In [1]:

```
import pandas as pd
```

In [2]:

```
df = pd.read_csv("emails.csv")
```

In [3]:

```
df.shape
```

Out[3]:

```
(5172, 3002)
```

In [4]:

```
df.head()
```

Out[4]:

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

5 rows × 3002 columns

In [5]:

```
x = df.drop(['Email No.', 'Prediction'], axis = 1)
y = df['Prediction']
```

In [6]:

```
x.shape
```

Out[6]:

```
(5172, 3000)
```

In [7]:

```
x.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5172 entries, 0 to 5171
Columns: 3000 entries, the to dry
dtypes: int64(3000)
memory usage: 118.4 MB
```

```
In [8]:  x.dtypes
```

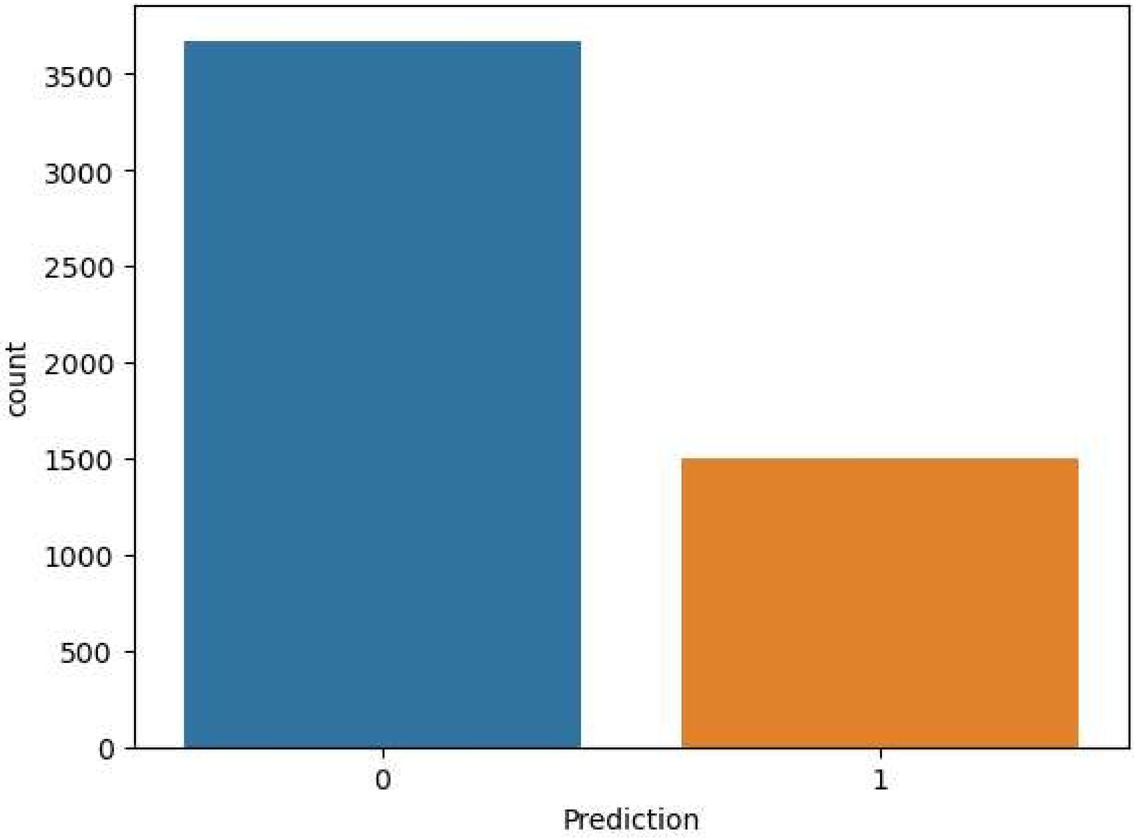
```
Out[8]: the                 int64
        to                  int64
        ect                 int64
        and                 int64
        for                 int64
                            ...
        infrastructure      int64
        military            int64
        allowing            int64
        ff                  int64
        dry                 int64
        Length: 3000, dtype: object
```

```
In [9]:  set(x.dtypes)
```

```
Out[9]: {dtype('int64')}
```

```
In [11]:  import seaborn as sns
          sns.countplot(x =y)
```

```
Out[11]: <Axes: xlabel='Prediction', ylabel='count'>
```



```
In [12]:  y.value_counts()
```

```
Out[12]: 0    3672
         1    1500
         Name: Prediction, dtype: int64
```

In [15]:
```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
x_scaled = scaler.fit_transform(x)
```

In [16]:
```
x_scaled
```

Out[16]:
```
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.        ]])
```

In [17]:
```
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)
```

In [18]:
```
x_scaled.shape
```

Out[18]:
```
(5172, 3000)
```

In [19]:
```
x_train.shape
```

Out[19]:
```
(3879, 3000)
```

In [21]:
```
x_test.shape
```

Out[21]:
```
(1293, 3000)
```

In [22]:
```
from sklearn.neighbors import KNeighborsClassifier
```

In [23]:
```
knn = KNeighborsClassifier(n_neighbors=5)
```

In [24]:
```
knn.fit(x_train, y_train)
```

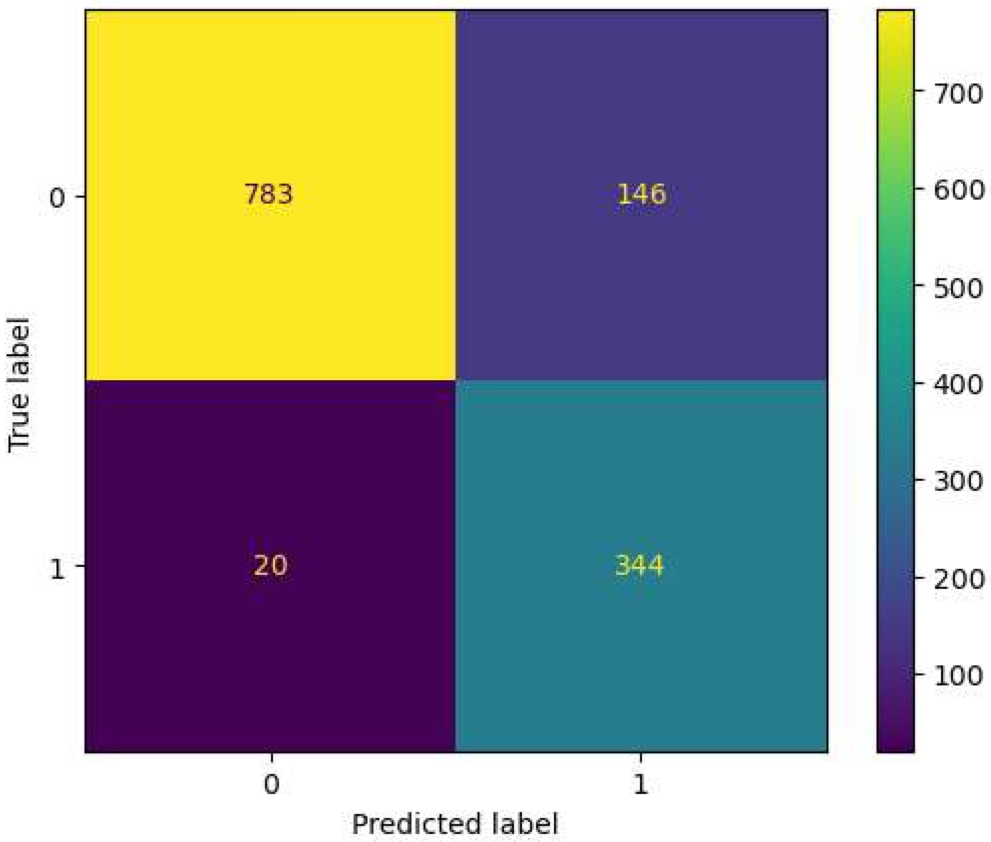
Out[24]:
```
▾ KNeighborsClassifier
KNeighborsClassifier()
```

In [25]:
```
y_pred = knn.predict(x_test)
```

In [27]:
```
from sklearn.metrics import ConfusionMatrixDisplay, accuracy_score
from sklearn.metrics import classification_report
```

In [30]:
```
ConfusionMatrixDisplay.from_predictions (y_test, y_pred)
```

Out[30]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x176d9d3d4
50>
```



In [32]:
```
y_test.value_counts()
```

Out[32]:
```
0    929
1    364
Name: Prediction, dtype: int64
```

In [33]:
```
accuracy_score(y_test, y_pred)
```

Out[33]:
```
0.871616395978345
```

In [34]:
```
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
```

In [39]:
```
import numpy as np
import matplotlib.pyplot as plt
```

In [41]:
```
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))
```

In [42]:
```
error
```

Out[42]:
```
[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]
```

```
In [43]: knn = KNeighborsClassifier(n_neighbors=1)
```

```
In [44]: knn.fit(x_train,y_train)

Out[44]: ▾        KNeighborsClassifier
         KNeighborsClassifier(n_neighbors=1)
```

```
In [45]: y_pred = knn.predict(x_test)
```

```
In [47]: accuracy_score(y_test, y_pred)

Out[47]: 0.8917246713070379
```

```
In [48]: from sklearn.svm import SVC
```

```
In [49]: svm = SVC(kernel= 'linear')
```

```
In [50]: svm.fit(x_train, y_train)

Out[50]: ▾         SVC
         SVC(kernel='linear')
```

```
In [51]: y_pred = svm.predict(x_test)
```

```
In [53]: accuracy_score(y_test, y_pred)

Out[53]: 0.9767981438515081
```

```
In [ ]:
```