recall  f1-score   support

           0       0.98      1.00      0.99       965
           1       0.99      0.89      0.94       150

    accuracy                           0.98      1115
   macro avg       0.98      0.95      0.96      1115
weighted avg       0.98      0.98      0.98      1115
```



📌 Conclusion

This project successfully implements a spam email detection model using scikit-learn. The dataset was preprocessed, vectorized, and classified using a Naive Bayes classifier. The model achieved high accuracy, and the confusion matrix confirms its performance in detecting spam vs ham messages.