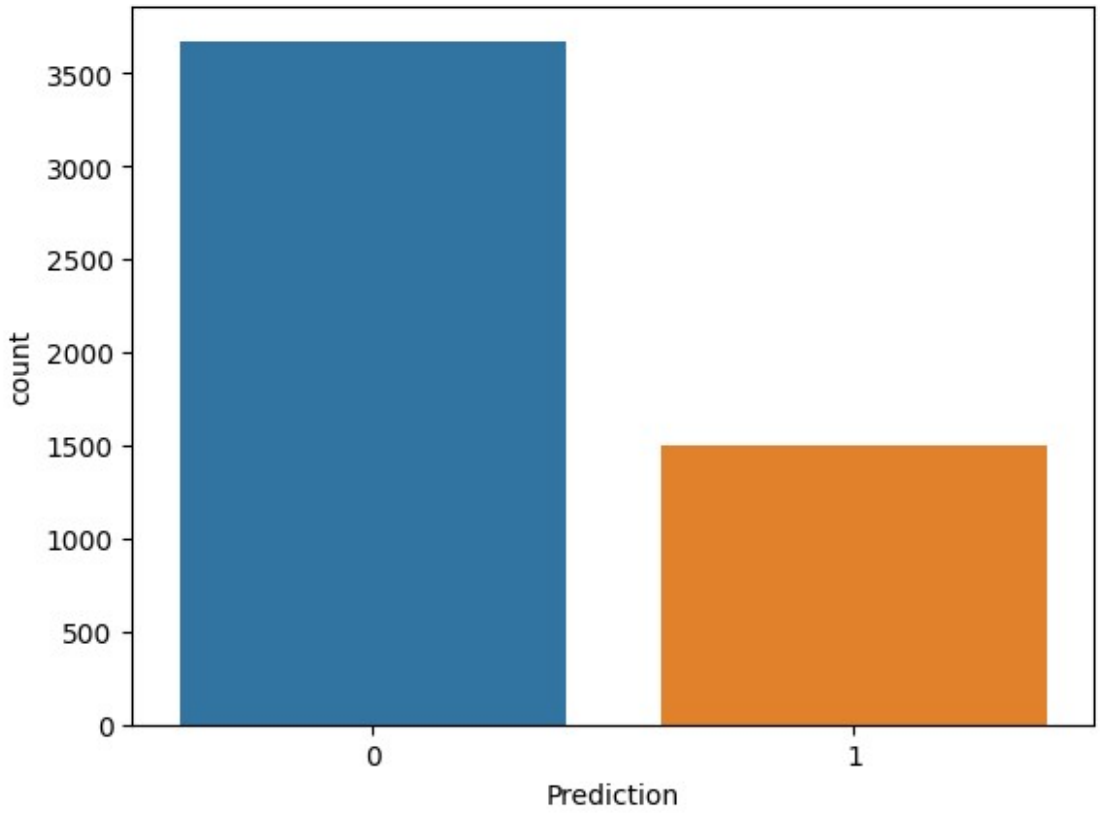
```
import pandas as pd

df = pd.read_csv('Dataset/emails.csv')

df.shape

(5172, 3002)

df.head()

  Email No.  the  to  ect  and  for  of    a  you  hou  ...  connevey
jay  \
0   Email 1    0   0    1    0    0   0    2    0    0  ...         0
0
1   Email 2    8  13   24    6    6   2  102    1   27  ...         0
0
2   Email 3    0   0    1    0    0   0    8    0    0  ...         0
0
3   Email 4    0   5   22    0    5   1   51    2   10  ...         0
0
4   Email 5    7   6   17    1    5   2   57    0    9  ...         0
0

   valued  lay  infrastructure  military  allowing  ff  dry
Prediction
0       0    0               0         0         0   0    0
0
1       0    0               0         0         0   1    0
0
2       0    0               0         0         0   0    0
0
3       0    0               0         0         0   0    0
0
4       0    0               0         0         0   1    0
0

[5 rows x 3002 columns]

# Input Data
x = df.drop(['Email No.','Prediction'], axis = 1)

# Output Data
y = df['Prediction']

x.shape

(5172, 3000)

x.dtypes

the               int64
to                int64
```

```
ect                int64
and                int64
for                int64
                   ...
infrastructure     int64
military           int64
allowing           int64
ff                 int64
dry                int64
Length: 3000, dtype: object
```

```
set(x.dtypes)
```

```
{dtype('int64')}
```

```
import seaborn as sns
sns.countplot(x = y);
```




```
y.value_counts()
```

```
0    3672
1    1500
Name: Prediction, dtype: int64
```

```
# Feature Scaling
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
x_scaled = scaler.fit_transform(x)

x_scaled
```

```
array([[0.        , 0.        , 0.        , ..., 0.        , 0.
,
        0.        ],
       [0.03809524, 0.09848485, 0.06705539, ..., 0.        ,
0.00877193,
        0.        ],
       [0.        , 0.        , 0.        , ..., 0.        , 0.
,
        0.        ],
       ...,
       [0.        , 0.        , 0.        , ..., 0.        , 0.
,
        0.        ],
       [0.00952381, 0.0530303 , 0.        , ..., 0.        ,
0.00877193,
        0.        ],
       [0.1047619 , 0.18181818, 0.01166181, ..., 0.        , 0.
,
        0.        ]])
```

```
# Cross Validation
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x_scaled, y,
random_state = 0 , test_size = 0.25)

x_scaled.shape
```

```
(5172, 3000)
```

```
x_train.shape
```

```
(3879, 3000)
```

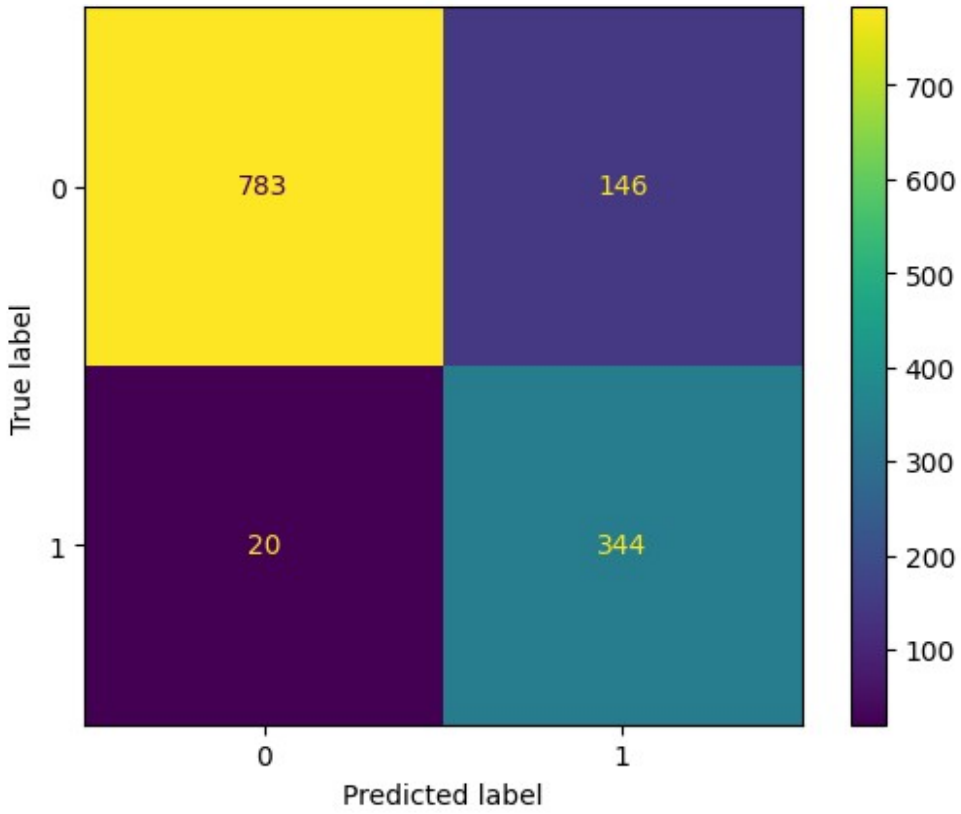
```
x_test.shape
```

```
(1293, 3000)
```

```
# Import the class
from sklearn.neighbors import KNeighborsClassifier

# Create the object
knn = KNeighborsClassifier(n_neighbors=5)

# Train the algorithm
knn.fit(x_train, y_train)
```

```
KNeighborsClassifier()

# predict on test data
y_pred = knn.predict(x_test)

# import the evaluation metrics
from sklearn.metrics import ConfusionMatrixDisplay, accuracy_score
from sklearn.metrics import classification_report

ConfusionMatrixDisplay.from_predictions(y_test, y_pred)
```

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at
0x21693f3a0e0>
```




```
y_test.value_counts()
```

```
0    929
1    364
Name: Prediction, dtype: int64
```

```
accuracy_score(y_test, y_pred)
```

```
0.871616395978345
```

```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.98      0.84      0.90       929
           1       0.70      0.95      0.81       364

    accuracy                           0.87      1293
   macro avg       0.84      0.89      0.85      1293
weighted avg       0.90      0.87      0.88      1293
```

```
import numpy as np
import matplotlib as plt

error = []
for k in range(1,41):
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(x_train, y_train)
    pred = knn.predict(x_test)
    error.append(np.mean(pred != y_test))

error
```

```
[0.10827532869296211,
 0.10982211910286156,
 0.12296983758700696,
 0.11523588553750967,
 0.12838360402165508,
 0.1214230471771075,
 0.15158546017014696,
 0.14849187935034802,
 0.17246713070378963,
 0.16705336426914152,
 0.1871616395978345,
 0.18329466357308585,
 0.21500386697602475,
 0.21345707656612528,
 0.22815158546017014,
 0.2266047950502707,
 0.23588553750966745,
 0.23356535189481825,
 0.2459396751740139,
 0.24361948955916474,
 0.2559938128383604,
 0.2552204176334107,
 0.2699149265274555,
 0.2691415313225058,
 0.2822892498066512,
 0.28306264501160094,
 0.2954369682907966,
 0.2923433874709977,
```

```
 0.3039443155452436,
 0.300077339520495,
 0.30549110595514306,
 0.30549110595514306,
 0.31245166279969067,
 0.31245166279969067,
 0.3194122196442382,
 0.317092034029389,
 0.32637277648878577,
 0.32559938128383603,
 0.33410672853828305,
 0.3325599381283836]
```

```
knn = KNeighborsClassifier(n_neighbors=1)
knn.fit(x_train, y_train)
```

```
KNeighborsClassifier(n_neighbors=1)
```

```
y_pred = knn.predict(x_test)
```

```
accuracy_score(y_test, y_pred)
```

```
0.8917246713070379
```

```
from sklearn.svm import SVC
svm = SVC(kernel='poly')
svm.fit(x_train, y_train)
```

```
SVC(kernel='poly')
```

```
y_pred = svm.predict(x_test)
```

```
accuracy_score(y_test, y_pred)
```

```
0.7548337200309359
```

```
# Linear:0.9767981438515081
# RBF:0.9450889404485692
# Poly:0.7548337200309359
```