EXPERIMENT-5

AIM:

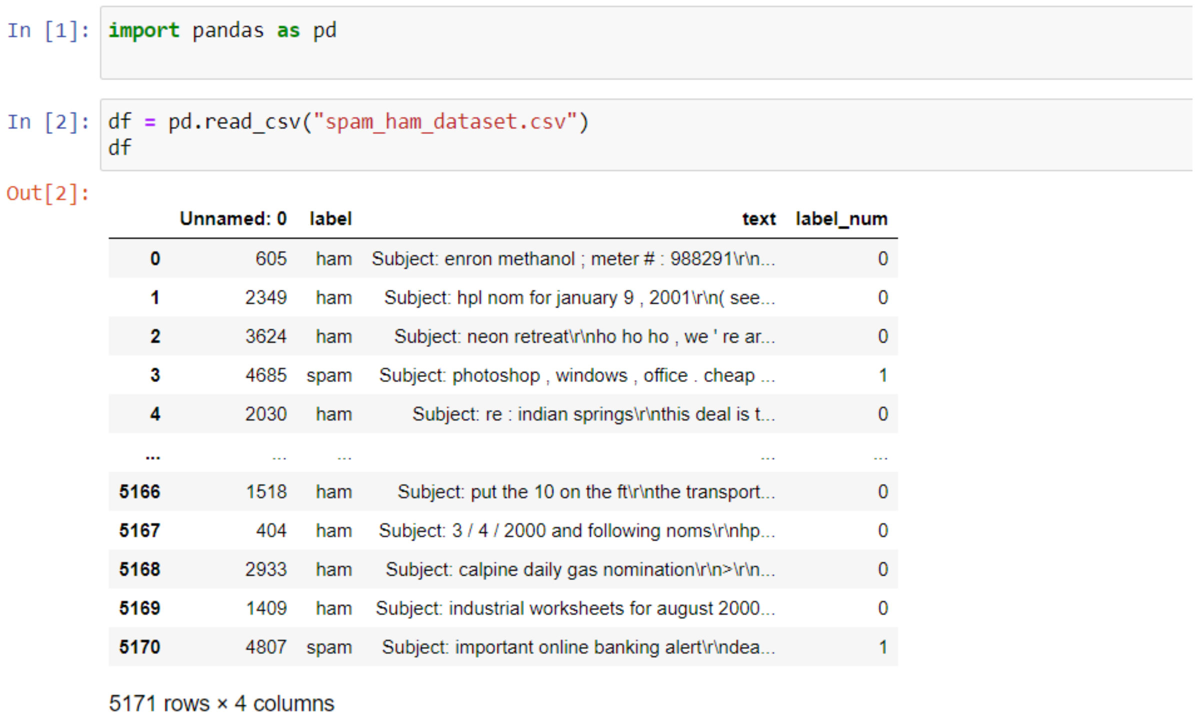
Study and implement the Multinomial Naive Bayes on spam ham dataset

ALGORITHM:

1. In the first step, feature engineering, we focus on extracting features of text. We need numerical features as input for our classifier.
2. In the non-naive Bayes way, we look at sentences in entirety, thus once the sentence does not show up in the training set, we will get a zero probability, making it difficult for further calculations.
3. In the final step, we are good to go : simply calculating the probabilities and compare which has a higher probability

PROGRAM CODE SNIPPET:

LOADING DATA SET:



```
In [1]: import pandas as pd
```

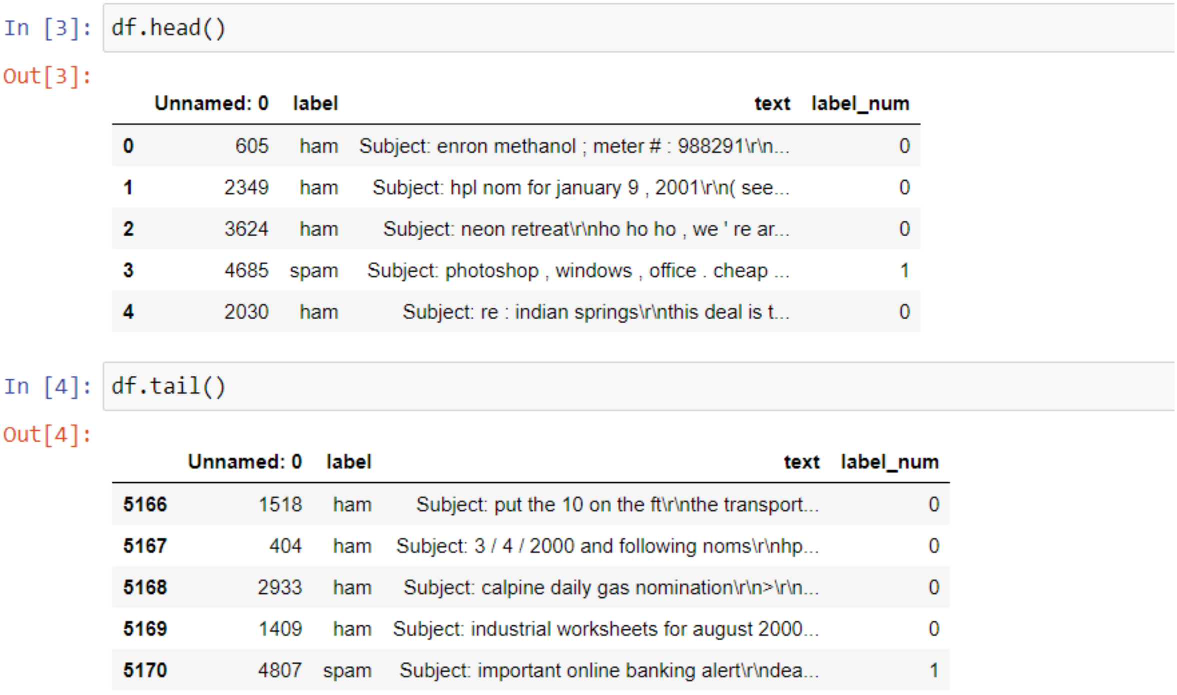
```
In [2]: df = pd.read_csv("spam_ham_dataset.csv")
        df
```

Out[2]:

	Unnamed: 0	label	text	label_num
0	605	ham	Subject: enron methanol ; meter # : 988291\r\n...	0
1	2349	ham	Subject: hpl nom for january 9 , 2001\r\n(see...	0
2	3624	ham	Subject: neon retreat\r\nho ho ho , we ' re ar...	0
3	4685	spam	Subject: photoshop , windows , office . cheap ...	1
4	2030	ham	Subject: re : indian springs\r\nthis deal is t...	0
...	...	...	...	...
5166	1518	ham	Subject: put the 10 on the ft\r\nthe transport...	0
5167	404	ham	Subject: 3 / 4 / 2000 and following noms\r\nhp...	0
5168	2933	ham	Subject: calpine daily gas nomination\r\n>\r\n...	0
5169	1409	ham	Subject: industrial worksheets for august 2000...	0
5170	4807	spam	Subject: important online banking alert\r\ndea...	1

5171 rows × 4 columns

PREPROCESSING:



```
In [3]: df.head()
```

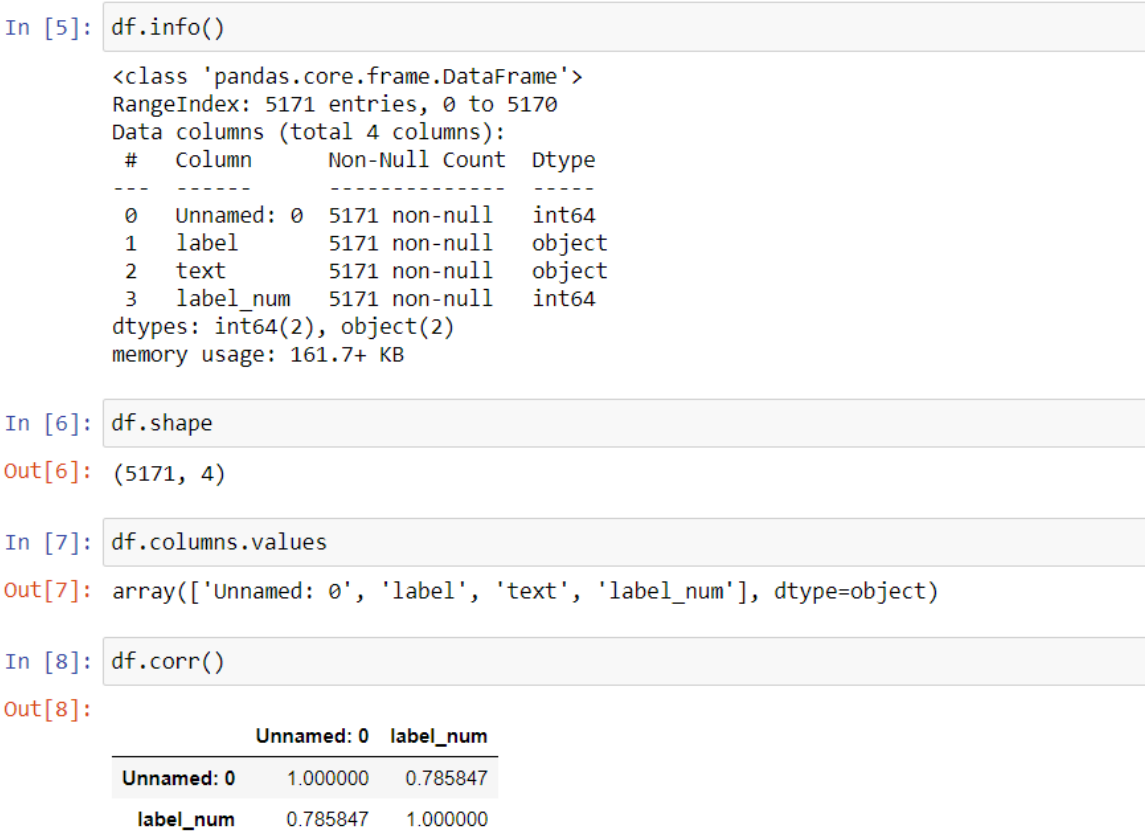
Out[3]:

	Unnamed: 0	label	text	label_num
0	605	ham	Subject: enron methanol ; meter # : 988291\r\n...	0
1	2349	ham	Subject: hpl nom for january 9 , 2001\r\n(see...	0
2	3624	ham	Subject: neon retreat\r\nho ho ho , we ' re ar...	0
3	4685	spam	Subject: photoshop , windows , office . cheap ...	1
4	2030	ham	Subject: re : indian springs\r\nthis deal is t...	0

```
In [4]: df.tail()
```

Out[4]:

	Unnamed: 0	label	text	label_num
5166	1518	ham	Subject: put the 10 on the ft\r\nthe transport...	0
5167	404	ham	Subject: 3 / 4 / 2000 and following noms\r\nhp...	0
5168	2933	ham	Subject: calpine daily gas nomination\r\n>\r\n...	0
5169	1409	ham	Subject: industrial worksheets for august 2000...	0
5170	4807	spam	Subject: important online banking alert\r\ndea...	1



```
In [5]: df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5171 entries, 0 to 5170
Data columns (total 4 columns):
 #   Column      Non-Null Count  Dtype 
---  ------      --------------  ----- 
 0   Unnamed: 0  5171 non-null   int64 
 1   label       5171 non-null   object
 2   text        5171 non-null   object
 3   label_num   5171 non-null   int64 
dtypes: int64(2), object(2)
memory usage: 161.7+ KB
```

```
In [6]: df.shape

Out[6]: (5171, 4)
```

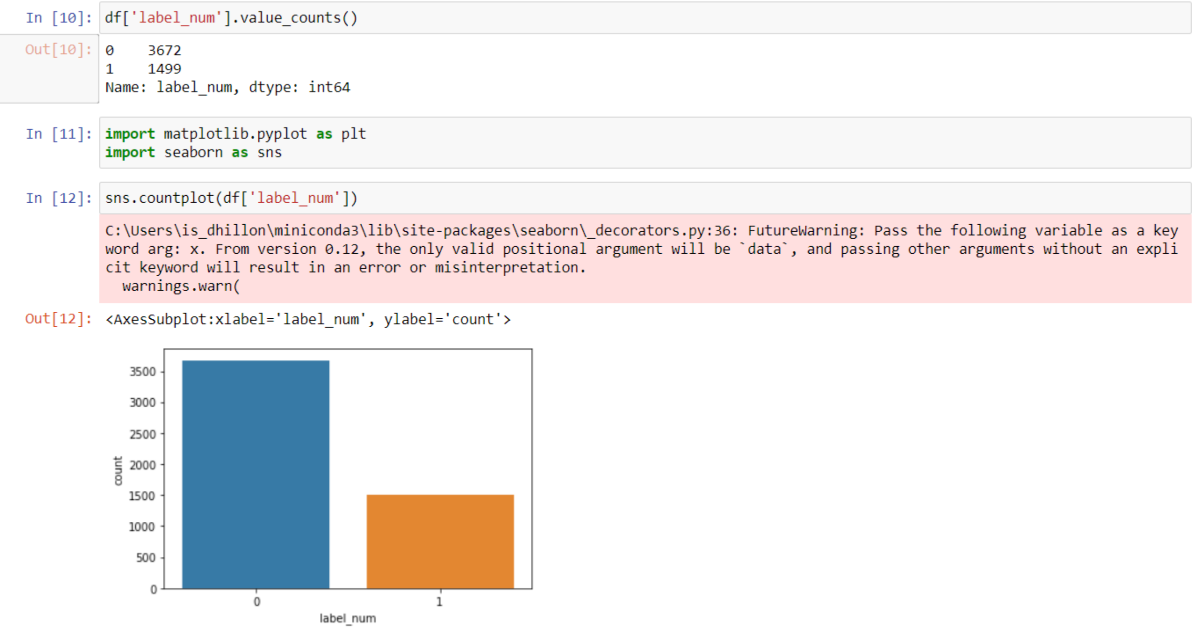
```
In [7]: df.columns.values

Out[7]: array(['Unnamed: 0', 'label', 'text', 'label_num'], dtype=object)
```

```
In [8]: df.corr()
```

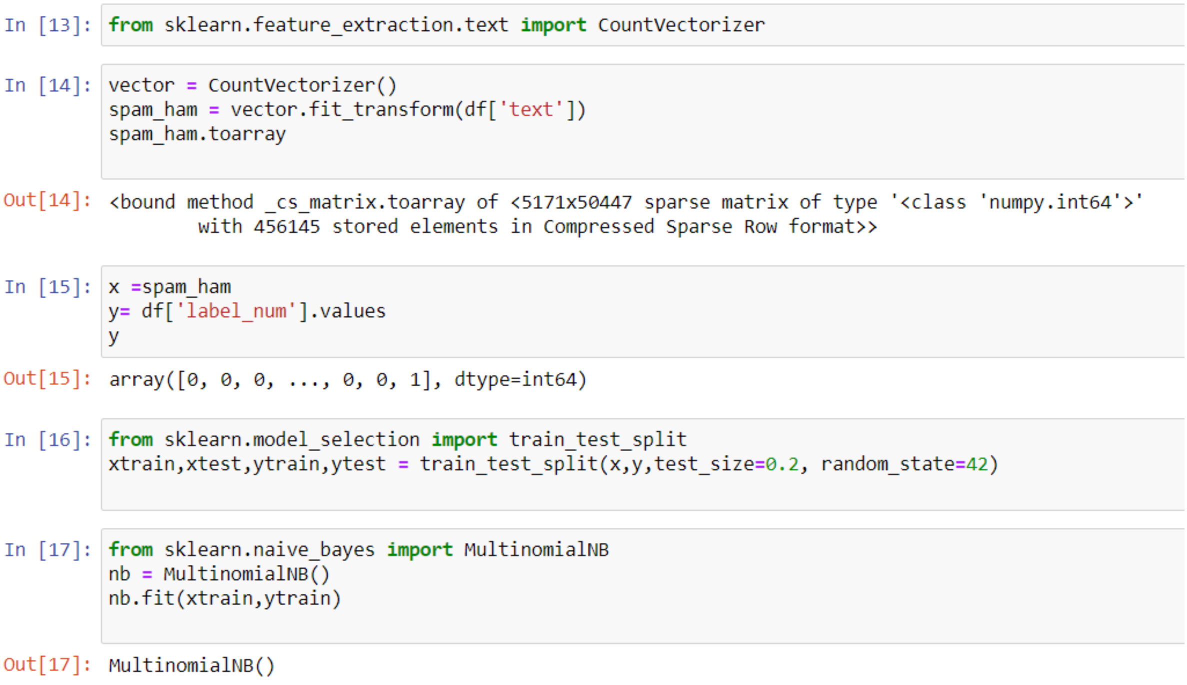
Out[8]:

	Unnamed: 0	label_num
Unnamed: 0	1.000000	0.785847
label_num	0.785847	1.000000

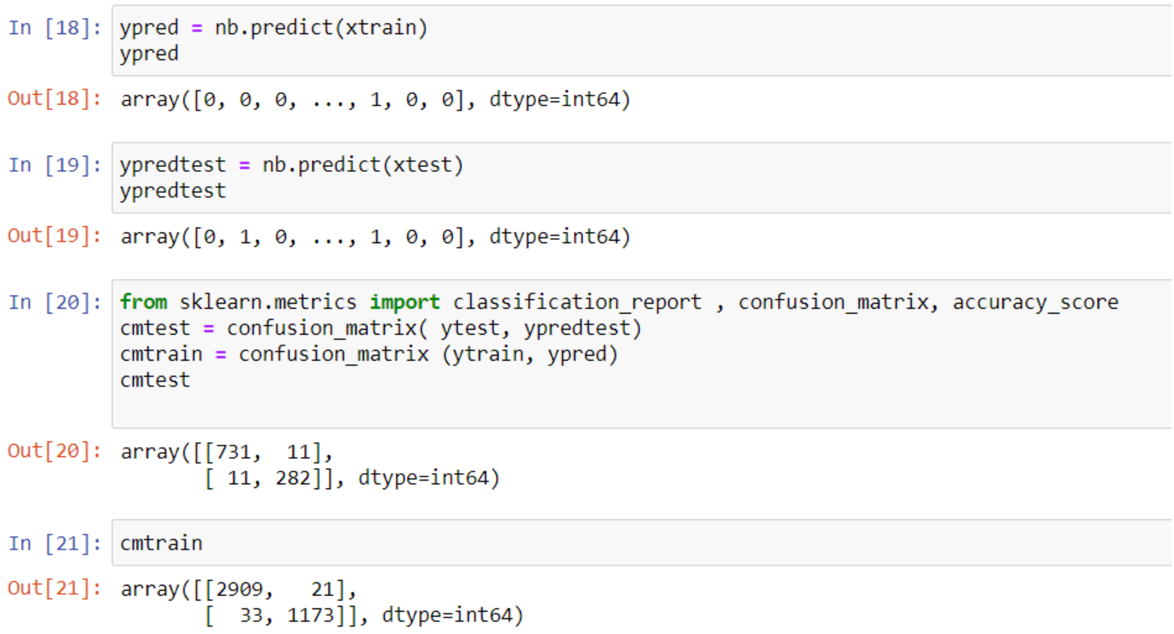
VISUALIZATION:



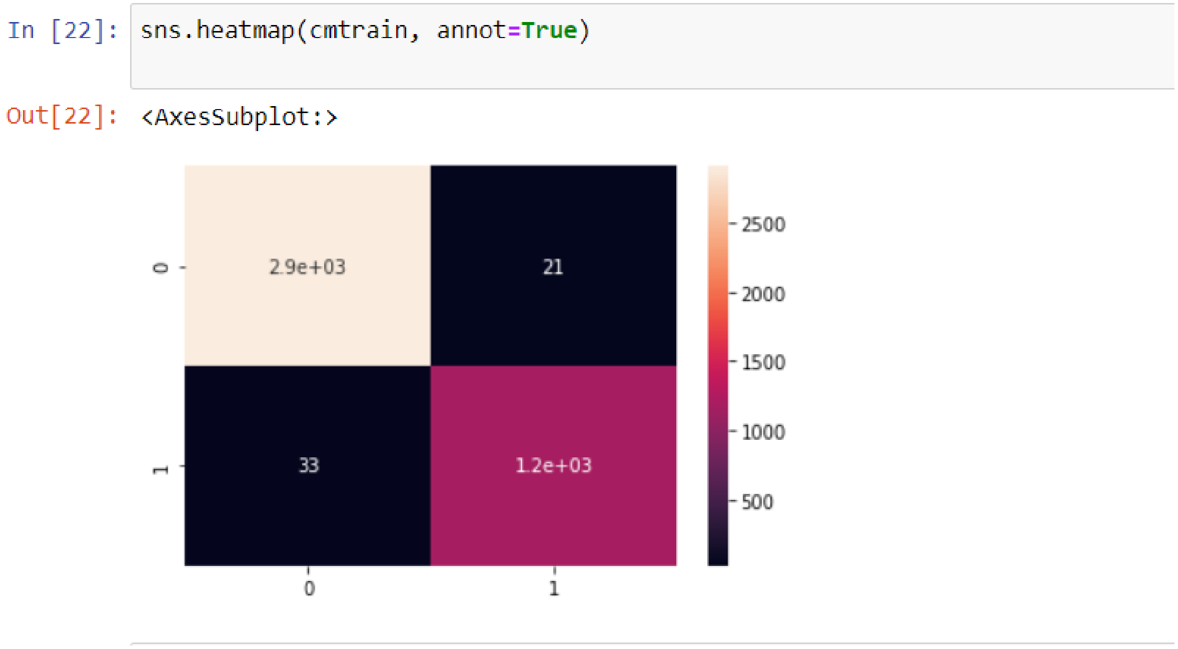
```
In [10]: df['label_num'].value_counts()

Out[10]: 0    3672
         1    1499
         Name: label_num, dtype: int64

In [11]: import matplotlib.pyplot as plt
         import seaborn as sns

In [12]: sns.countplot(df['label_num'])

         C:\Users\is_dhillon\miniconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a key
         word arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an expli
         cit keyword will result in an error or misinterpretation.
           warnings.warn(

Out[12]: <AxesSubplot:xlabel='label_num', ylabel='count'>
```



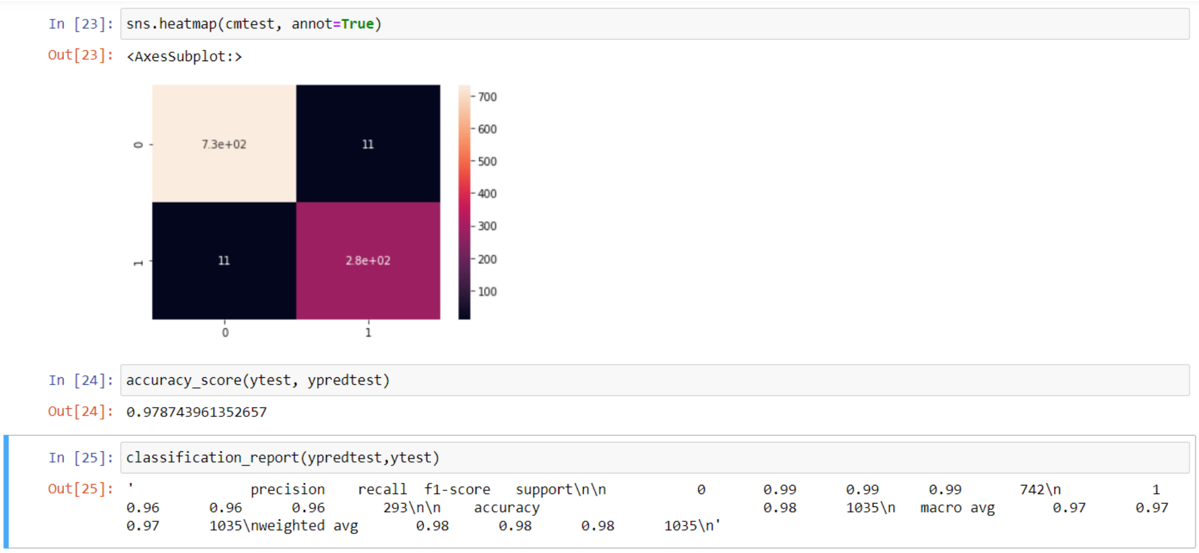
```
In [13]: from sklearn.feature_extraction.text import CountVectorizer

In [14]: vector = CountVectorizer()
         spam_ham = vector.fit_transform(df['text'])
         spam_ham.toarray

Out[14]: <bound method _cs_matrix.toarray of <5171x50447 sparse matrix of type '<class 'numpy.int64'>'
                 with 456145 stored elements in Compressed Sparse Row format>>

In [15]: x =spam_ham
         y= df['label_num'].values
         y

Out[15]: array([0, 0, 0, ..., 0, 0, 1], dtype=int64)

In [16]: from sklearn.model_selection import train_test_split
         xtrain,xtest,ytrain,ytest = train_test_split(x,y,test_size=0.2, random_state=42)

In [17]: from sklearn.naive_bayes import MultinomialNB
         nb = MultinomialNB()
         nb.fit(xtrain,ytrain)

Out[17]: MultinomialNB()
```



```
In [18]: ypred = nb.predict(xtrain)
         ypred

Out[18]: array([0, 0, 0, ..., 1, 0, 0], dtype=int64)

In [19]: ypredtest = nb.predict(xtest)
         ypredtest

Out[19]: array([0, 1, 0, ..., 1, 0, 0], dtype=int64)

In [20]: from sklearn.metrics import classification_report , confusion_matrix, accuracy_score
         cmtest = confusion_matrix( ytest, ypredtest)
         cmtrain = confusion_matrix (ytrain, ypred)
         cmtest

Out[20]: array([[731,  11],
                [ 11, 282]], dtype=int64)

In [21]: cmtrain

Out[21]: array([[2909,   21],
                [  33, 1173]], dtype=int64)
```



```
In [22]: sns.heatmap(cmtrain, annot=True)

Out[22]: <AxesSubplot:>
```



```
In [23]: sns.heatmap(cmtest, annot=True)
Out[23]: <AxesSubplot:>
```

```
In [24]: accuracy_score(ytest, ypredtest)
Out[24]: 0.978743961352657

In [25]: classification_report(ypredtest,ytest)
Out[25]: '              precision    recall  f1-score   support\n\n           0       0.99      0.99      0.99       742\n           1
         0.96      0.96      0.96       293\n\n    accuracy                           0.98      1035\n   macro avg       0.97      0.97
         0.97      1035\nweighted avg       0.98      0.98      0.98      1035\n'
```

GITHUB LINK:

https://github.com/AkSingh03/MACHINE_LEARNING