Major Project

Sentiment Analysis

Sentiment analysis, also referred to as opinion mining, is an approach to natural language processing (NLP) that identifies the emotional tone behind a body of text. This is a popular way for organizations to determine and categorize opinions about a product, service, or idea.

It help organizations gather insights from unorganized and unstructured text that comes from online sources such as emails, blog posts, support tickets, web chats, social media channels, forums and comments. In addition to identifying sentiment, opinion mining can extract the polarity (or the amount of positivity and negativity), subject and opinion holder within the text

Twitter Sentiments

Tweets are often useful in generating a vast amount of sentiment data upon analysis. These data are useful in understanding the opinion of the people about a variety of topics.Twitter allows businesses to engage personally with consumers.

However, there's so much data on Twitter that it can be hard for brands to prioritize which tweets or mentions to respond to first.

That's why sentiment analysis has become a key instrument in social media marketing strategies.

preprocessing the data

```
import pandas as pd

df=pd.read_table("E:\Verzeo\Restaurant_Reviews.tsv")
df
```

```
                                                Review  Liked
0                            Wow... Loved this place.      1
1                                  Crust is not good.      0
2            Not tasty and the texture was just nasty.      0
3    Stopped by during the late May bank holiday of...      1
4    The selection on the menu was great and so wer...      1
..                                                 ...    ...
995  I think food should have flavor and texture an...      0
996                            Appetite instantly gone.      0
997  Overall I was not impressed and would not go b...      0
998  The whole experience was underwhelming, and I ...      0
```

```
999  Then, as if I hadn't wasted enough of my life ...      0

[1000 rows x 2 columns]
```

1 - positive review

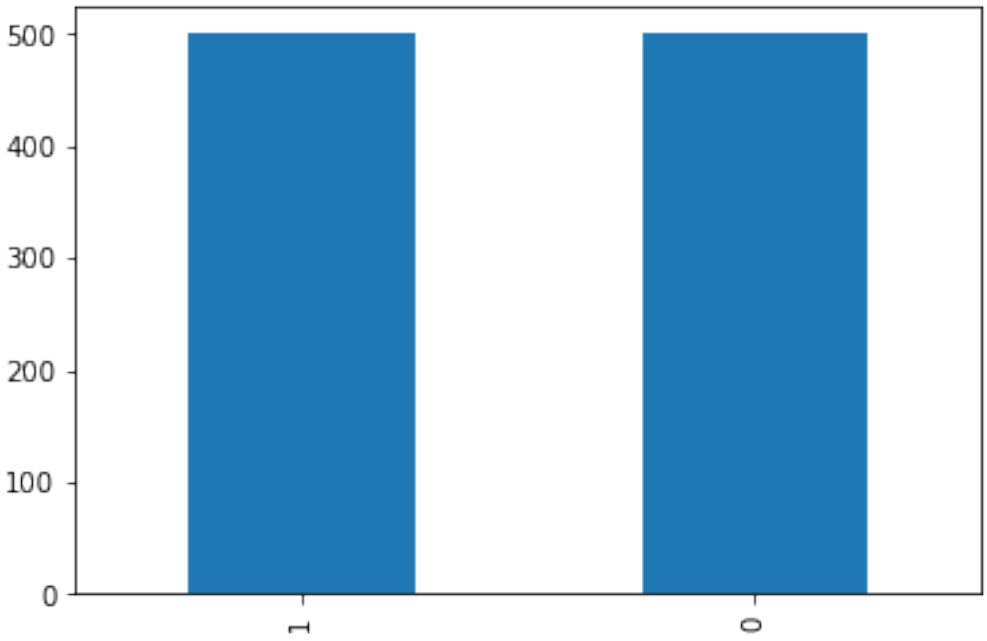
0 - negative review

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   Review  1000 non-null   object
 1   Liked   1000 non-null   int64 
dtypes: int64(1), object(1)
memory usage: 15.8+ KB
```

```
df['Liked'].value_counts().plot(kind='bar') # the dataset is balanced
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x15877d3de80>
```



I/O

```
x=df['Review'].values  # input data
y=df['Liked'].values   # output data
```

train_test_split

```
from sklearn.model_selection import train_test_split

x_train,x_test, y_train,y_test=train_test_split(x,y, random_state=0)

x_train.size

750

x_test.size

250

y_train.size

750

y_test.size

250
```

Count Vectorizer(Bag Of Words)

```
from sklearn.feature_extraction.text import CountVectorizer

count_vect=CountVectorizer(stop_words='english')

x_train_vect=count_vect.fit_transform(x_train)
x_test_vect=count_vect.transform(x_test)

x_train_vect.toarray()

array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 1, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]], dtype=int64)

x_test_vect.toarray()

array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]], dtype=int64)
```

Training and testing the model using SVM

```
from sklearn.svm import SVC

model1=SVC() # calling Support Vector Classifier

model1.fit(x_train_vect,y_train)

SVC()

y_pred1= model1.predict(x_test_vect)
y_pred1

array([0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0,
0,
       1, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0,
0,
       0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0,
       0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0,
0,
       1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 0,
0,
       0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0,
1,
       0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
1,
       0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0,
0,
       0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1,
1,
       0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0,
1,
       0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1,
1,
       1, 1, 0, 0, 1, 1, 0, 0], dtype=int64)

# x_test
```

Accuracy

```
from sklearn.metrics import accuracy_score
accuracy_score(y_pred1,y_test)

0.72
```

The accuracy score of SVM is 0.72

SVM with Pipeline

```
from sklearn.pipeline import make_pipeline

model2=make_pipeline(CountVectorizer(),SVC())

model2.fit(x_train,y_train) # training the model
```

```
Pipeline(steps=[('countvectorizer', CountVectorizer()), ('svc',
SVC())])
```

```
y_pred2=model2.predict(x_test)
y_pred2
```

```
array([0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0,
1,
       1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1,
0,
       0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0,
1,
       1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0,
0,
       1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0,
0,
       0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
1,
       0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1,
1,
       0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0,
0,
       0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1,
1,
       0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1,
1,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1,
1,
       1, 1, 0, 1, 1, 0, 0, 0], dtype=int64)
```

Accuracy

```
accuracy_score(y_pred2,y_test)
```

```
0.792
```

Therefore, the accuracy score of SVM with Pipeline is 0.792

Training and testing the model using Naive Bayes

```
from sklearn.naive_bayes import MultinomialNB
model3=MultinomialNB()
```

```
model3.fit(x_train_vect,y_train)
```

```
MultinomialNB()
```

```
y_pred3=model3.predict(x_test_vect)
y_pred3
```

```
array([1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0,
1,
```

```
       1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0,
0,
       0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1,
0,
       1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0,
0,
       0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0,
1,
       0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1,
1,
       1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0,
1,
       0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1,
1,
       0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 1,
1,
       0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1,
1,
       1, 1, 0, 1, 1, 1, 0, 0], dtype=int64)
```

Accuracy

```
accuracy_score(y_pred3, y_test)
```

```
0.744
```

The accuracy of Naive Bayes is 0.744

Naive Bayes with Pipeline

```
model4=make_pipeline(CountVectorizer(), MultinomialNB())

model4.fit(x_train,y_train) # training the model

Pipeline(steps=[('countvectorizer', CountVectorizer()),
                ('multinomialnb', MultinomialNB())])

y_pred4=model4.predict(x_test)
y_pred4
```

```
array([1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0,
0,
       1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 0,
0,
       0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0,
1,
       1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1,
0,
       1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0,
0,
       0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
```

```
1,
       0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1,
1,
       1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0,
1,
       0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1,
1,
       0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1,
1,
       0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1,
1,
       1, 1, 0, 1, 1, 1, 0, 0], dtype=int64)
```

Accuracy

```
accuracy_score(y_pred4,y_test)
```

```
0.784
```

Therefore, the accuracy score of Naive Bayes with Pipeline is 0.784

Creating the DataFrame for accuracies

```
accuracy1=[accuracy_score(y_pred1,y_test)]  #SVM
accuracy2=[accuracy_score(y_pred2,y_test)]  #SVM with Pipeline
accuracy3=[accuracy_score(y_pred3,y_test)]  #Naive Baes
accuracy4=[accuracy_score(y_pred4,y_test)]  #naive Bayes with Pipeline
```

```
dct={"model1":pd.Series(accuracy1,
["accuracy"]) ,"model2":pd.Series(accuracy2,["accuracy"]),
"model3":pd.Series(accuracy3,
["accuracy"]),"model4":pd.Series(accuracy4,["accuracy"])}
dct=pd.DataFrame(dct)
dct
```

```
          model1  model2  model3  model4
accuracy    0.72   0.792   0.744   0.784
```

SVM with Pipeline(model2) has highest accuracy of 0.792

Saving the model with highest accuracy using "joblib"

```
import joblib
```

```
joblib.dump(model2,"sentiment analysis")
```

```
['sentiment analysis']
```

loading the file containg saved model

```
import joblib
saved_model=joblib.load("sentiment analysis")
```

predicting the output

```
print(saved_model.predict(["service at your restuarant is good"]))
```

```
[1]
```

1 - indicates "positive" review

```
print(saved_model.predict(["service at your restuarant sucks"]))
```

```
[0]
```

0 - indicates "negative" review