Classify the email using the binary classification method. Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors for classification. Analyze their performance. Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv

In [16]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import confusion_matrix, accuracy_score
import seaborn as sns
import matplotlib.pyplot as plt
```

In [17]:
```
# Load the dataset
df = pd.read_csv("C:/Users/Atharva/OneDrive/Desktop/LP3 code/emails.csv")
print(df.head())
```

```
  Email No.  the  to  ect  and  for  of    a  you  hou  ...  connevey  jay  \
0   Email 1    0   0    1    0    0   0    2    0    0  ...         0    0
1   Email 2    8  13   24    6    6   2  102    1   27  ...         0    0
2   Email 3    0   0    1    0    0   0    8    0    0  ...         0    0
3   Email 4    0   5   22    0    5   1   51    2   10  ...         0    0
4   Email 5    7   6   17    1    5   2   57    0    9  ...         0    0

   valued  lay  infrastructure  military  allowing  ff  dry  Prediction
0       0    0               0         0         0   0    0           0
1       0    0               0         0         0   1    0           0
2       0    0               0         0         0   0    0           0
3       0    0               0         0         0   0    0           0
4       0    0               0         0         0   1    0           0

[5 rows x 3002 columns]
```

In [18]:
```
# Drop the 'Email No.' column as it's just an identifier
X = df.drop(columns=['Email No.', 'Prediction'])  # Drop 'Email No.' and 'Prediction' columns
y = df['Prediction']  # 'Prediction' column is the target (spam = 1, not spam = 0)
```

In [19]:
```
# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

In [20]:
```
# Normalize the data (standardize the features for better performance with KNN)
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

In [21]:
```
# Initialize and train the KNN model
knn = KNeighborsClassifier(n_neighbors=5)  # You can adjust 'n_neighbors' as needed
knn.fit(X_train, y_train)
```

Out[21]:
```
▾ KNeighborsClassifier
KNeighborsClassifier()
```

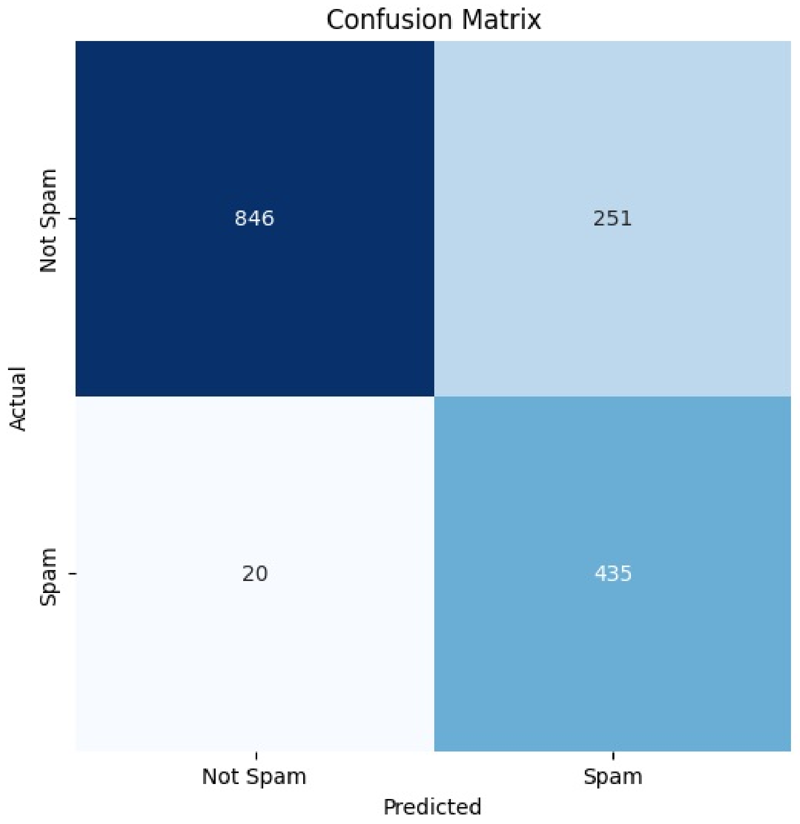
In [22]:
```
# Make predictions on the test set
y_pred = knn.predict(X_test)
```

In [23]:
```
# Calculate and print performance metrics
conf_matrix = confusion_matrix(y_test, y_pred)
accuracy = accuracy_score(y_test, y_pred)
```

In [24]:
```
# Display results
print(f"Confusion Matrix:\n{conf_matrix}")
print(f"Accuracy: {accuracy:.2f}")
```

```
Confusion Matrix:
[[846 251]
 [ 20 435]]
Accuracy: 0.83
```

In [25]:
```
# Visualization of the confusion matrix using Seaborn
plt.figure(figsize=(6, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', cbar=False,
            xticklabels=['Not Spam', 'Spam'], yticklabels=['Not Spam', 'Spam'])
plt.title("Confusion Matrix")
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```



In [ ]:

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