In [ ]:

```
# Importing the required libraries
import string
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# NLP libraries
import nltk
from nltk.corpus import stopwords
nltk.download('stopwords')
from sklearn.feature_extraction.text import CountVectorizer, TfidfTransformer

# Importing train_test_split
from sklearn.model_selection import train_test_split

# ML Algo
from sklearn.naive_bayes import MultinomialNB

# Validation Metrics
from sklearn.metrics import ConfusionMatrixDisplay, classification_report
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
```

In [ ]:

```
# Importing the data
data = pd.read_csv('/content/sms_spam.csv')
data.head()
```

Out[ ]:

	type	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...

In [ ]:

```
# data dimension
print(f"the data has {data.shape[0]} rows and {data.shape[1]} columns")
```

```
the data has 5574 rows and 2 columns
```

In [ ]:

```
# data distribution
round(data['type'].value_counts(normalize=True)*100, 1)
```

Out[ ]:

	proportion
type	
ham	86.6
spam	13.4

dtype: float64

In [ ]:

```
# Statistical nature of the text columns
data.describe()
```

Out[ ]:

	type	text
count	5574	5574
unique	2	5160
top	ham	Sorry, I'll call later
freq	4827	30

In [ ]:

```
# Statistical summary of the data WRT target
data.groupby('type').describe()
```

Out[ ]:

	text			
	count	**unique**	**top**	**freq**
type				
ham	4827	4518	Sorry, I'll call later	30
spam	747	642	Please call our customer service representativ...	4

In [ ]:

```
# creating a length column to understand more about text
data['length'] = data['text'].apply(len)
data.head()
```

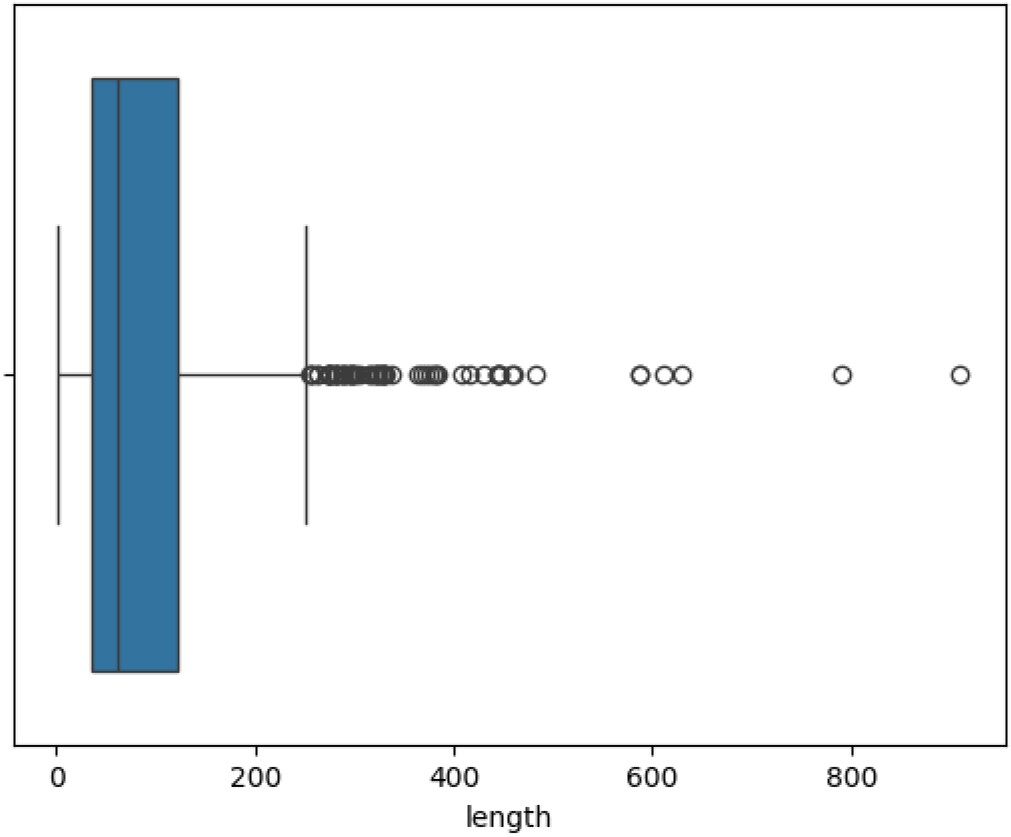
Out[ ]:

	type	text	length
0	ham	Go until jurong point, crazy.. Available only ...	111
1	ham	Ok lar... Joking wif u oni...	29
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155
3	ham	U dun say so early hor... U c already then say...	49
4	ham	Nah I don't think he goes to usf, he lives aro...	61

In [ ]:

```
# Distribution of text messages
```

```
sns.boxplot(data['length'], orient='h')
plt.show()
```



In [ ]:

```
# statistics of message length
data['length'].describe()
```

Out[ ]:

	length
count	5574.000000
mean	80.444923
std	59.841828
min	2.000000
25%	36.000000
50%	61.000000
75%	122.000000
max	910.000000

dtype: float64

In [ ]:

```
# understanding the lengthy message
data[data['length'] == data['length'].max()]['text'].iloc[0]
```

Out[ ]:

```
"For me the love should start with attraction.i should feel that I need her e
very time around me.she should be the first thing which comes in my thought
s.I would start the day and end it with her.she should be there every time I
dream.love will be then when my every breath has her name.my life should happ
en around her.my life will be named to her.I would cry for her.will give all
my happiness and take all her sorrows.I will be ready to fight with anyone fo
r her.I will be in love when I will be doing the craziest things for her.love
will be when I don't have to proove anyone that my girl is the most beautiful
lady on the whole planet.I will always be singing praises for her.love will b
e when I start up making chicken curry and end up makiing sambar.life will be
the most beautiful then.will get every morning and thank god for the day beca
use she is with me.I would like to say a lot..will tell later.."
```

In [ ]:

```
# understanding the shortest message
data[data['length'] == data['length'].min()]['text'].value_counts()
```

Out[ ]:

	count
text	
Ok	4
:)	1

dtype: int64

In [ ]:

```
# Creating a function to remove punctuations and stopwords form the message
def text_process(mess):
  # Getting all the words and from messages and removing punctuations
  no_punc = [letter for letter in mess if letter not in string.punctuation]
  # Joining all the words back
  out_mess = ''.join(no_punc)
  # Removing the stopword from the messages and returning it in list
  return [word for word in out_mess.split() if word.lower() not in stopwords.w
```

In [ ]:

```
# Let's look at the working of the function
print('Sample data before applying the function:\n', data['text'].head())
# THIS LINE OF CODE IS NOT MODIFYING THE RAW DATA
print('\nSample data after applying the function:\n', data['text'].head().appl
Sample data before applying the function:
 0    Go until jurong point, crazy.. Available only ...
1                         Ok lar... Joking wif u oni...
2    Free entry in 2 a wkly comp to win FA Cup fina...
3    U dun say so early hor... U c already then say...
4    Nah I don't think he goes to usf, he lives aro...
Name: text, dtype: object

Sample data after applying the function:
 0    [Go, jurong, point, crazy, Available, bugis, n...
1                        [Ok, lar, Joking, wif, u, oni]
2    [Free, entry, 2, wkly, comp, win, FA, Cup, fin...
3        [U, dun, say, early, hor, U, c, already, say]
4    [Nah, dont, think, goes, usf, lives, around, t...
Name: text, dtype: object
```

In [ ]:
```
# Spliting the data into X (Fratures) and y (Output)
X = data['text']
y = data['type']


# Train/Test split (80%/20%)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, strat
```

In [ ]:
```
# Word Embedding

bow = CountVectorizer(analyzer=text_process)

X_train_bow = bow.fit_transform(X_train)
X_test_bow = bow.transform(X_test)
```

In [ ]:
```
tfidf = TfidfTransformer()

X_train_tfidf = tfidf.fit_transform(X_train_bow)
X_test_tfidf = tfidf.transform(X_test_bow)
```

In [ ]:
```
# ML Algorithm - Naive Bayes Classifier
nb_model = MultinomialNB(alpha=0.5)
nb_model.fit(X_train_tfidf, y_train)
```

Out[ ]:
```
▾ MultinomialNB
MultinomialNB(alpha=0.5)
```

In [ ]:
```
# Prediction
y_pred = nb_model.predict(X_test_tfidf)
y_pred
```

Out[ ]:
```
array(['ham', 'ham', 'ham', ..., 'ham', 'ham', 'spam'], dtype='<U4')
```

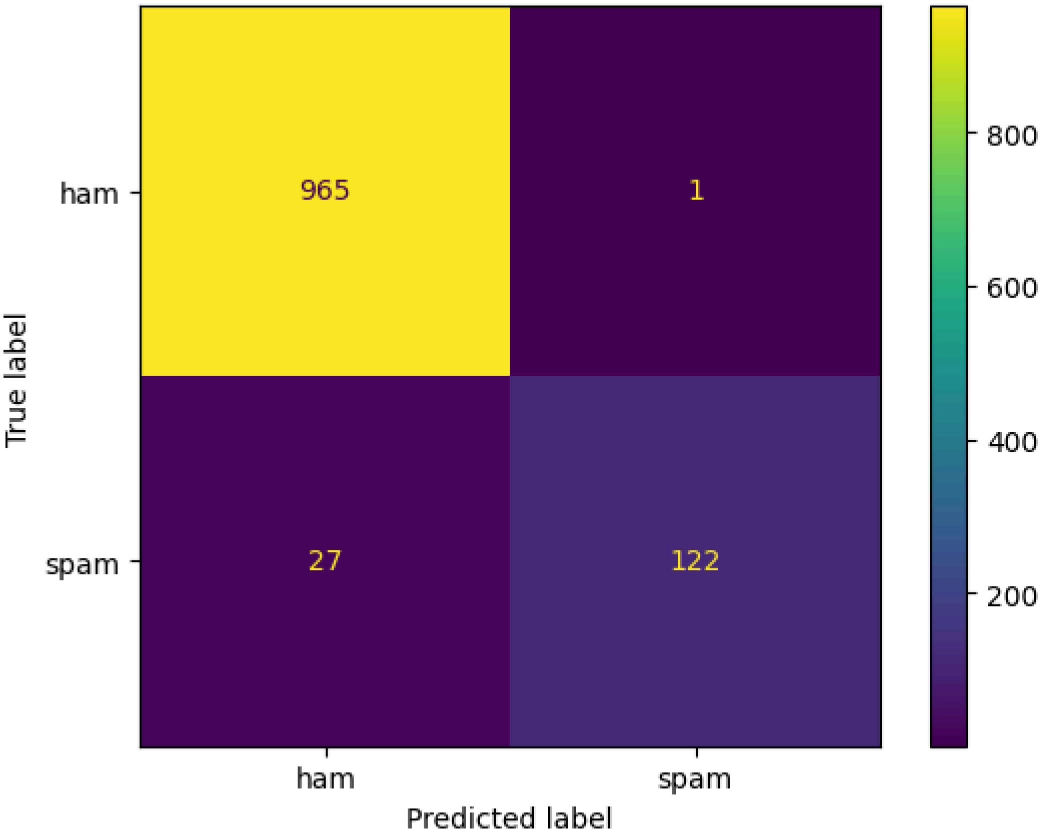
In [ ]:
```
# Metric comparision
```

```
cm = ConfusionMatrixDisplay.from_predictions(y_test, y_pred)
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

         ham       0.97      1.00      0.99       966
        spam       0.99      0.82      0.90       149

    accuracy                           0.97      1115
   macro avg       0.98      0.91      0.94      1115
weighted avg       0.98      0.97      0.97      1115
```



Final Project Conclusion

This project focused on building a text-based spam detection system using classical **Natural Language Processing techniques** and a **Multinomial Naive Bayes classifier**. Due to a significant class imbalance in the dataset, spam messages only made up a small portion of the total samples. This meant that recall for the spam class was more important than overall accuracy as an evaluation goal.

The final model achieved strong overall accuracy while maintaining a reasonable balance between precision and recall for spam detection, demonstrating that Naive

Bayes remains an effective baseline for text classification tasks when evaluated correctly.

Overall, this project demonstrates the effectiveness of classical NLP techniques for spam detection.

In [ ]: