Load Data Set

```
from numpy import NaN
import pandas as pd
df=pd.read_csv('/content/complaints_processed.csv',nrows=3000)
```

Drop irrelvant columns

```
df = df.drop(df.columns[0], axis=1)
```

Check null values

```
df.isna().sum()
```

```
product      0
narrative    1
dtype: int64
```

Drop rows with null values

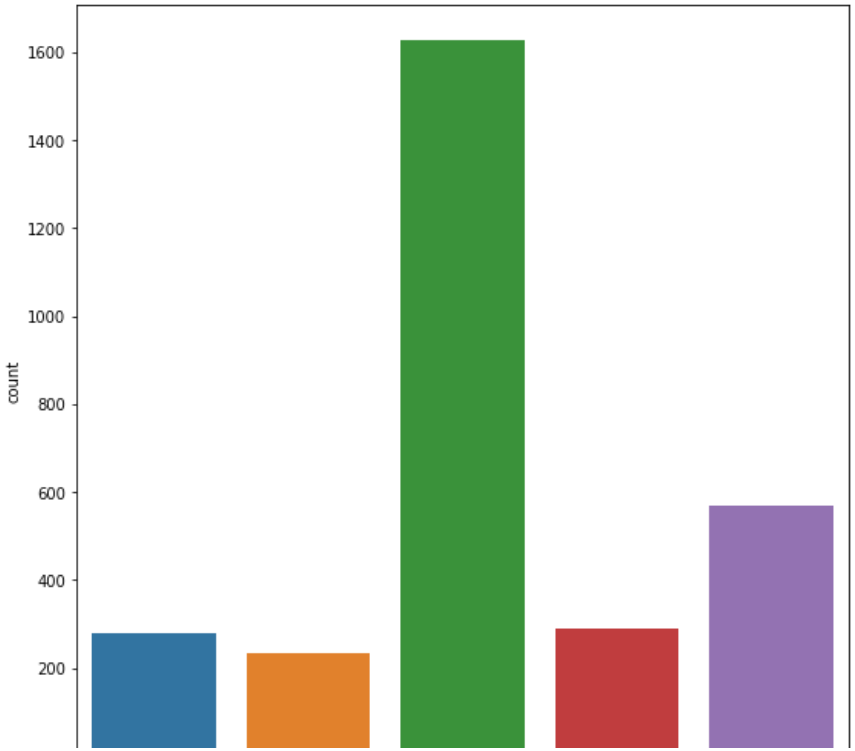
```
df=df[df['narrative'].notna()]
df.isna().sum()
```

```
product      0
narrative    0
dtype: int64
```

Countplot of feature labels

```
import warnings
warnings.filterwarnings('ignore')
df['product'].value_counts()
import matplotlib.pyplot as plt
plt.figure(figsize=(9,9))
import seaborn as sns
sns.countplot(df['product'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f963c366b50>
```



Remap labels from objects to integers

```
df['product']=df['product'].map({'credit_card':0,'retail_banking':1,'credit_reporting':2,'mortgages_and_loans':3,'debt_collection':4})
df['product'].value_counts()
```

```
2    1627
4     570
3     289
0     278
1     235
Name: product, dtype: int64
```

Remove special characters

```
message=df.narrative
message=message.str.replace('[^a-zA-Z0-9]+',' ')
message
```

```
0       purchase order day shipping amount receive pro...
1       forwarded message date tue subject please inve...
2       forwarded message cc sent friday pdt subject f...
3       payment history missing credit report speciali...
4       payment history missing credit report made mis...
                              ...
2995    account name account numberxxxx account type c...
2996    account name account number reason failed veri...
2997    account name original creditor status collecti...
2998    account name account numberxxxx account type c...
2999    account name account namestate farm bank accou...
Name: narrative, Length: 2999, dtype: object
```

Tokenize --> stem --> lowercase --> join the words

```
import nltk
from nltk.stem import SnowballStemmer
from nltk.tokenize import TweetTokenizer
tk=TweetTokenizer()
stem=SnowballStemmer('english')
message=message.apply(lambda x:[stem.stem(i.lower()) for i in tk.tokenize(x)]).apply(lambda x:' '.join(x))
message
```

```
0       purchas order day ship amount receiv product w...
1       forward messag date tue subject pleas investig...
2       forward messag cc sent friday pdt subject fina...
3       payment histori miss credit report special loa...
4       payment histori miss credit report made mistak...
                              ...
2995    account name account numberxxxx account type c...
2996    account name account number reason fail verifi...
2997    account name origin creditor status collect ac...
2998    account name account numberxxxx account type c...
2999    account name account namest farm bank account ...
Name: narrative, Length: 2999, dtype: object
```

fit & Transform

```
from sklearn.feature_extraction.text import TfidfVectorizer
vect=TfidfVectorizer()
train_vec=vect.fit_transform(message)
print(train_vec)
```

```
  (0, 261)      0.03145306185252639
  (0, 2720)     0.02704952269989653
  (0, 3779)     0.05950618268420057
  (0, 3139)     0.05950618268420057
  (0, 103)      0.044067533658794796
```

```
  (0, 2045)     0.06522326976512727
  (0, 104)      0.06856755132082676
  (0, 520)      0.0284200630194463
  (0, 3415)     0.07087509878555535
  (0, 689)      0.11123702921684842
  (0, 694)      0.022655527984966756
  (0, 781)      0.02432820403233156
  (0, 1838)     0.09192213335853189
  (0, 4315)     0.13284533943901608
  (0, 2944)     0.06547957390018924
  (0, 4627)     0.03529308136612153
  (0, 4827)     0.03597764105264088
  (0, 4504)     0.02442535489851529
  (0, 1465)     0.02546552388078634
  (0, 714)      0.1271208856401543
  (0, 4691)     0.03306756570457268
  (0, 4415)     0.023363169246372485
  (0, 1966)     0.025443381550226535
  (0, 3983)     0.12201994657526437
  (0, 4687)     0.0687842456634632
  :     :
  (2998, 57)    0.18653289449571084
  (2998, 3868)  0.027289917219063212
  (2998, 1138)  0.03470545775130207
  (2998, 3214)  0.07744957431161295
  (2998, 438)   0.10300857633595792
  (2998, 2624)  0.08063133035760622
  (2998, 4315)  0.065604459970339
  (2998, 714)   0.09416623596195439
  (2998, 276)   0.04600222649807095
  (2998, 5088)  0.03471532133467979
  (2998, 97)    0.0310976993770764
  (2998, 3244)  0.035320506839975264
  (2998, 3333)  0.043444764989330746
  (2998, 1425)  0.03251311995905314
  (2998, 2657)  0.07417566747465075
  (2998, 4173)  0.02734597061267396
  (2998, 3677)  0.03255607121023382
  (2998, 1202)  0.029607626332483566
  (2998, 3659)  0.0827504418898557
  (2998, 4881)  0.04164379479744037
  (2998, 2525)  0.06658880867470798
  (2998, 4205)  0.09124066468609442
  (2998, 928)   0.0988605057804725
  (2998, 3997)  0.02886979953061118
  (2998, 3889)  0.046666499729399784
```

Feature & Target

```
X=train_vec
y=df['product'].values
```

Train Test Split

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=.3,random_state=1)
```

Classifiers : SVC, MultinomialNB, RandomForestClassifier & AdaBoostClassifier

```
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from sklearn.ensemble import RandomForestClassifier,AdaBoostClassifier
svc=SVC()
mb=MultinomialNB()
rf=RandomForestClassifier()
ab=AdaBoostClassifier()
```

Classification report, **ConfusionMatrix & Predcition**

```
lst=[svc,mb,rf,ab]
from sklearn.metrics import classification_report,ConfusionMatrixDisplay
for i in lst:
  i.fit(X_train,y_train)
  y_pred=i.predict(X_test)
  y_sent=i.predict(vect.transform(['yes disputing sending publish government website also including copy driver license utility mail keep reporting updated also included cop
  print('Predicting sentence')
  if y_sent==[0]:
    print('credit_card')
  elif y_sent==[1]:
    print('retail_banking')
  elif y_sent==[2]:
    print('credit_reporting')
  elif y_sent==[3]:
    print('mortgages_and_loans')
  elif y_sent==[4]:
    print('debt_collection')
  else:
    print('doesnot belongs to any')
  print('*****************************')
  print(classification_report(y_test,y_pred))
  print('*****************************')
  print(ConfusionMatrixDisplay.from_predictions(y_test,y_pred))
```

```
    accuracy                           0.85       900
   macro avg       0.83      0.76      0.79       900
weighted avg       0.85      0.85      0.84       900

****************************
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at 0x7f963b274280>
Predicting sentence
credit_reporting
****************************
              precision    recall  f1-score   support

           0       1.00      0.02      0.04        88
           1       1.00      0.01      0.03        70
           2       0.56      1.00      0.72       485
           3       1.00      0.05      0.10        77
           4       0.81      0.14      0.24       180

    accuracy                           0.57       900
   macro avg       0.87      0.25      0.23       900
weighted avg       0.73      0.57      0.45       900

****************************
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at 0x7f9639f26550>
Predicting sentence
credit_reporting
****************************
              precision    recall  f1-score   support

           0       0.77      0.45      0.57        88
           1       0.80      0.73      0.76        70
           2       0.79      0.98      0.88       485
           3       0.84      0.66      0.74        77
           4       0.88      0.63      0.73       180

    accuracy                           0.81       900
   macro avg       0.82      0.69      0.74       900
weighted avg       0.81      0.81      0.80       900

****************************
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at 0x7f963b274280>
Predicting sentence
credit_reporting
```

```
           macro avg       0.71      0.65      0.67       900
        weighted avg       0.74      0.75      0.74       900

        ****************************
        <sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at 0x7f963b782d00>
```

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