In [44]:
```
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import ConfusionMatrixDisplay, accuracy_score
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```
df = pd.read_csv("emails.csv")
```

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]:
```
df.isnull().sum()
```

Out[5]:
```
Email No.     0
the           0
to            0
ect           0
and           0
             ..
military      0
allowing      0
ff            0
dry           0
Prediction    0
Length: 3002, dtype: int64
```

In [57]:
```
X = df.iloc[:,1:3001]
X
```

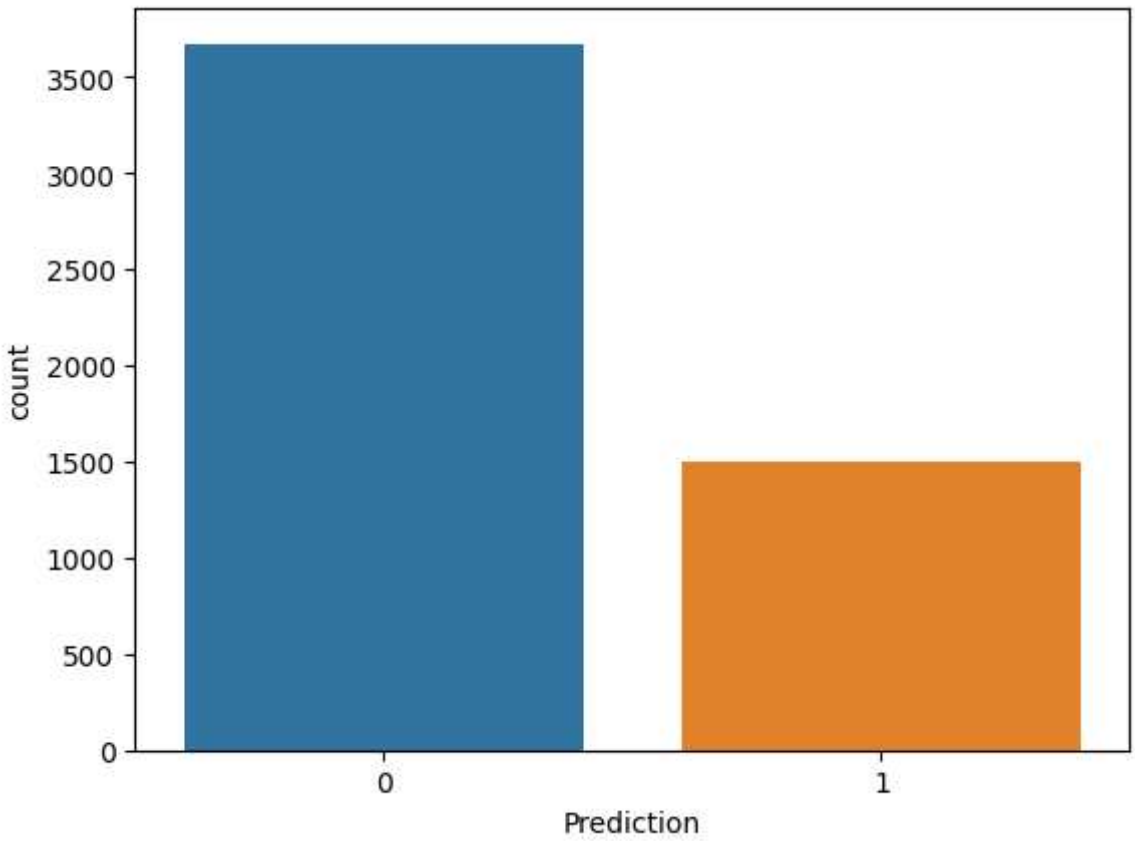
Out[57]:

	the	to	ect	and	for	of	a	you	hou	in	...	enhancements	connevey	jay	valued
0	0	0	1	0	0	0	2	0	0	0	...	0	0	0	0
1	8	13	24	6	6	2	102	1	27	18	...	0	0	0	0
2	0	0	1	0	0	0	8	0	0	4	...	0	0	0	0
3	0	5	22	0	5	1	51	2	10	1	...	0	0	0	0
4	7	6	17	1	5	2	57	0	9	3	...	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5167	2	2	2	3	0	0	32	0	0	5	...	0	0	0	0
5168	35	27	11	2	6	5	151	4	3	23	...	0	0	0	0
5169	0	0	1	1	0	0	11	0	0	1	...	0	0	0	0
5170	2	7	1	0	2	1	28	2	0	8	...	0	0	0	0
5171	22	24	5	1	6	5	148	8	2	23	...	0	0	0	0

5172 rows × 3000 columns

In [21]:
```
x=df.drop(["Email No.","Prediction"],axis=1)
y=df["Prediction"]
print(y)
print(x.shape)
print(sns.countplot(x=y))
print(y.value_counts())
```

```
0       0
1       0
2       0
3       0
4       0
       ..
5167    0
5168    0
5169    1
5170    1
5171    0
Name: Prediction, Length: 5172, dtype: int64
(5172, 3000)
AxesSubplot(0.125,0.11;0.775x0.77)
0    3672
1    1500
Name: Prediction, dtype: int64
```



In [23]:
```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
x_scaled=scaler.fit_transform(x)
x_scaled
```

Out[23]:
```
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 [7]:
```
Y = df.iloc[:,-1].values
Y
```

Out[7]:
```
array([0, 0, 0, ..., 1, 1, 0], dtype=int64)
```

In [27]:
```
x_train,x_test,y_train,y_test = train_test_split(x_scaled,y,random_state=0,tes
print(x_scaled.shape)
print(x_train.shape)
print(x_test.shape)
```

```
(5172, 3000)
(3879, 3000)
(1293, 3000)
```

In [32]:
```
knn = KNeighborsClassifier(n_neighbors=5)
knn.fit(x_train, y_train)
```

Out[32]:
```
KNeighborsClassifier()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [33]:
```
y_pred=knn.predict(x_test)
print(y_pred)
```

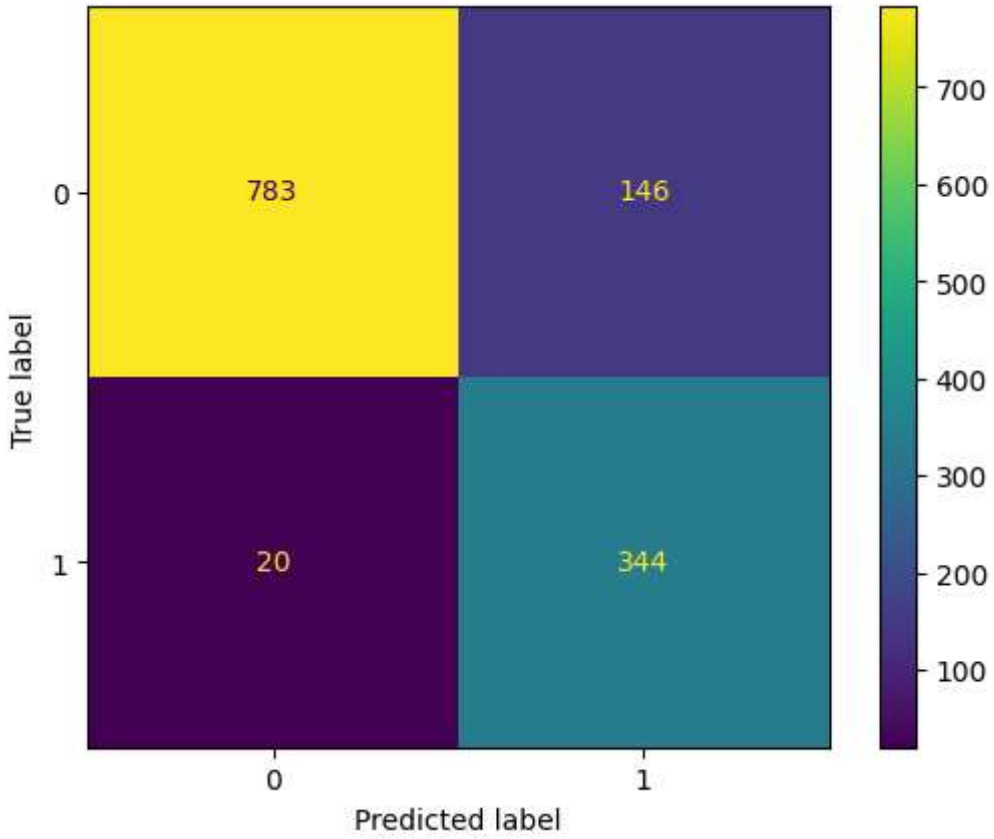
```
[1 0 0 ... 1 0 1]
```

In [10]:
```

```

In [36]:
```
ConfusionMatrixDisplay.from_predictions(y_test,y_pred)
```

Out[36]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x228e740f0
40>
```



In [37]:
```
y_test.value_counts()
```

Out[37]:
```
0    929
1    364
Name: Prediction, dtype: int64
```

In [38]:
```
accuracy_score(y_test,y_pred)
```

Out[38]:
```
0.871616395978345
```

In [40]:
```
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 [46]:
```
error=[]
for k in range(1,41):
    knn=KNeighborsClassifier(n_neighbors=5)
    knn.fit(x_train,y_train)
    pred=knn.predict(x_test)
    error.append(np.mean(pred!=y_test))
error
```

Out[46]:
```
[0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
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 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508,
 0.12838360402165508]
```

In [51]:
```
svc = SVC(C=1.0,kernel='rbf',gamma='auto')
# C here is the regularization parameter. Here, L2 penalty is used(default). I
# As C increases, model overfits.
# Kernel here is the radial basis function kernel.
# gamma (only used for rbf kernel) : As gamma increases, model overfits.
svc.fit(x_train,y_train)
y_pred2 = svc.predict(x_test)
print("Accuracy Score for SVC : ", accuracy_score(y_pred,y_test))
```

```
Accuracy Score for SVC :  0.871616395978345
```

In [55]:
```
svc = SVC(C=1.0,kernel='linear',gamma='auto')

svc.fit(x_train,y_train)
y_pred2 = svc.predict(x_test)
print("Accuracy Score for SVC : ", accuracy_score(y_pred,y_test))
```

```
Accuracy Score for SVC :  0.871616395978345
```

In [56]:
```
svc = SVC(C=1.0,kernel='poly',gamma='auto')

svc.fit(x_train,y_train)
y_pred2 = svc.predict(x_test)
print("Accuracy Score for SVC : ", accuracy_score(y_pred,y_test))
```

```
Accuracy Score for SVC :  0.871616395978345
```

In [ ]:
```

```