Project_03_Sentiment Analysis IMDB Dataset

https://www.kaggle.com/code/lakshmi25npathi/sentiment-analysis-of-imdb-movie-reviews (https://www.kaggle.com/code/lakshmi25npathi/sentiment-analysis-of-imdb-movie-reviews)

In [1]:

```
import numpy as np
import pandas as pd
import nltk
from nltk.sentiment.vader import SentimentIntensityAnalyzer
import re
from textblob import TextBlob
from wordcloud import WordCloud
import seaborn as sns
import matplotlib.pyplot as plt
import cufflinks as cf
%matplotlib inline
from plotly.offline import init_notebook_mode, iplot
init_notebook_mode(connected = True)
cf.go_offline();
import plotly.graph_objs as go
from plotly.subplots import make_subplots

import warnings
warnings.filterwarnings('ignore')
warnings.warn('this will not show')

pd.set_option('display.max_columns', None)


from nltk.corpus import stopwords
from nltk.stem import SnowballStemmer
from sklearn.feature_extraction.text import CountVectorizer

from collections import Counter
from numpy import where

from imblearn.over_sampling import SMOTE
from sklearn.decomposition import PCA

from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import StandardScaler

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay
from sklearn import metrics

from scipy.sparse import hstack, vstack

from prettytable import PrettyTable
from scipy.stats import loguniform # Log-uniform is useful for searching
from sklearn.model_selection import RepeatedStratifiedKFold, RandomizedSe
```

```
C:\ProgramData\anaconda3\Lib\site-packages\paramiko\transport.py:219: Crypto
graphyDeprecationWarning:

Blowfish has been deprecated
```

In [2]:

```
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\blues\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

Out[2]:

```
True
```

In [3]:

```
nltk.download('punkt')
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\blues\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

Out[3]:

```
True
```

In [4]:

```
df = pd.read_csv("IMDB Dataset.csv", delimiter=',', engine='python', enco
df.head()
```

Out[4]:

	review	sentiment
0	One of the other reviewers has mentioned that ...	positive
1	A wonderful little production. <br /><br />The...	positive
2	I thought this was a wonderful way to spend ti...	positive
3	Basically there's a family where a little boy ...	negative
4	Petter Mattei's "Love in the Time of Money" is...	positive

In [5]:

```
df.shape
```

Out[5]:

```
(50000, 2)
```

In [6]:

```
# Limiting current dataset to 10000 rows
df = df[:10000]
```

In [7]:

```
print('No. of datapoints/rows: {}'.format(df.shape[0]))
print('No. of features/columns: {}'.format(df.shape[1]))
```

```
No. of datapoints/rows: 10000
No. of features/columns: 2
```

In [8]:

```
print("Feature names: \n{}".format(df.columns))
```

```
Feature names: 
Index(['review', 'sentiment'], dtype='object')
```

In [9]:

```
#Check null and missing values
# Calculate the number of missing values in each column using isna()
df.isna().sum()
```

Out[9]:

```
review       0
sentiment    0
dtype: int64
```

In [10]:

```
# Calculate the number of missing values in each column
df.isnull().sum()
```

Out[10]:

```
review       0
sentiment    0
dtype: int64
```

In [11]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   review     10000 non-null  object
 1   sentiment  10000 non-null  object
dtypes: object(2)
memory usage: 156.4+ KB
```

In [12]:

```
# Check original shape of the dataset
df.shape
```

Out[12]:

```
(10000, 2)
```

In [13]:

```
df['sentiment'].value_counts()
```

Out[13]:

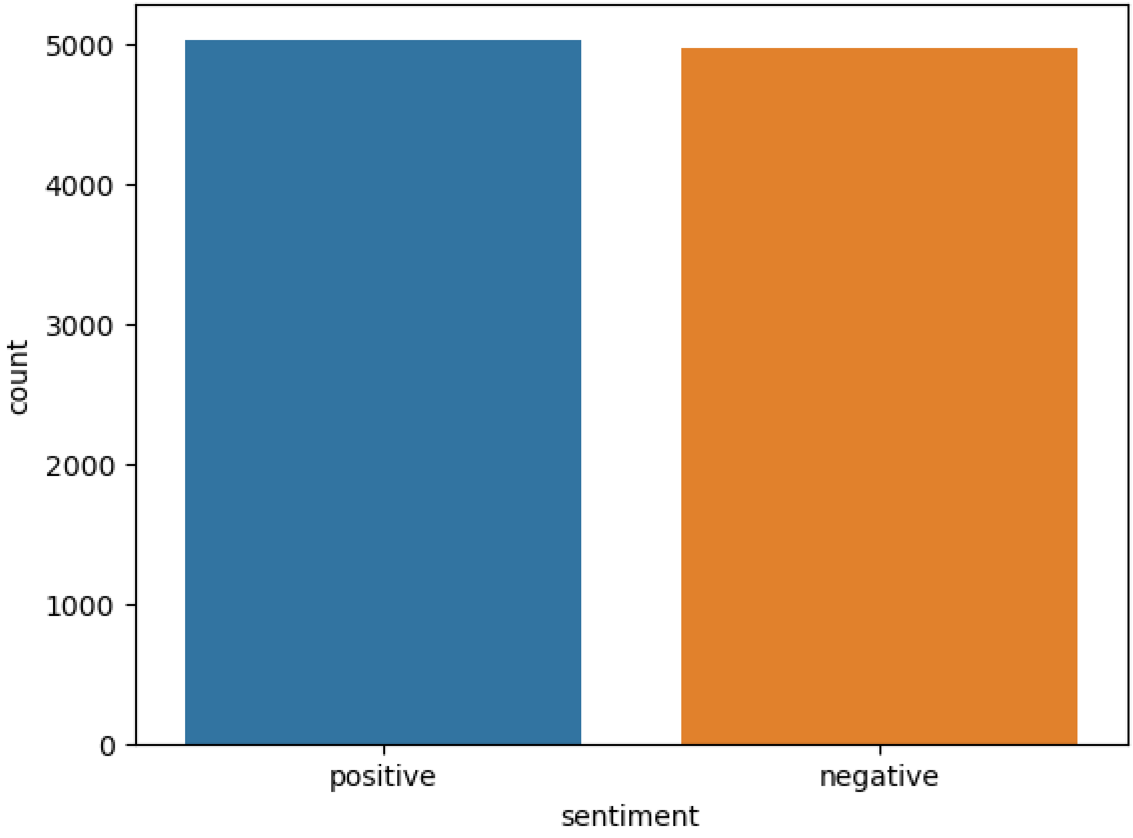
```
positive    5028
negative    4972
Name: sentiment, dtype: int64
```

In [14]:

```python
import seaborn as sns
sns.countplot(x='sentiment',data=df)
```

Out[14]:

```
<Axes: xlabel='sentiment', ylabel='count'>
```



In [15]:

```python
positive_review=list(df[df['sentiment']=='positive']['review'])[:100]
negative_review=list(df[df['sentiment']=='negative']['review'])[:100]
```

In [16]:

```
from wordcloud import WordCloud,STOPWORDS
from matplotlib import pyplot as plt
stopwords=set(STOPWORDS)
stopwords
```

Out[16]:

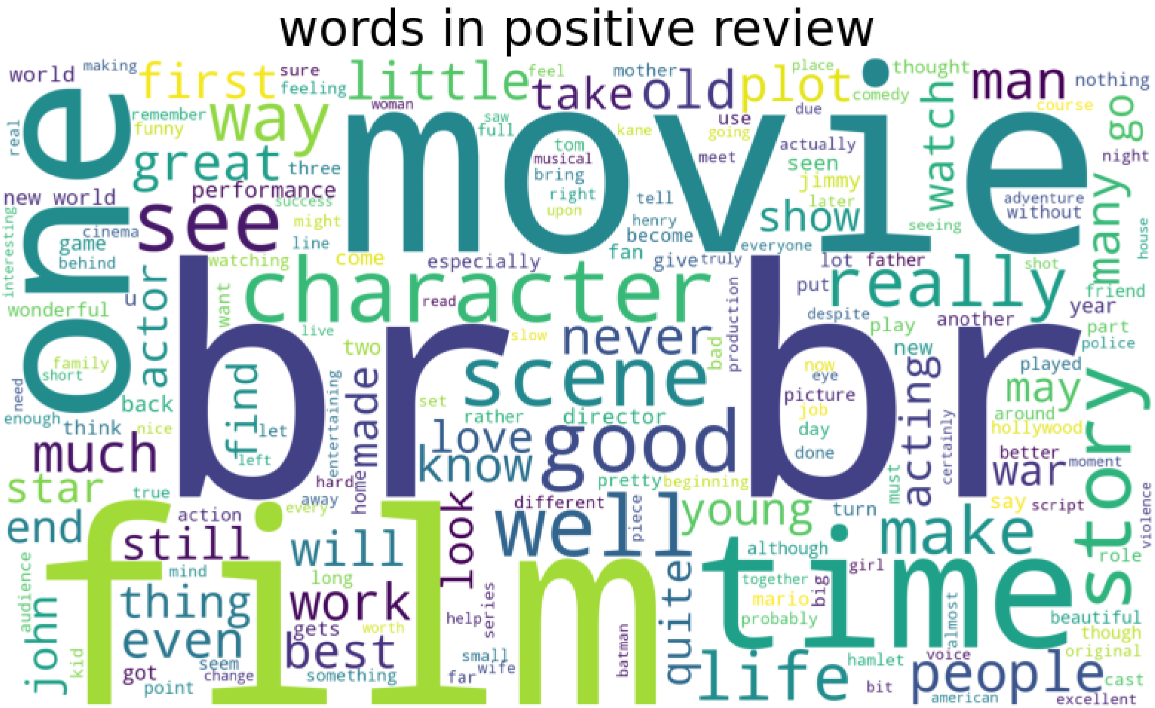
```
{'a',
 'about',
 'above',
 'after',
 'again',
 'against',
 'all',
 'also',
 'am',
 'an',
 'and',
 'any',
 'are',
 "aren't",
 'as',
 'at',
 'be',
 'because',
 'been',
```

In [17]:

```
def create_cloud(string, title=None):
    cloud = WordCloud(height=1080,
                      width=1920,
                      background_color='white',
                      min_font_size=10,
                      stopwords=STOPWORDS).generate(string)
    plt.figure(figsize=(10,20))
    plt.imshow(cloud)
    plt.axis("off")
    if title:
        plt.title(title, fontdict={'fontsize':24})
    plt.show()
```

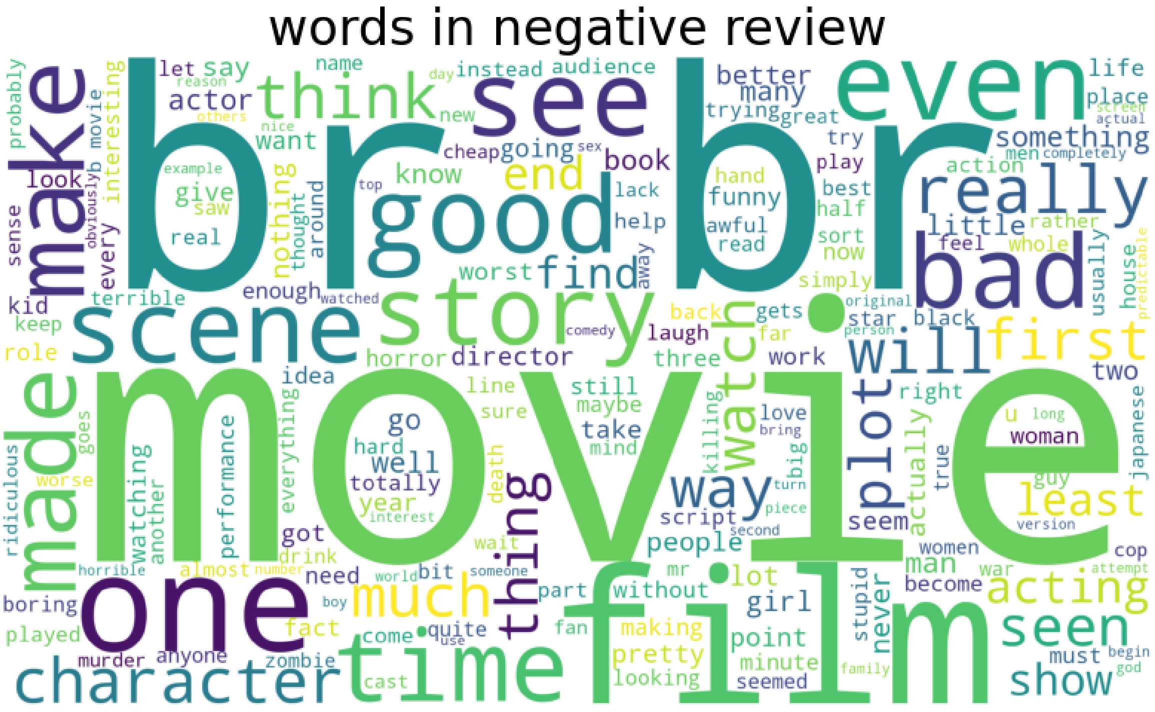
In [18]:

```
create_cloud(' '.join(positive_review).lower(),'words in positive review')
```



In [19]:

```
create_cloud(' '.join(negative_review).lower(),'words in negative review')
```



In [20]:

```
def text_processing(data):
    from bs4 import BeautifulSoup
    import re
    def decontracted(phrase):
        # specific
        phrase= re.sub(r'<br /><br />',' ',phrase)
        phrase = re.sub(r"won't", "will not", phrase)
        phrase = re.sub(r"can\'t", "can not", phrase)

        # general
        phrase = re.sub(r"n\'t", " not", phrase)
        phrase = re.sub(r"\'re", " are", phrase)
        phrase = re.sub(r"\'s", " is", phrase)
        phrase = re.sub(r"\'d", " would", phrase)
        phrase = re.sub(r"\'ll", " will", phrase)
        phrase = re.sub(r"\'t", " not", phrase)
        phrase = re.sub(r"\'ve", " have", phrase)
        phrase = re.sub(r"\'m", " am", phrase)
        phrase = re.sub(r'"', " ", phrase)
        return phrase
    stopwords=set(STOPWORDS)

    # Combining all the above sentence
    from tqdm import tqdm
    preprocessed_reviews = []
    # tqdm is for printing the status bar
    for sentance in tqdm(data['review'].values):
        sentance = re.sub(r"http\S+", "", sentance)
        sentance = BeautifulSoup(sentance, 'lxml').get_text()
        sentance = decontracted(sentance)
        sentance = re.sub("\S*\d\S*", "", sentance).strip()
        # https://gist.github.com/sebleier/554280
        sentance = ' '.join(e.lower() for e in sentance.split() if e not
        preprocessed_reviews.append(sentance.strip())

    from nltk.stem import PorterStemmer

    porter = PorterStemmer()
    list_of_sentence=[]
    for  sentence in preprocessed_reviews:
        words_in_sentence=[]
        for words in sentence.split():
            words_in_sentence.append(porter.stem(words))

        list_of_sentence.append(' '.join(words_in_sentence))
    return(list_of_sentence)
```

In [21]:

```
x=text_processing(df[:5000])
```

```
100%|██████████████████████████████████████████████████
████| 5000/5000 [00:02<00:00, 2345.01it/s]
```

In [22]:

```python
df = df[:5000]
```

In [23]:

```python
df['cleaned_review']=x
```

In [24]:

```python
df.head()
```

Out[24]:

	review	sentiment	cleaned_review
0	One of the other reviewers has mentioned that ...	positive	one review mention watch oz episod will hooked...
1	A wonderful little production. <br /><br />The...	positive	a wonder littl production. the film techniqu u...
2	I thought this was a wonderful way to spend ti...	positive	i thought wonder way spend time hot summer wee...
3	Basically there's a family where a little boy ...	negative	basic famili littl boy (jake) think zombi clos...
4	Petter Mattei's "Love in the Time of Money" is...	positive	petter mattei love time money visual stun film...

In [25]:

```python
X = df['cleaned_review']
Y = df['sentiment']
```

In [26]:

```python
Y = list(Y)
for i in range(len(Y)):
    if Y[i]=='positive':
        Y[i]=1
    else:
        Y[i]=0

df['sentiment_score']=Y

Y=df['sentiment_score']
```

In [27]:

```
df
```

Out[27]:

	review	sentiment	cleaned_review	sentiment_score
0	One of the other reviewers has mentioned that ...	positive	one review mention watch oz episod will hooked...	1
1	A wonderful little production. <br /><br />The...	positive	a wonder littl production. the film techniqu u...	1
2	I thought this was a wonderful way to spend ti...	positive	i thought wonder way spend time hot summer wee...	1
3	Basically there's a family where a little boy ...	negative	basic famili littl boy (jake) think zombi clos...	0
4	Petter Mattei's "Love in the Time of Money" is...	positive	petter mattei love time money visual stun film...	1
...	...	...	...	...
4995	An interesting slasher film with multiple susp...	negative	an interest slasher film multipl suspects.incl...	0
4996	i watched this series when it first came out i...	positive	watch seri first came year old watch best frie...	1
4997	Once again Jet Li brings his charismatic prese...	positive	onc jet li bring charismat presenc movi screen...	1
4998	I rented this movie, after hearing Chris Gore ...	negative	i rent movie, hear chri gore say someth effect...	0
4999	This was a big disappointment for me. I think ...	negative	thi big disappoint me. i think worst mastroian...	0

5000 rows × 4 columns

In [28]:

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(
    X[:5000], Y[:5000], test_size=0.3, random_state=0)
```

In [29]:

```
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

Out[29]:

```
((3500,), (1500,), (3500,), (1500,))
```

In [30]:

```
X_train
```

Out[30]:

```
2858    thi film littl recommend it, though littl brea...
1559    thi kind inspir saccharin enough make sick. it...
1441    i confess i know involved, i forerunn the plan...
2179    thi movi delic argument search someth make thi...
1390    there dvd publish uk code cover, asin, vfc dis...
                              ...                        
4931    françoi villon real-lif poet rogu live pari ce...
3264    i want one - situat rich, set unusu interestin...
1653    yeah, sum up. thi movi horrifying. two minut i...
2607    i honest, i realli good time watch she man. de...
2732    ag excel present drama, suspens thriller rare ...
Name: cleaned_review, Length: 3500, dtype: object
```

In [31]:

```
list(y_test).count(0)
```

Out[31]:

```
777
```

In [32]:

```
from sklearn.feature_extraction.text import CountVectorizer

vectorizer = CountVectorizer()
X_train_bow = vectorizer.fit_transform(X_train)
X_test_bow = vectorizer.transform(X_test)
```

In [33]:

```
X_train_bow.shape,X_test_bow.shape
```

Out[33]:

```
((3500, 30112), (1500, 30112))
```

In [34]:

```
X_train.shape
```

Out[34]:

```
(3500,)
```

1. KNN

In [35]:

```python
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score, f1_score
for i in range(25,30):

    print('K',i)

    # initialization
    neigh = KNeighborsClassifier(n_neighbors=i)

    # Training
    neigh.fit(X_train_bow, y_train)

    # Test the training data
    y_pred_train = neigh.predict(X_train_bow)
    accuracy_train = accuracy_score(y_pred_train,y_train)
    f1_train = f1_score(y_pred_train,y_train)

    # Test the test data
    y_pred_test = neigh.predict(X_test_bow)
    accuracy_test = accuracy_score(y_pred_test,y_test)
    f1_test = f1_score(y_pred_test,y_test)

    print(accuracy_train,accuracy_test)
    print(f1_train,f1_test)
    print()
```

```
K 25
0.7245714285714285 0.6406666666666667
0.7169700528479155 0.6254343293954134

K 26
0.7102857142857143 0.634
0.6805293005671077 0.5887640449438202

K 27
0.7222857142857143 0.644
0.7136122569239836 0.6307053941908713

K 28
0.7077142857142857 0.6493333333333333
0.680811232449298 0.6120943952802359

K 29
0.7131428571428572 0.6506666666666666
0.7079697498545666 0.6401098901098901
```

In [ ]:

```python
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
from sklearn.metrics import f1_score

# initialization
neigh = KNeighborsClassifier(n_neighbors=28)

# Training
neigh.fit(X_train_bow, y_train)

# Test the training data
y_pred_train = neigh.predict(X_train_bow)
accuracy_train = accuracy_score(y_pred_train,y_train)
f1_train = f1_score(y_pred_train,y_train)


# Test the test data
y_pred_test = neigh.predict(X_test_bow)
accuracy_test = accuracy_score(y_pred_test,y_test)
f1_test = f1_score(y_pred_test,y_test)


print(accuracy_train,accuracy_test)
print(f1_test,f1_test)
```

In [36]:

```python
from sklearn.metrics import classification_report
target_names = ['Postive', 'Negative']
print(classification_report(y_pred_test, y_test, target_names=target_name
print(classification_report(y_pred_train, y_train, target_names=target_na
```

```
              precision    recall  f1-score   support

     Postive       0.66      0.66      0.66       767
    Negative       0.64      0.64      0.64       733

    accuracy                           0.65      1500
   macro avg       0.65      0.65      0.65      1500
weighted avg       0.65      0.65      0.65      1500

              precision    recall  f1-score   support

     Postive       0.73      0.71      0.72      1807
    Negative       0.70      0.72      0.71      1693

    accuracy                           0.71      3500
   macro avg       0.71      0.71      0.71      3500
weighted avg       0.71      0.71      0.71      3500
```

In [37]:

```
from sklearn.metrics import confusion_matrix
c= confusion_matrix(y_pred_train, y_train)
c
```

Out[37]:

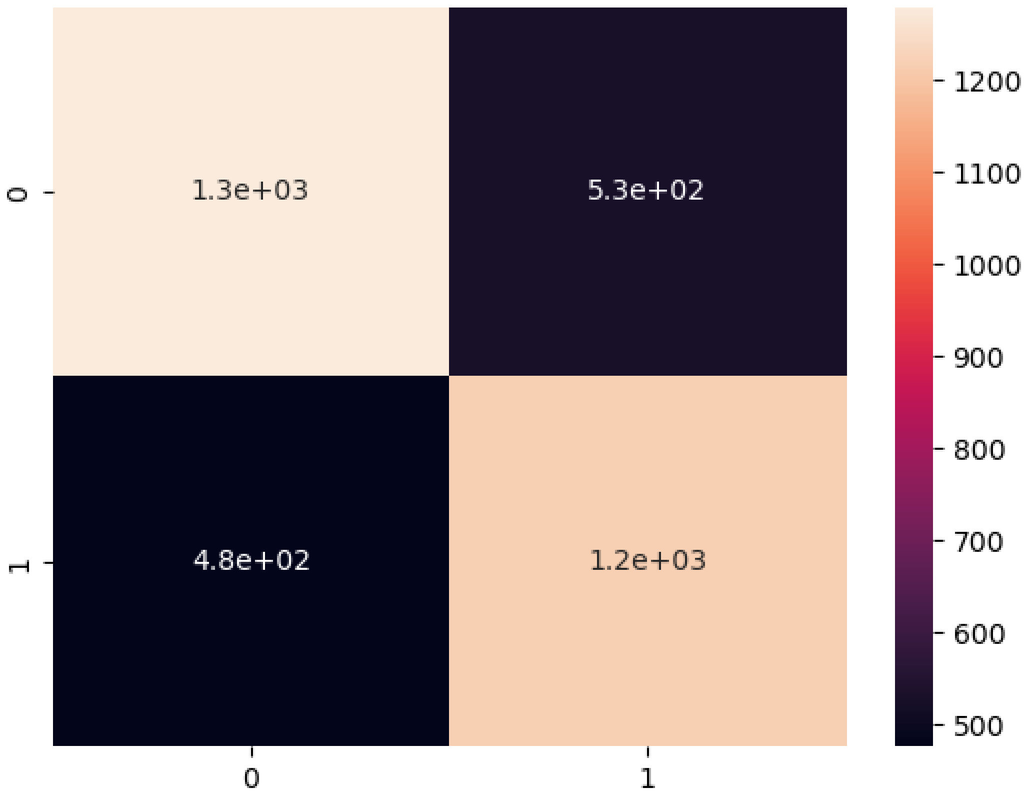
```
array([[1279,  528],
       [ 476, 1217]], dtype=int64)
```

In [38]:

```
import seaborn as sns
sns.heatmap(c, annot=True)
```

Out[38]:

```
<Axes: >
```



In [39]:

```
from sklearn.model_selection import GridSearchCV

parameters = {'n_neighbors':list(range(10,30,2))}
neigh = KNeighborsClassifier()

clf = GridSearchCV(neigh, parameters)
clf.fit(X_train_bow, y_train)
```

Out[39]:

```
GridSearchCV(estimator=KNeighborsClassifier(),
             param_grid={'n_neighbors': [10, 12, 14, 16, 18, 20, 22, 24, 26,
                                         28]})
```

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 [40]:

```
clf.best_params_
```

Out[40]:

```
{'n_neighbors': 28}
```

In [41]:

```
neigh = KNeighborsClassifier(n_neighbors=10, p=2)
neigh.fit(X_train_bow, y_train)

y_pred_train = clf.predict(X_train_bow)
f1_train = f1_score(y_pred_train,y_train)
print(f1_train)
print(classification_report(y_pred_train, y_train, target_names=target_na
```

```
0.680811232449298
              precision    recall  f1-score   support

     Postive       0.79      0.68      0.73      2040
    Negative       0.63      0.75      0.68      1460

    accuracy                           0.71      3500
   macro avg       0.71      0.71      0.71      3500
weighted avg       0.72      0.71      0.71      3500
```

In [42]:

```
y_pred_test = clf.predict(X_test_bow)
f1_test = f1_score(y_pred_test,y_test)
print(f1_test)
print(classification_report(y_pred_test, y_test, target_names=target_name
```

```
0.6120943952802359
              precision    recall  f1-score   support

     Postive       0.72      0.64      0.68       867
    Negative       0.57      0.66      0.61       633

    accuracy                           0.65      1500
   macro avg       0.65      0.65      0.65      1500
weighted avg       0.66      0.65      0.65      1500
```

2. Decision Tree

In [43]:

```
from sklearn.tree import DecisionTreeClassifier
clf = DecisionTreeClassifier()
clf.fit(X_train_bow, y_train)
DecisionTreeClassifier()
y_pred = clf.predict(X_test_bow)
accuracy = metrics.accuracy_score(y_test, y_pred)
accuracy
```

Out[43]:

```
0.682
```

3. Random Forest

In [44]:

```
from sklearn.ensemble import RandomForestClassifier
rf_classifier = RandomForestClassifier(n_estimators=100,
random_state=42)
rf_classifier.fit(X_train_bow, y_train)
RandomForestClassifier(random_state=42)
y_pred = rf_classifier.predict(X_test_bow)
accuracy = metrics.accuracy_score(y_test, y_pred)
accuracy
```

Out[44]:

```
0.828
```

4. Boosting Algorithm

In [45]:

```
from sklearn.ensemble import AdaBoostClassifier
base_classifier = DecisionTreeClassifier(max_depth=3)
adaboost_classifier = AdaBoostClassifier(base_classifier,
n_estimators=50, random_state=42)
adaboost_classifier.fit(X_train_bow, y_train)
AdaBoostClassifier(estimator=DecisionTreeClassifier(max_depth=1),
random_state=42)
y_pred = adaboost_classifier.predict(X_test_bow)
accuracy = metrics.accuracy_score(y_test, y_pred)
accuracy
```

Out[45]:

```
0.7646666666666667
```

Boosting Algorithm is the best accuracy

In [47]:

```
accuracy
```

Out[47]:

```
0.7646666666666667
```

In [ ]:

```

```

5. Naive Bayes classifier

In [49]:

```
from sklearn.naive_bayes import GaussianNB
from sklearn.naive_bayes import BernoulliNB
from sklearn.naive_bayes import MultinomialNB
from sklearn import metrics
```

In [59]:

```
# BernoulliNB
B_classifier = BernoulliNB()
B_classifier.fit(X_train_bow, y_train)
BernoulliNB()
predictions_B = B_classifier.predict(X_test_bow)
accuracy_B = metrics.accuracy_score(y_test, predictions_B)
accuracy_B
```

Out[59]:

```
0.816
```

6. Logistic Regression

In [46]:

```
from sklearn import linear_model
lrg = linear_model.LogisticRegression()
lrg.fit(X_train_bow, y_train)
LogisticRegression()
lrg.score(X_test_bow, y_test)
```

Out[46]:

```
0.8513333333333334
```

In [ ]:

```

```