Machine Learning Lab program 5

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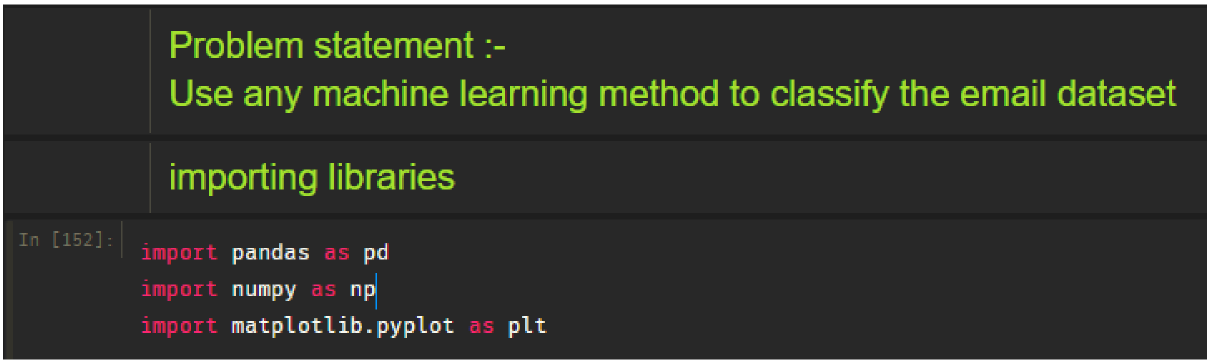
AIM: Use any machine learning method to classify the email dataset

GitHub Link: - https://github.com/pranshuag9/machine-learning-lab/blob/main/lab6/Classify%20email%20dataset.ipynb

Program Snippets: -

1. Importing Modules

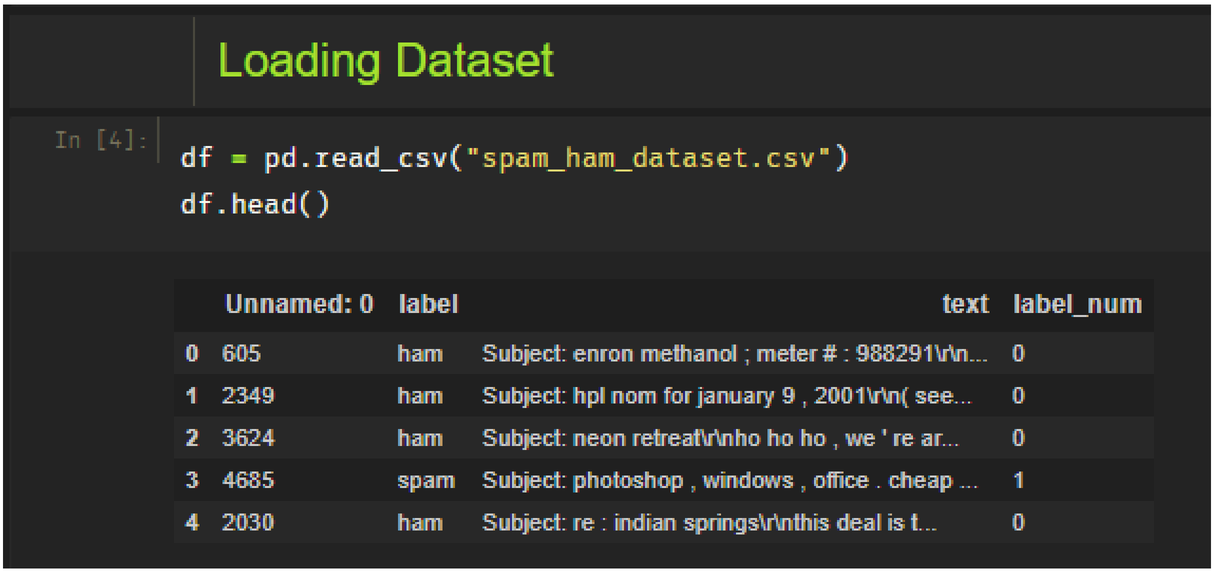


Problem statement :-
Use any machine learning method to classify the email dataset

importing libraries

```
In [152]:
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

2. Loading dataset: -

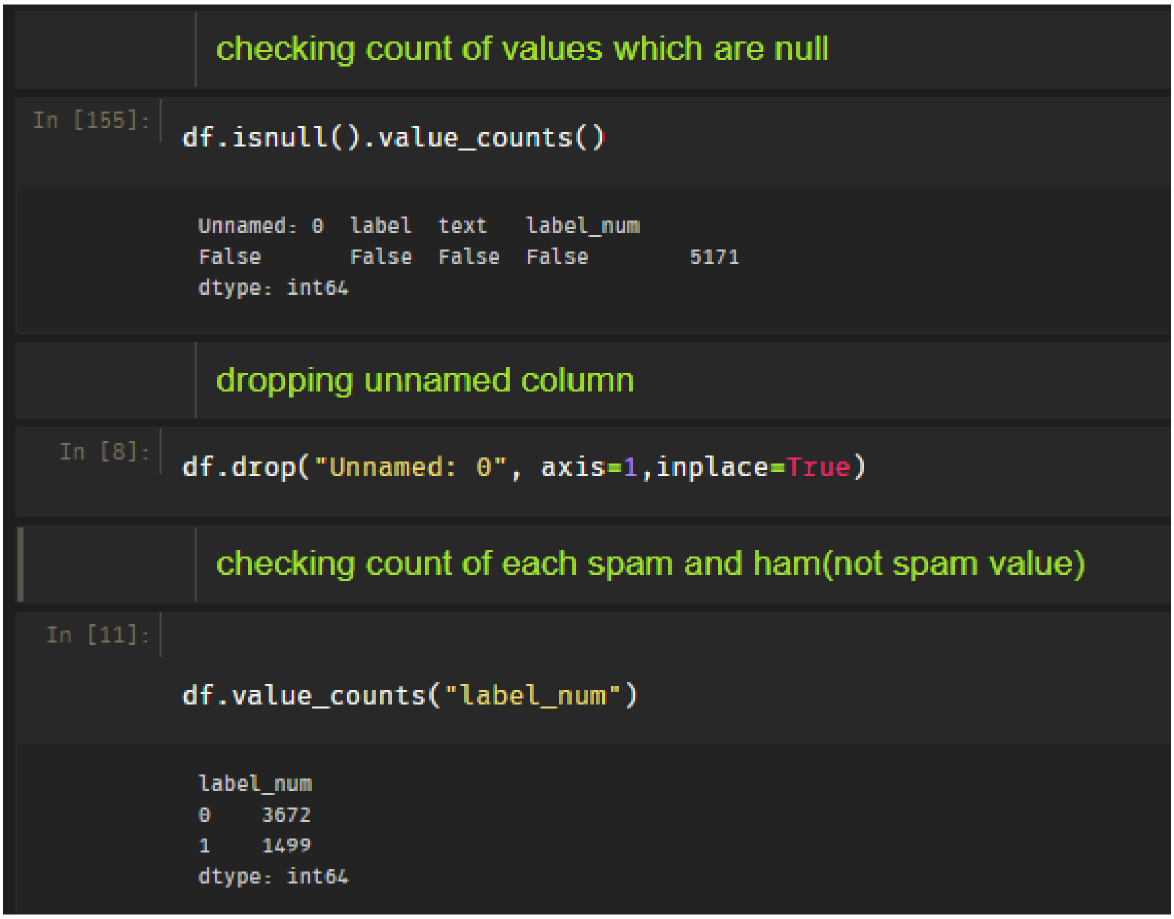


Loading Dataset

```
In [4]:
df = pd.read_csv("spam_ham_dataset.csv")
df.head()
```

	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

3. Data Cleaning/ Preprocessing



checking count of values which are null

```
In [155]: df.isnull().value_counts()
```

```
Unnamed: 0  label  text   label_num
False       False  False  False        5171
dtype: int64
```

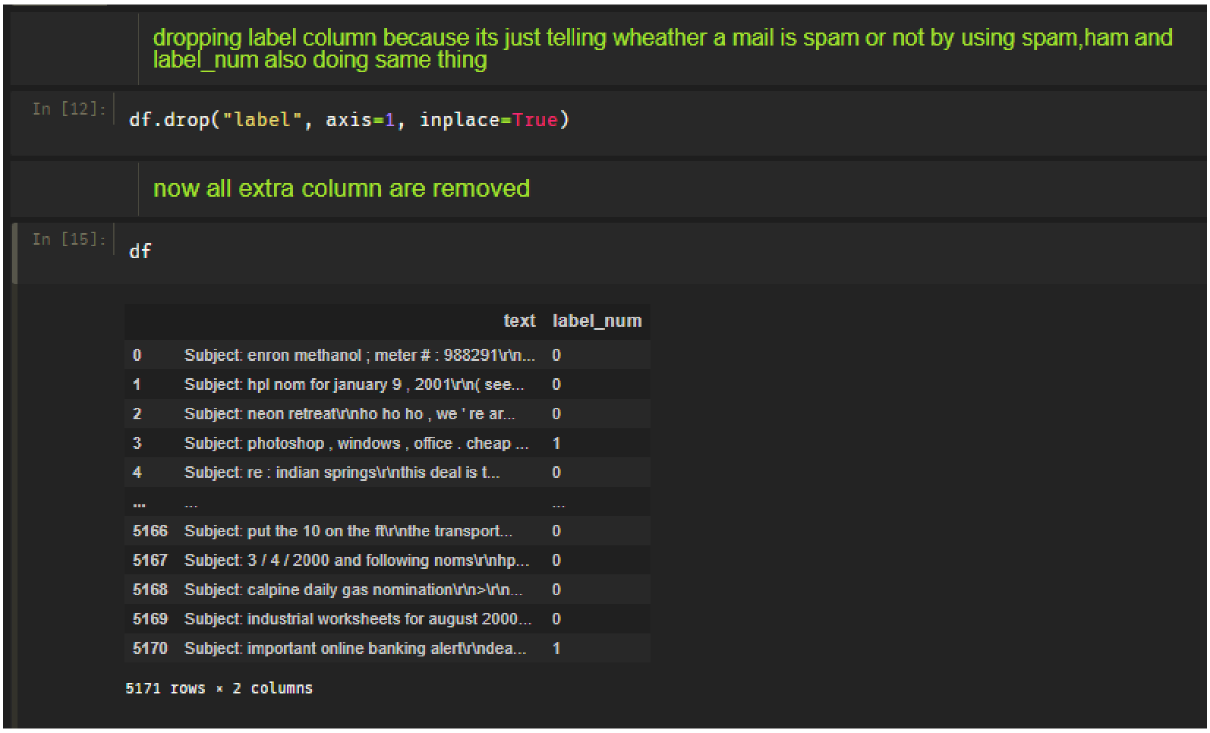
dropping unnamed column

```
In [8]: df.drop("Unnamed: 0", axis=1,inplace=True)
```

checking count of each spam and ham(not spam value)

```
In [11]: df.value_counts("label_num")
```

```
label_num
0    3672
1    1499
dtype: int64
```



dropping label column because its just telling wheather a mail is spam or not by using spam,ham and label_num also doing same thing

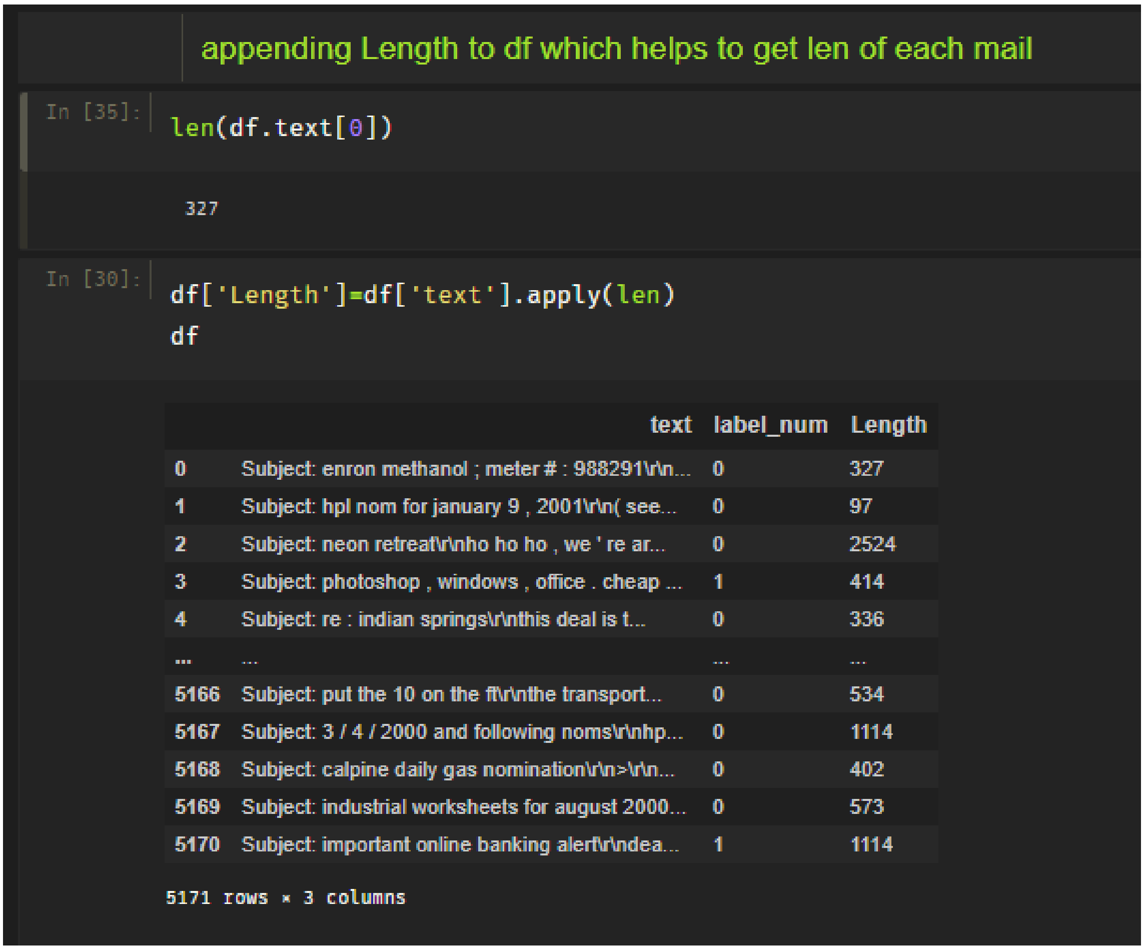
```
In [12]: df.drop("label", axis=1, inplace=True)
```

now all extra column are removed

```
In [15]: df
```

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

5171 rows × 2 columns



appending Length to df which helps to get len of each mail

In [35]:

```
len(df.text[0])
```

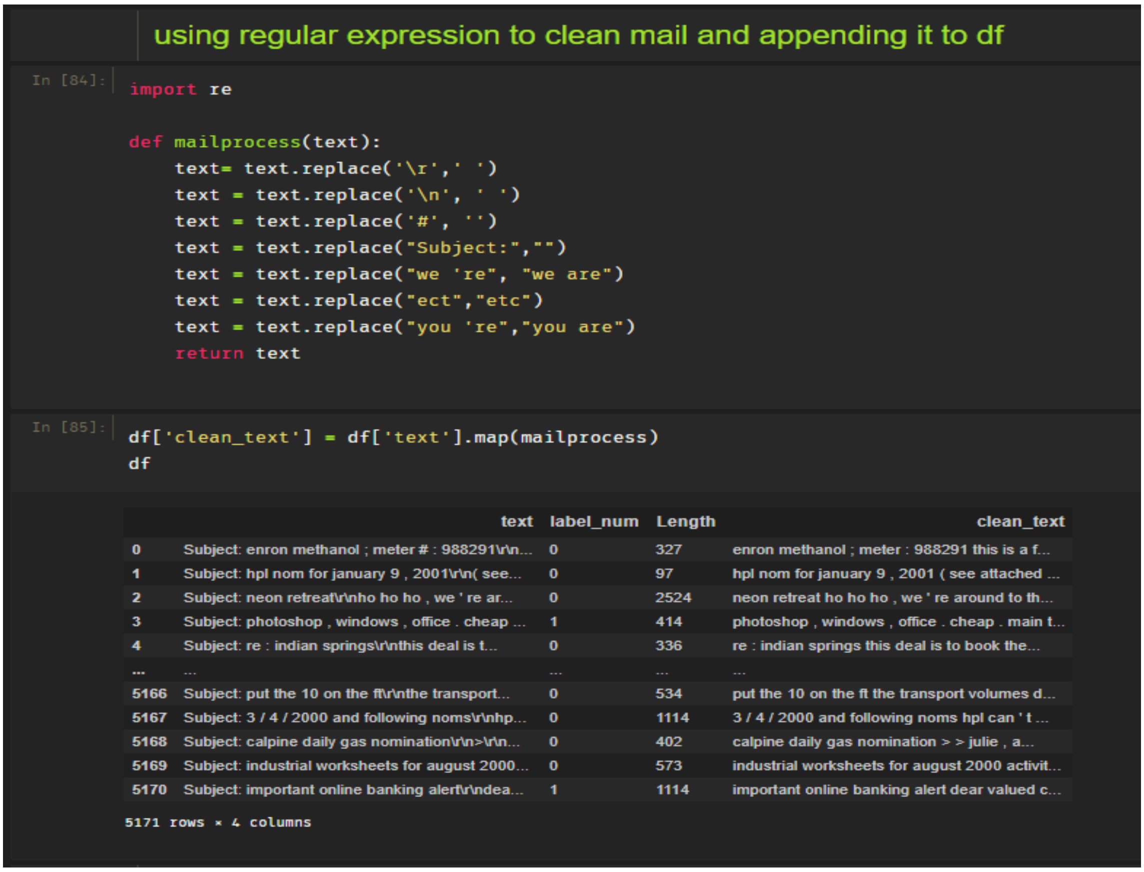
```
327
```

In [30]:

```
df['Length']=df['text'].apply(len)
df
```

	text	label_num	Length
0	Subject: enron methanol ; meter # : 988291\r\n...	0	327
1	Subject: hpl nom for january 9 , 2001\r\n(see...	0	97
2	Subject: neon retreat\r\nho ho ho , we ' re ar...	0	2524
3	Subject: photoshop , windows , office . cheap ...	1	414
4	Subject: re : indian springs\r\nthis deal is t...	0	336
...	...	...	...
5166	Subject: put the 10 on the ft\r\nthe transport...	0	534
5167	Subject: 3 / 4 / 2000 and following noms\r\nhp...	0	1114
5168	Subject: calpine daily gas nomination\r\n>\r\n...	0	402
5169	Subject: industrial worksheets for august 2000...	0	573
5170	Subject: important online banking alert\r\ndea...	1	1114

```
5171 rows × 3 columns
```



using regular expression to clean mail and appending it to df

In [84]:

```
import re

def mailprocess(text):
    text= text.replace('\r',' ')
    text = text.replace('\n', ' ')
    text = text.replace('#', '')
    text = text.replace("Subject:","")
    text = text.replace("we 're", "we are")
    text = text.replace("ect","etc")
    text = text.replace("you 're","you are")
    return text
```

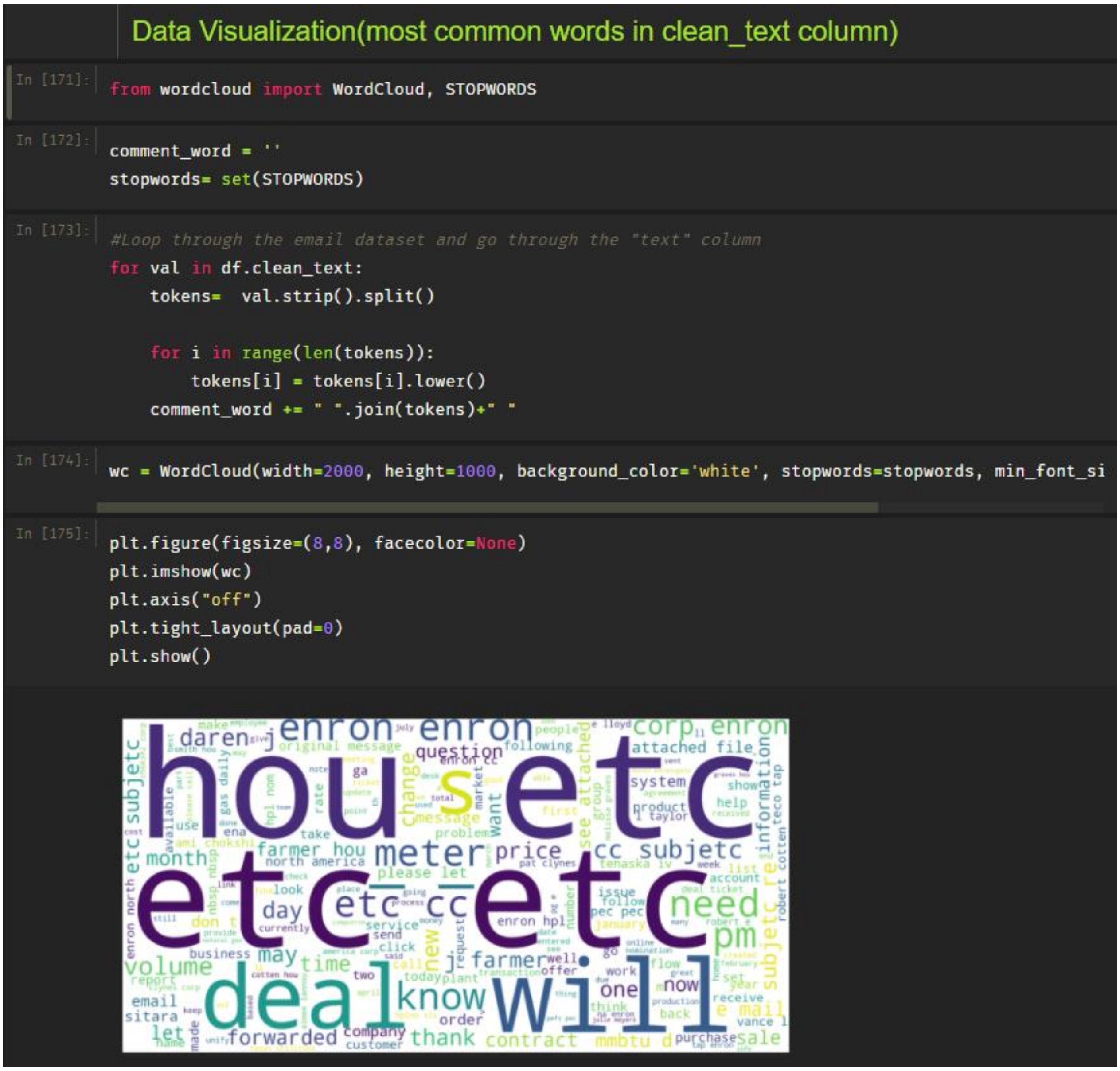
In [85]:

```
df['clean_text'] = df['text'].map(mailprocess)
df
```

	text	label_num	Length	clean_text
0	Subject: enron methanol ; meter # : 988291\r\n...	0	327	enron methanol ; meter : 988291 this is a f...
1	Subject: hpl nom for january 9 , 2001\r\n(see...	0	97	hpl nom for january 9 , 2001 (see attached ...
2	Subject: neon retreat\r\nho ho ho , we ' re ar...	0	2524	neon retreat ho ho ho , we ' re around to th...
3	Subject: photoshop , windows , office . cheap ...	1	414	photoshop , windows , office . cheap . main t...
4	Subject: re : indian springs\r\nthis deal is t...	0	336	re : indian springs this deal is to book the...
...	...	...	...	...
5166	Subject: put the 10 on the ft\r\nthe transport...	0	534	put the 10 on the ft the transport volumes d...
5167	Subject: 3 / 4 / 2000 and following noms\r\nhp...	0	1114	3 / 4 / 2000 and following noms hpl can ' t ...
5168	Subject: calpine daily gas nomination\r\n>\r\n...	0	402	calpine daily gas nomination > > julie , a...
5169	Subject: industrial worksheets for august 2000...	0	573	industrial worksheets for august 2000 activit...
5170	Subject: important online banking alert\r\ndea...	1	1114	important online banking alert dear valued c...

```
5171 rows × 4 columns
```

4. Data Visualization



Data Visualization(most common words in clean_text column)

```
In [171]: from wordcloud import WordCloud, STOPWORDS
```

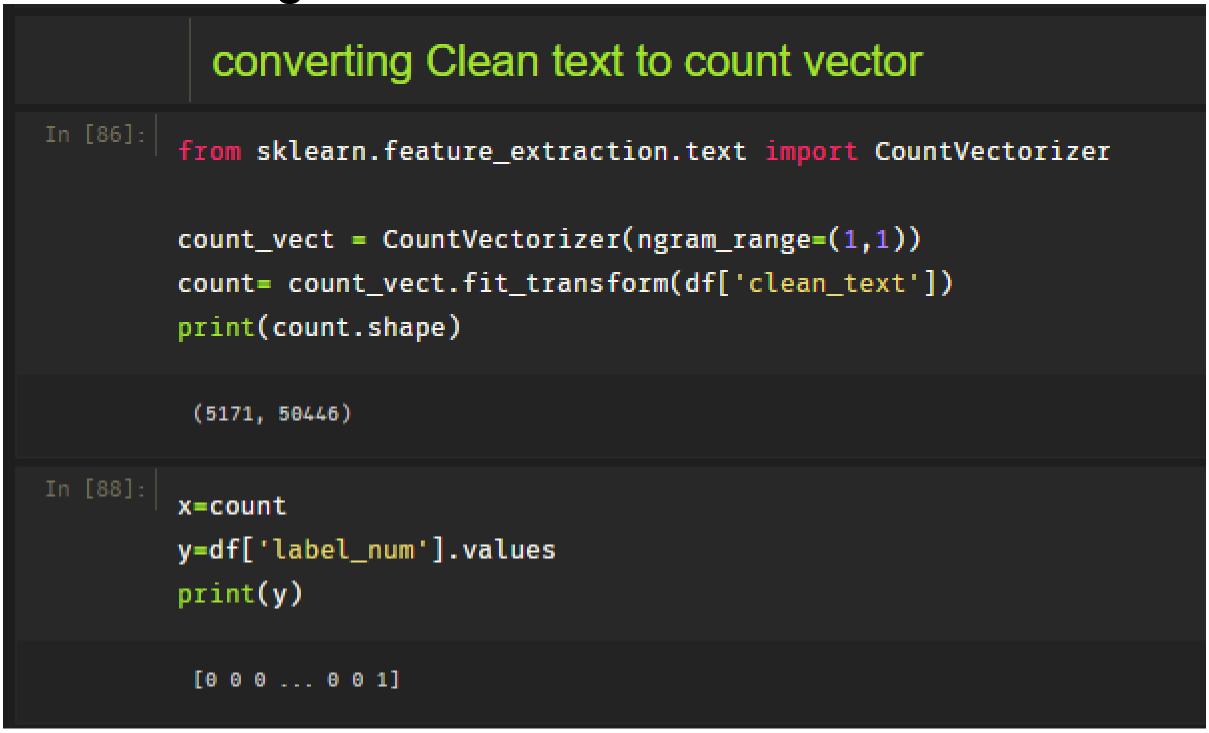
```
In [172]: comment_word = ''
          stopwords= set(STOPWORDS)
```

```
In [173]: #Loop through the email dataset and go through the "text" column
          for val in df.clean_text:
              tokens=  val.strip().split()

              for i in range(len(tokens)):
                  tokens[i] = tokens[i].lower()
              comment_word += " ".join(tokens)+" "
```

```
In [174]: wc = WordCloud(width=2000, height=1000, background_color='white', stopwords=stopwords, min_font_si
```

```
In [175]: plt.figure(figsize=(8,8), facecolor=None)
          plt.imshow(wc)
          plt.axis("off")
          plt.tight_layout(pad=0)
          plt.show()
```

5. Converting data into X and Y



converting Clean text to count vector

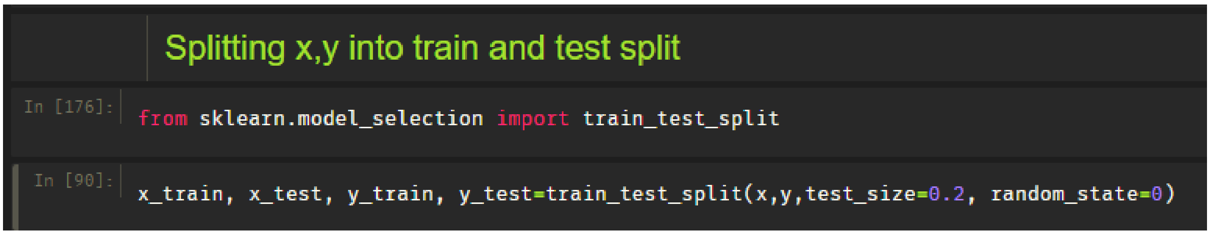
In [86]:
```
from sklearn.feature_extraction.text import CountVectorizer

count_vect = CountVectorizer(ngram_range=(1,1))
count= count_vect.fit_transform(df['clean_text'])
print(count.shape)
```

```
(5171, 50446)
```

In [88]:
```
x=count
y=df['label_num'].values
print(y)
```

```
[0 0 0 ... 0 0 1]
```

6. Dividing data into train/test splits

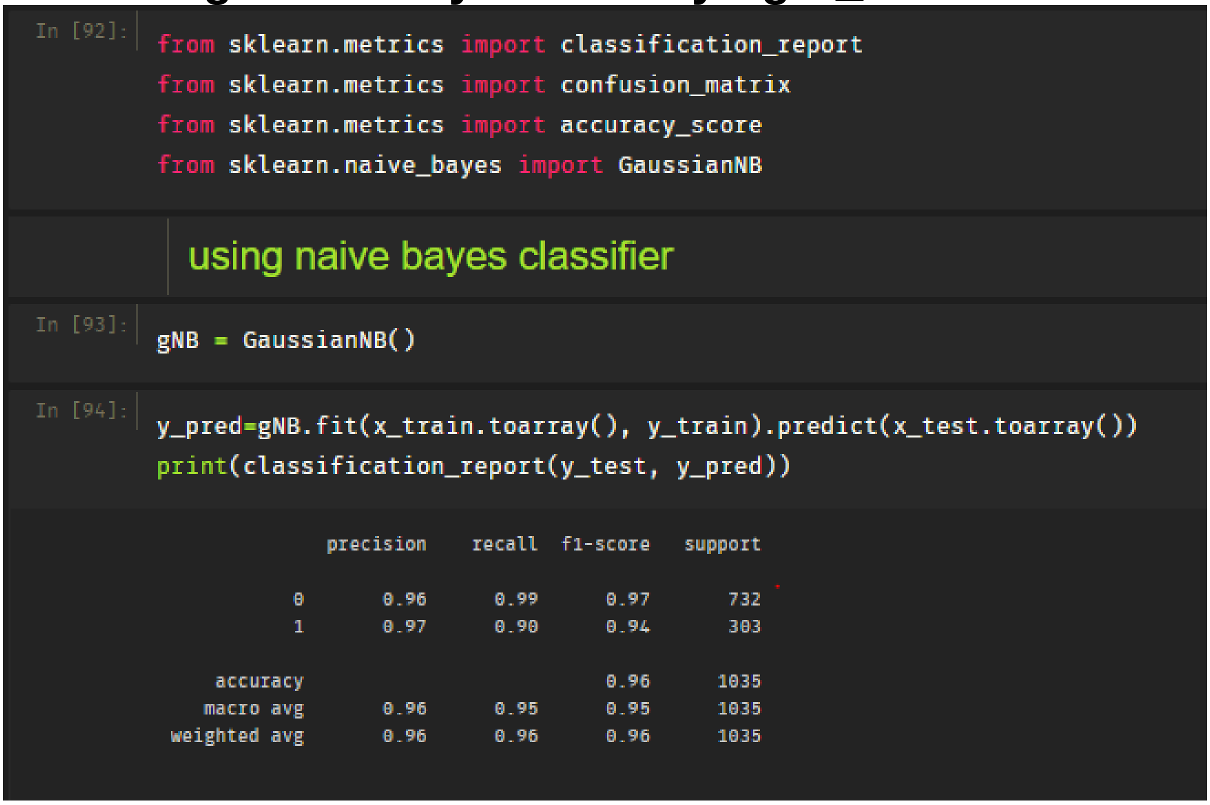


Splitting x,y into train and test split

In [176]:
```
from sklearn.model_selection import train_test_split
```

In [90]:
```
x_train, x_test, y_train, y_test=train_test_split(x,y,test_size=0.2, random_state=0)
```

7. Using Naïve Bayes classifying X_test



In [92]:
```
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import GaussianNB
```

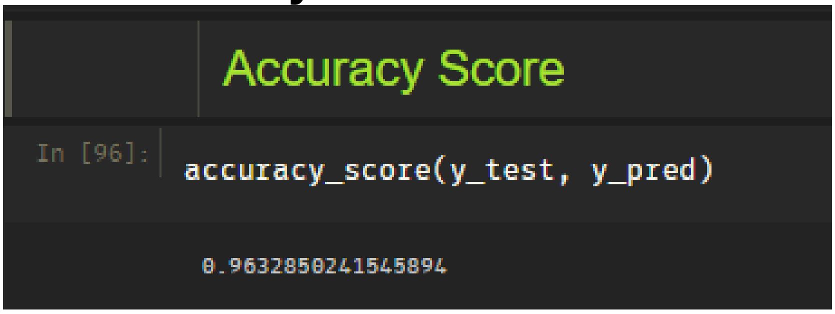
using naive bayes classifier

In [93]:
```
gNB = GaussianNB()
```

In [94]:
```
y_pred=gNB.fit(x_train.toarray(), y_train).predict(x_test.toarray())
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.96      0.99      0.97       732
           1       0.97      0.90      0.94       303

    accuracy                           0.96      1035
   macro avg       0.96      0.95      0.95      1035
weighted avg       0.96      0.96      0.96      1035
```

8. Accuracy Score:-

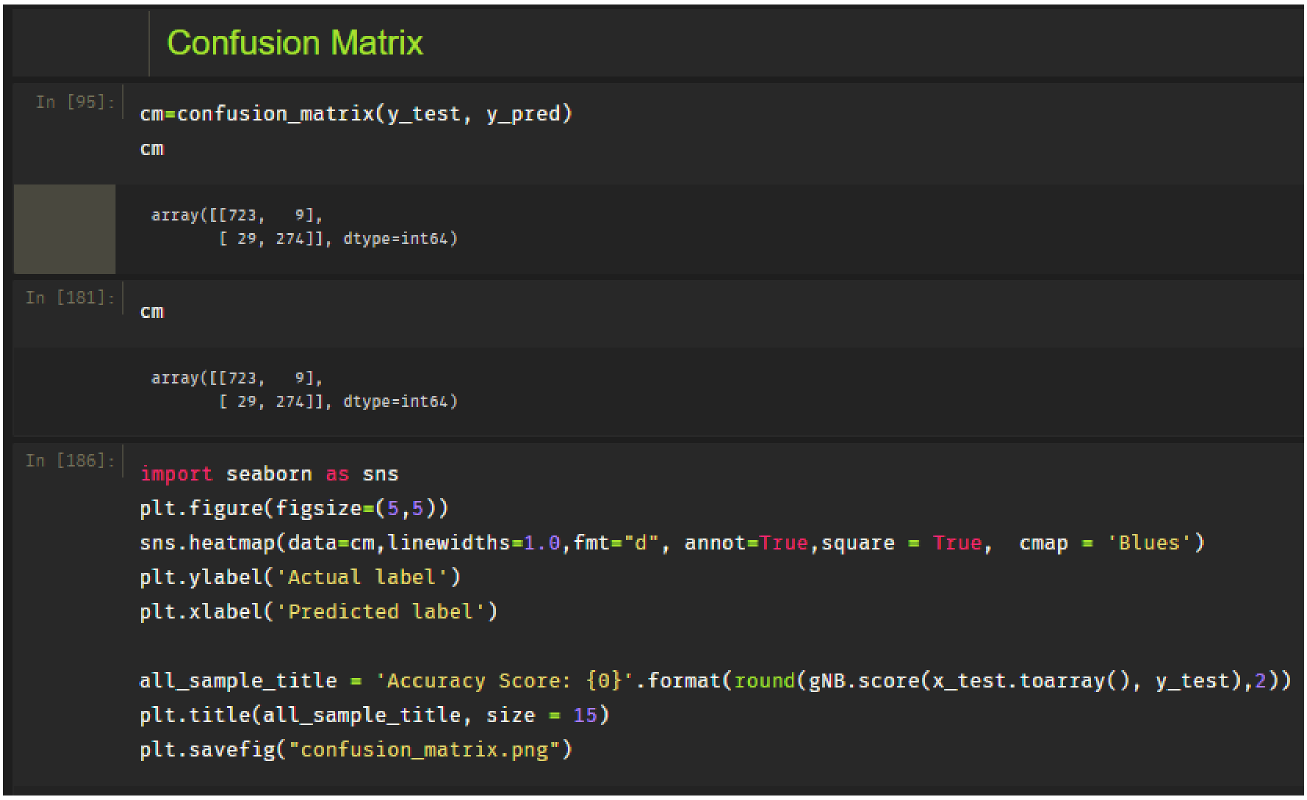


Accuracy Score

In [96]:
```
accuracy_score(y_test, y_pred)
```

```
0.9632850241545894
```

9. Confusion matrix :-



Confusion Matrix

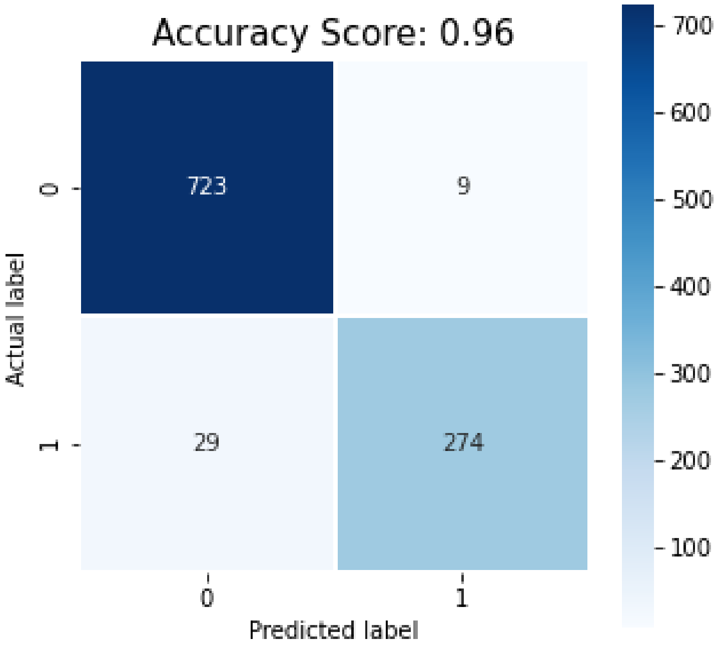
```
In [95]: cm=confusion_matrix(y_test, y_pred)
         cm
```

```
array([[723,   9],
       [ 29, 274]], dtype=int64)
```

```
In [181]: cm
```

```
array([[723,   9],
       [ 29, 274]], dtype=int64)
```

```
In [186]: import seaborn as sns
          plt.figure(figsize=(5,5))
          sns.heatmap(data=cm,linewidths=1.0,fmt="d", annot=True,square = True,  cmap = 'Blues')
          plt.ylabel('Actual label')
          plt.xlabel('Predicted label')

          all_sample_title = 'Accuracy Score: {0}'.format(round(gNB.score(x_test.toarray(), y_test),2))
          plt.title(all_sample_title, size = 15)
          plt.savefig("confusion_matrix.png")
```


Accuracy Score: 0.96
Actual label
Predicted label