## ML Prac2

October 18, 2023

## 1 Email Spam Classification

1.0.1 Aim: 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 and Support Vector Machine for classification

Name: Chinmay Gokhale

Div: BE-A

Roll No. B211047 #### import the libraries

```
[1]: import pandas as pd
     import numpy as np
     import seaborn as sns
     import matplotlib.pyplot as plt
[2]: df=pd.read_csv('emails.csv')
     df
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[7]: df.tail

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[8]: df.tail()
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	4	Em	ail 5	7	6	17	1	5	2	57	0	9	•••		0	
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	5167	Email	5168	2	2	2	3	0	0	32	0	0	•••		0	
	5168	Email	5169	35	27	11	2	6	5	151	4	3	•••		0	
	5169	Email	5170	0	0	1	1	0	0	11	0	0	•••		0	
	5170	Email	5171	2	7	1	0	2	1	28	2	0	•••		0	
	5171	Email	5172	22	24	5	1	6	5	148	8	2	•••		0	
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## [10]: df.describe()

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	mean	6.640565	6.188128	5.143852	3.075599	3.124710		
	std	11.745009	9.534576	14.101142	6.045970	4.680522		
	min	0.000000	0.000000	1.000000	0.000000	0.000000		
	25%	0.000000	1.000000	1.000000	0.000000	1.000000		
	50%	3.000000	3.000000	1.000000	1.000000	2.000000		
	75%	8.000000	7.000000	4.000000	3.000000	4.000000		
	max	210.000000	132.000000	344.000000	89.000000	47.000000		
		of	a	you	hou	in		\
	count	5172.000000	5172.000000	5172.000000	5172.000000	5172.000000		
	mean	2.627030	55.517401	2.466551	2.024362	10.600155		
	std	6.229845	87.574172	4.314444	6.967878	19.281892		
	min	0.000000	0.000000	0.000000	0.000000	0.000000		
	25%	0.000000	12.000000	0.000000	0.000000	1.000000	•••	
	50%	1.000000	28.000000	1.000000	0.000000	5.000000	•••	
	75%	2.000000	62.250000	3.000000	1.000000	12.000000		
	max	77.000000	1898.000000	70.000000	167.000000	223.000000	•••	
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	count	5172.000000	5172.000000	5172.000000	5172.000000	5172.0000		
	mean	0.005027	0.012568	0.010634	0.098028	0.0042	54	
	std	0.105788	0.199682	0.116693	0.569532	0.0962		
	min	0.000000	0.000000	0.000000	0.000000	0.0000		
	25%	0.000000	0.000000	0.000000	0.000000	0.0000		
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5170	1
5171	0

[5172 rows x 3002 columns]

# 2 Splitting the data into input and output data

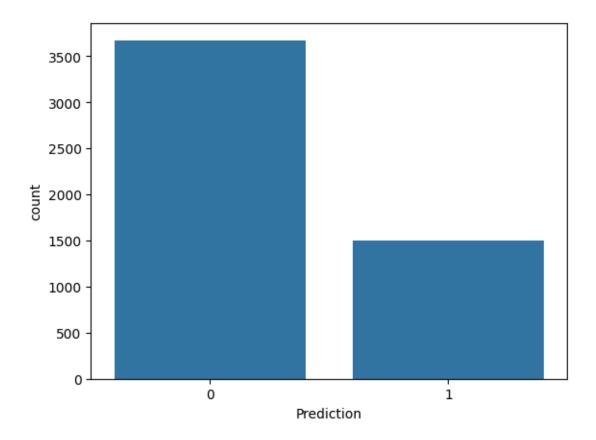
```
[13]: X=df.drop(["Email No.", "Prediction"],axis=1)
[14]: X
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                                       for
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                 7
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```

[5172 rows x 3000 columns]

```
[15]: Y=df["Prediction"]
[16]: Y
[16]: 0
              0
              0
      1
      2
              0
      3
              0
      4
              0
      5167
              0
      5168
              0
      5169
              1
      5170
              1
      5171
      Name: Prediction, Length: 5172, dtype: int64
[17]: sns.countplot(x=Y)
```

[17]: <Axes: xlabel='Prediction', ylabel='count'>



```
[18]: Y.value_counts
[18]: <bound method IndexOpsMixin.value_counts of 0
      1
      2
              0
      3
              0
      4
              0
      5167
              0
      5168
      5169
              1
      5170
              1
      5171
              0
      Name: Prediction, Length: 5172, dtype: int64>
```

#### 3 Feature Scaling

```
[19]: from sklearn.preprocessing import MinMaxScaler
      scaler=MinMaxScaler()
      X Scale=scaler.fit transform(X)
[20]: X_Scale
[20]: array([[0.
                        , 0.
                                    , 0.
                                         , ..., 0.
                                                               , 0.
              0.
                        ],
             [0.03809524, 0.09848485, 0.06705539, ..., 0.
                                                               , 0.00877193,
             0.
                        ],
             [0.
                        , 0.
                                    , 0.
                                             , ..., 0.
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             [0.00952381, 0.0530303 , 0.
                                                , ..., 0.
                                                               , 0.00877193,
             0.
                        ],
             [0.1047619 , 0.18181818, 0.01166181, ..., 0.
                                                              , 0.
                        ]])
              0.
     3.0.1 Cross Validation
[21]: from sklearn.model_selection import train_test_split
      X_train, X_test, Y_train, Y_Test=train_test_split(X_Scale,Y,test_size=0.
       →47, random_state47)
      X_train.shape
[21]: (3879, 3000)
[22]: X_Scale.shape
[22]: (5172, 3000)
[23]: X_test.shape
[23]: (1293, 3000)
[24]: Y_train.shape
[24]: (3879,)
```

## 4 calling the models

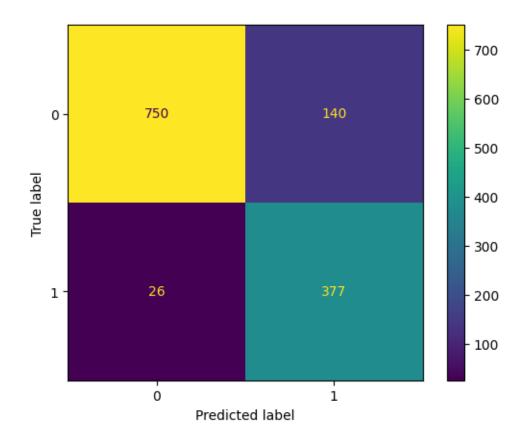
```
[25]: from sklearn.neighbors import KNeighborsClassifier
knn= KNeighborsClassifier()
knn.fit(X_train,Y_train)
```

[25]: KNeighborsClassifier()

[26]: Y\_pred=knn.predict(X\_test)
Y\_pred

[26]: array([0, 0, 1, ..., 0, 1, 0])

[27]: <sklearn.metrics.\_plot.confusion\_matrix.ConfusionMatrixDisplay at 0x7fed8c985660>



 $accuracy\_score(Y\_train, Y\_Test)$ 

[28]: accuracy\_score(Y\_Test,Y\_pred)

[28]: 0.871616395978345

[29]: print(classification\_report(Y\_Test,Y\_pred))

	precision	recall	f1-score	support
0	0.97	0.84	0.90	890
1	0.73	0.94	0.82	403
accuracy			0.87	1293
macro avg	0.85	0.89	0.86	1293
weighted avg	0.89	0.87	0.88	1293

[]: