```python
In [1]: import pandas as pd
        import numpy as np                    # For mathematical calculations
        import seaborn as sns                 # For data visualization
        import matplotlib.pyplot as plt
        import seaborn as sn                  # For plotting graphs
        import io
        %matplotlib inline
        import warnings                       # To ignore any warnings
        warnings.filterwarnings("ignore")
```

```python
In [2]: filepath2 = r"C:\Users\91623\OneDrive\Desktop\projects\spam_ham\spam.xlsx"
        df= pd.read_excel(filepath2)
        print(df)
```

```
     Column1                                            Column2
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...
...      ...                                                ...
5569    spam  This is the 2nd time we have tried 2 contact u...
5570     ham               Will ü b going to esplanade fr home?
5571     ham  Pity, * was in mood for that. So...any other s...
5572     ham  The guy did some bitching but I acted like i'd...
5573     ham                         Rofl. Its true to its name

[5574 rows x 2 columns]
```

```python
In [3]: df.isnull().sum()
```

```
Out[3]: Column1    0
        Column2    0
        dtype: int64
```

```python
In [4]: df= df.dropna()
```

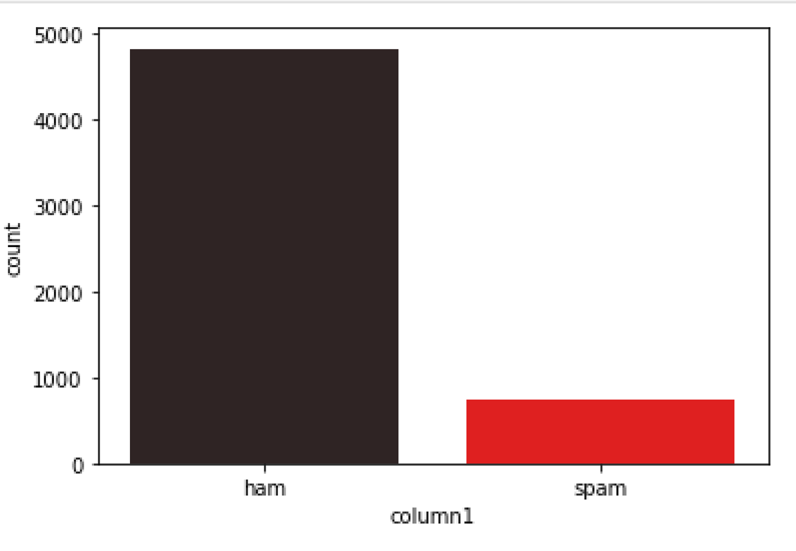
```python
In [5]: df.head()
```

Out[5]:

	Column1	Column2
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...

```python
In [6]: df.columns = df.columns.str.lower()
```

```python
In [7]: sns.countplot(df['column1'],palette='dark:r');
```




```python
In [8]: from sklearn.preprocessing import LabelEncoder
        le=LabelEncoder()
```

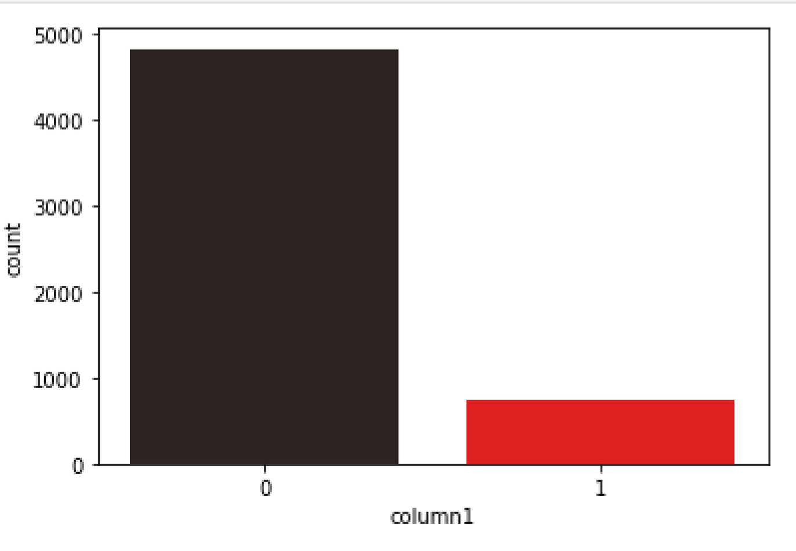
```python
In [9]: list1=['column1']
        for i in list1:
            df[i]=le.fit_transform(df[i])

        df.head()
```

Out[9]:

	column1	column2
0	0	Go until jurong point, crazy.. Available only ...
1	0	Ok lar... Joking wif u oni...
2	1	Free entry in 2 a wkly comp to win FA Cup fina...
3	0	U dun say so early hor... U c already then say...
4	0	Nah I don't think he goes to usf, he lives aro...

```python
In [10]: sns.countplot(df['column1'],palette='dark:r');
```




```python
In [11]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5574 entries, 0 to 5573
Data columns (total 2 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   column1  5574 non-null   int32
 1   column2  5574 non-null   object
dtypes: int32(1), object(1)
memory usage: 268.9+ KB
```

```python
In [12]: x=df['column2']
```

```python
In [13]: x.shape
```

```
Out[13]: (5574,)
```

```python
In [14]: y=df['column1']
```

making word bags

```python
In [15]: from sklearn.feature_extraction.text import CountVectorizer
```

```python
In [16]: cv = CountVectorizer(lowercase = True ,ngram_range =(1,1))
```

```python
In [17]: x = cv.fit_transform(x)
```

```python
In [18]: x.shape
```

```
Out[18]: (5574, 8713)
```

Ml model

```python
In [19]: from sklearn.model_selection import train_test_split
         x_train,x_test,y_train,y_test =train_test_split(x,y, test_size=0.3,random_state=2529)
         x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

```
Out[19]: ((3901, 8713), (1673, 8713), (3901,), (1673,))
```

```python
In [20]: from sklearn.metrics import confusion_matrix ,classification_report
```

```python
In [21]: from sklearn.ensemble import RandomForestClassifier
         rfc=RandomForestClassifier()
         rfc.fit(x_train,y_train)
         rfc_pred=rfc.predict(x_test)
         print(confusion_matrix(y_test,rfc_pred))
         print(classification_report(y_test,rfc_pred))
```

```
[[1468    0]
 [  41  164]]
              precision    recall  f1-score   support

           0       0.97      1.00      0.99      1468
           1       1.00      0.80      0.89       205

    accuracy                           0.98      1673
   macro avg       0.99      0.90      0.94      1673
weighted avg       0.98      0.98      0.97      1673
```

```python
In [22]: from sklearn.linear_model import LogisticRegression
         lr=LogisticRegression()
         lr.fit(x_train,y_train)
         y_pred = lr.predict(x_test)
         print(confusion_matrix(y_test,y_pred))
         print(classification_report(y_test,y_pred))
```

```
[[1462    6]
 [  32  173]]
              precision    recall  f1-score   support

           0       0.98      1.00      0.99      1468
           1       0.97      0.84      0.90       205

    accuracy                           0.98      1673
   macro avg       0.97      0.92      0.94      1673
weighted avg       0.98      0.98      0.98      1673
```

```python
In [23]: from sklearn import tree
         clf = tree.DecisionTreeClassifier()
         clf.fit(x_train,y_train)
         clf_pred=clf.predict(x_test)
         print(confusion_matrix(y_test,clf_pred))
         print(classification_report(y_test,clf_pred))
```

```
[[1444   24]
 [  29  176]]
              precision    recall  f1-score   support

           0       0.98      0.98      0.98      1468
           1       0.88      0.86      0.87       205

    accuracy                           0.97      1673
   macro avg       0.93      0.92      0.93      1673
weighted avg       0.97      0.97      0.97      1673
```

```python
In [24]: from sklearn.svm import SVC
         svC=SVC()
         svC.fit(x_train,y_train)
         svC_pred=svC.predict(x_test)
         from sklearn.metrics import confusion_matrix ,classification_report
         print(confusion_matrix(y_test,svC_pred))
         print(classification_report(y_test,svC_pred))
```

```
[[1467    1]
 [  34  171]]
              precision    recall  f1-score   support

           0       0.98      1.00      0.99      1468
           1       0.99      0.83      0.91       205

    accuracy                           0.98      1673
   macro avg       0.99      0.92      0.95      1673
weighted avg       0.98      0.98      0.98      1673
```

random under sampling

```python
In [25]: from imblearn.under_sampling import RandomUnderSampler
```

```python
In [26]: rus = RandomUnderSampler(random_state=2529)
```

```python
In [27]: x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

```
Out[27]: ((3901, 8713), (1673, 8713), (3901,), (1673,))
```

```python
In [28]: x_rus,y_rus = rus.fit_resample(x,y)
```

```python
In [29]: from sklearn.model_selection import train_test_split
         xru_train,xru_test,yru_train,yru_test =train_test_split(x_rus,y_rus, test_size=0.3,random_state=2529)
         xru_train.shape,xru_test.shape,yru_train.shape,yru_test.shape
```

```
Out[29]: ((1045, 8713), (449, 8713), (1045,), (449,))
```

```python
In [30]: xru_train.shape,xru_test.shape,yru_train.shape,yru_test.shape
```

```
Out[30]: ((1045, 8713), (449, 8713), (1045,), (449,))
```

```python
In [31]: from sklearn.ensemble import RandomForestClassifier
         rfc=RandomForestClassifier()
         rfc.fit(xru_train,yru_train)
         rfc_pred1=rfc.predict(xru_test)
         print(confusion_matrix(yru_test,rfc_pred1))
         print(classification_report(yru_test,rfc_pred1))
```

```
[[206   1]
 [ 21 221]]
              precision    recall  f1-score   support

           0       0.91      1.00      0.95       207
           1       1.00      0.91      0.95       242

    accuracy                           0.95       449
   macro avg       0.95      0.95      0.95       449
weighted avg       0.95      0.95      0.95       449
```

```python
In [32]: from sklearn.svm import SVC
         svC=SVC()
         svC.fit(xru_train,yru_train)
         svC_pred1=svC.predict(xru_test)
         from sklearn.metrics import confusion_matrix ,classification_report
         print(confusion_matrix(yru_test,svC_pred1))
         print(classification_report(yru_test,svC_pred1))
```

```
[[200   7]
 [ 17 225]]
              precision    recall  f1-score   support

           0       0.92      0.97      0.94       207
           1       0.97      0.93      0.95       242

    accuracy                           0.95       449
   macro avg       0.95      0.95      0.95       449
weighted avg       0.95      0.95      0.95       449
```

```python
In [33]: from sklearn import tree
         clf = tree.DecisionTreeClassifier()
         clf.fit(xru_train,yru_train)
         clf_pred1=clf.predict(xru_test)
         print(confusion_matrix(yru_test,clf_pred1))
         print(classification_report(yru_test,clf_pred1))
```

```
[[195  12]
 [ 21 221]]
              precision    recall  f1-score   support

           0       0.90      0.94      0.92       207
           1       0.95      0.91      0.93       242

    accuracy                           0.93       449
   macro avg       0.93      0.93      0.93       449
weighted avg       0.93      0.93      0.93       449
```

```python
In [34]: from sklearn.linear_model import LogisticRegression
         lr=LogisticRegression()
         lr.fit(xru_train,yru_train)
         y_pred1 = lr.predict(xru_test)
         print(confusion_matrix(yru_test,y_pred1))
         print(classification_report(yru_test,y_pred1))
```

```
[[205   2]
 [ 15 227]]
              precision    recall  f1-score   support

           0       0.93      0.99      0.96       207
           1       0.99      0.94      0.96       242

    accuracy                           0.96       449
   macro avg       0.96      0.96      0.96       449
weighted avg       0.96      0.96      0.96       449
```

random over sampling

```python
In [35]: from imblearn.over_sampling import RandomOverSampler
```

```python
In [36]: ros = RandomOverSampler(random_state=2529)
```

```python
In [37]: x_ros,y_ros = rus.fit_resample(x,y)
```

```python
In [38]: from sklearn.model_selection import train_test_split
         xro_train,xro_test,yro_train,yro_test =train_test_split(x_ros,y_ros, test_size=0.3,random_state=2529)
         xro_train.shape,xro_test.shape,yro_train.shape,yro_test.shape
```

```
Out[38]: ((1045, 8713), (449, 8713), (1045,), (449,))
```

```python
In [39]: from sklearn.linear_model import LogisticRegression
         lr=LogisticRegression()
         lr.fit(xro_train,yro_train)
         y_pred2 = lr.predict(xro_test)
         print(confusion_matrix(yro_test,y_pred2))
         print(classification_report(yro_test,y_pred2))
```

```
[[205   2]
 [ 15 227]]
              precision    recall  f1-score   support

           0       0.93      0.99      0.96       207
           1       0.99      0.94      0.96       242

    accuracy                           0.96       449
   macro avg       0.96      0.96      0.96       449
weighted avg       0.96      0.96      0.96       449
```

```python
In [40]: from sklearn.svm import SVC
         svC=SVC()
         svC.fit(xro_train,yro_train)
         svC_pred2=svC.predict(xro_test)
         from sklearn.metrics import confusion_matrix ,classification_report
         print(confusion_matrix(yro_test,svC_pred2))
         print(classification_report(yro_test,svC_pred2))
```

```
[[200   7]
 [ 17 225]]
              precision    recall  f1-score   support

           0       0.92      0.97      0.94       207
           1       0.97      0.93      0.95       242

    accuracy                           0.95       449
   macro avg       0.95      0.95      0.95       449
weighted avg       0.95      0.95      0.95       449
```

```python
In [41]: from sklearn import tree
         clf = tree.DecisionTreeClassifier()
         clf.fit(xro_train,yro_train)
         clf_pred2=clf.predict(xro_test)
         print(confusion_matrix(yro_test,clf_pred2))
         print(classification_report(yro_test,clf_pred2))
```

```
[[197  10]
 [ 23 219]]
              precision    recall  f1-score   support

           0       0.90      0.95      0.92       207
           1       0.96      0.90      0.93       242

    accuracy                           0.93       449
   macro avg       0.93      0.93      0.93       449
weighted avg       0.93      0.93      0.93       449
```

```python
In [42]: from sklearn.ensemble import RandomForestClassifier
         rfc=RandomForestClassifier()
         rfc.fit(xro_train,yro_train)
         rfc_pred2=rfc.predict(xro_test)
         print(confusion_matrix(yro_test,rfc_pred2))
         print(classification_report(yro_test,rfc_pred2))
```

```
[[205   2]
 [ 29 213]]
              precision    recall  f1-score   support

           0       0.88      0.99      0.93       207
           1       0.99      0.88      0.93       242

    accuracy                           0.93       449
   macro avg       0.93      0.94      0.93       449
weighted avg       0.94      0.93      0.93       449
```

```python
In [ ]:
```