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Data Analysis 2

Task1

Dataset:

Spambase

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Naive Bayes Classifier

1. Data Processing Steps

Loading the Data:

- The dataset was loaded using pandas.

```
import pandas as pd
data = pd.read_csv('/content/spambase.data', header=None)
```

Splitting the Data:

- The dataset was split into features (X) and target (y). In this case, the target variable is assumed to be in the last column.

```
X = data.drop(columns=[57])  # Features
y = data[57]  # Target variable
```

2. Model Choice

Selected Model:

- I used the Multinomial Naive Bayes model for the classification task.

```
from sklearn.naive_bayes import MultinomialNB
nb_classifier = MultinomialNB()
```

Reason for Choice:

- This model is particularly effective for classification problems, especially with text data or count features, which fits well for spam detection.

3. Performance Evaluation

Splitting the Dataset:

- The data was split into training and testing sets using train_test_split().

from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)

Training the Model:

- The model was trained on the training data.

nb_classifier.fit(X_train, y_train)

Making Predictions:

- Predictions were made on the test data.

y_pred = nb_classifier.predict(X_test)

Evaluating Performance:

- We calculated the accuracy and generated a classification report to evaluate the model's performance.

from sklearn.metrics import accuracy_score, classification_report
accuracy = accuracy_score(y_test, y_pred)
classification_report_output = classification_report(y_test, y_pred)
*print(f"Accuracy: {accuracy * 100:.2f}%")*
print("Classification Report:")
print(classification_report_output)

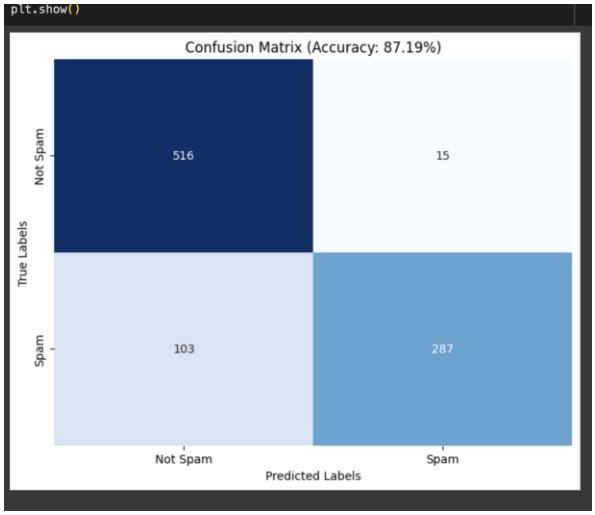
Output :

```
Accuracy: 87.19%
Classification Report:
              precision    recall  f1-score   support

           0       0.83      0.97      0.90       531
           1       0.95      0.74      0.83       390

    accuracy                           0.87       921
   macro avg       0.89      0.85      0.86       921
weighted avg       0.88      0.87      0.87       921
```

4. Confusion Matrix Visualization

- A confusion matrix was generated to visualize the model's performance.

```
from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
conf_matrix = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', cbar=False, xticklabels=['Not Spam', 'Spam'], yticklabels=['Not Spam', 'Spam'])
plt.title(f'Confusion Matrix (Accuracy: {accuracy * 100:.2f}%)')
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.show()
```



5. Conclusion and Future Work

- The model demonstrated a solid performance with an accuracy of approximately87.19%.

To improve the results, We could:

• Experiment with different feature scaling techniques.

• Tune the model’s hyperparameters.

• Gather more data or explore advanced models like Support Vector Machines (SVM).