Importing Libraries

In [1]:
```
import numpy as np
import pandas as pd
import re

# Modules for visualization
import matplotlib.pyplot as plt
import seaborn as sb

from sklearn.naive_bayes import GaussianNB
from sklearn.ensemble import RandomForestClassifier
from sklearn import tree
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report

# Tools for preprocessing input data
from bs4 import BeautifulSoup
from nltk import word_tokenize
from nltk.corpus import stopwords
import nltk
from sklearn.feature_extraction.text import CountVectorizer
from nltk.stem.porter import PorterStemmer
from nltk.stem import WordNetLemmatizer
import gensim
```

Loading Data

In [2]:
```
data = pd.read_csv(r'C:\Users\vamsi\Desktop\M.Tech\ML\19 Projects\sentiment_data.
#data = data[:2000]
```

In [3]:
```
data.head()
```

Out[3]:

	id	sentiment	review
0	5814_8	1	With all this stuff going down at the moment w...
1	2381_9	1	\The Classic War of the Worlds\" by Timothy Hi...
2	7759_3	0	The film starts with a manager (Nicholas Bell)...
3	3630_4	0	It must be assumed that those who praised this...
4	9495_8	1	Superbly trashy and wondrously unpretentious 8...

In [4]:
```
data.describe()
```

Out[4]:

	sentiment
count	25000.00000
mean	0.50000
std	0.50001
min	0.00000
25%	0.00000
50%	0.50000
75%	1.00000
max	1.00000

In [5]:
```
data = data.drop(['id'], axis=1)
```

In [6]:
```
data.head()
```

Out[6]:

	sentiment	review
0	1	With all this stuff going down at the moment w...
1	1	\The Classic War of the Worlds\" by Timothy Hi...
2	0	The film starts with a manager (Nicholas Bell)...
3	0	It must be assumed that those who praised this...
4	1	Superbly trashy and wondrously unpretentious 8...

In [7]:
```
data.shape
```

Out[7]:
```
(25000, 2)
```

Processing Message

In [8]:
```
def processing(review):

    # Remove email addresses with 'emailaddr'
    raw_review = re.sub('\b[\w\-.]+?@\w+?\.\w{2,4}\b', " ", review)

    # Remove URLs with 'httpaddr'
    raw_review = re.sub('(http[s]?\S+)|(\w+\.[A-Za-z]{2,4}\S*)', " ", raw_review)

    # Remove non-letters
    raw_review = re.sub("[^a-zA-Z]", " ", raw_review)

    # Remove numbers
    raw_review = re.sub('\d+(\.\d+)?', " ", raw_review)

    # Convert to lower case, split into individual words
    words = raw_review.lower().split()

    # Gather the list of stopwords in English Language
    stops = set(stopwords.words("english"))

    # Remove stop words and stemming the remaining words
    meaningful_words = [ps.stem(w) for w in words if not w in stops]

    # Join the tokens back into one string separated by space,
    # and return the result.
    return( " ".join( meaningful_words ))
```

In [9]:
```
# Corpus
clean_reviews_corpus = []

# Porter Stemmer
ps = PorterStemmer()
```

In [10]:
```
# No. of Reviews
review_count = data['review'].size
review_count
```

Out[10]: 25000

In [11]:
```
for i in range( 0, review_count):
    clean_reviews_corpus.append(processing(data["review"][i]))
```

In [12]:
```
print ("Original Text : \n")
data["review"][0]
```

```
Original Text :
```

Out[12]:
```
"With all this stuff going down at the moment with MJ i've started listening to
his music, watching the odd documentary here and there, watched The Wiz and wat
ched Moonwalker again. Maybe i just want to get a certain insight into this guy
who i thought was really cool in the eighties just to maybe make up my mind whe
ther he is guilty or innocent. Moonwalker is part biography, part feature film
which i remember going to see at the cinema when it was originally released. So
me of it has subtle messages about MJ's feeling towards the press and also the
obvious message of drugs are bad m'kay.<br /><br />Visually impressive but of c
ourse this is all about Michael Jackson so unless you remotely like MJ in anywa
y then you are going to hate this and find it boring. Some may call MJ an egoti
st for consenting to the making of this movie BUT MJ and most of his fans would
say that he made it for the fans which if true is really nice of him.<br /><br
/>The actual feature film bit when it finally starts is only on for 20 minutes
or so excluding the Smooth Criminal sequence and Joe Pesci is convincing as a p
sychopathic all powerful drug lord. Why he wants MJ dead so bad is beyond me. B
ecause MJ overheard his plans? Nah, Joe Pesci's character ranted that he wanted
people to know it is he who is supplying drugs etc so i dunno, maybe he just ha
tes MJ's music.<br /><br />Lots of cool things in this like MJ turning into a c
ar and a robot and the whole Speed Demon sequence. Also, the director must have
had the patience of a saint when it came to filming the kiddy Bad sequence as u
sually directors hate working with one kid let alone a whole bunch of them perf
orming a complex dance scene.<br /><br />Bottom line, this movie is for people
who like MJ on one level or another (which i think is most people). If not, the
n stay away. It does try and give off a wholesome message and ironically MJ's b
estest buddy in this movie is a girl! Michael Jackson is truly one of the most
talented people ever to grace this planet but is he guilty? Well, with all the
attention i've gave this subject....hmmm well i don't know because people can b
e different behind closed doors, i know this for a fact. He is either an extrem
ely nice but stupid guy or one of the most sickest liars. I hope he is not the
latter."
```

In [13]:
```
print ("Processed Text : \n")

clean_reviews_corpus[:1]
```

```
Processed Text :
```

Out[13]:
```
['stuff go moment mj start listen music watch odd documentari watch wiz watch m
oonwalk mayb want get certain insight guy thought realli cool eighti mayb make
mind whether guilti innoc moonwalk part biographi part featur film rememb go se
e cinema origin releas subtl messag mj feel toward press also obviou messag dru
g bad kay br br visual impress cours michael jackson unless remot like mj anywa
y go hate find bore may call mj egotist consent make movi mj fan would say made
fan true realli nice br br actual featur film bit final start minut exclud smoo
th crimin sequenc joe pesci convinc psychopath power drug lord want mj dead bad
beyond mj overheard plan nah joe pesci charact rant want peopl know suppli drug
etc dunno mayb hate mj music br br lot cool thing like mj turn car robot whole
speed demon sequenc also director must patienc saint came film kiddi bad sequen
c usual director hate work one kid let alon whole bunch perform complex danc sc
ene br br bottom line movi peopl like mj one level anoth think peopl stay away
tri give wholesom messag iron mj bestest buddi movi girl michael jackson truli
one talent peopl ever grace planet guilti well attent gave subject hmmm well kn
ow peopl differ behind close door know fact either extrem nice stupid guy one s
ickest liar hope latter']
```

Preparing Vectors for each message

In [14]:
```
cv = CountVectorizer()
data_input = cv.fit_transform(clean_reviews_corpus)
data_input = data_input.toarray()
```

In [15]:
```
data_input[0]
```

Out[15]:
```
array([0, 0, 0, ..., 0, 0, 0], dtype=int64)
```

In [16]:
```
data_input.size
```

Out[16]:
```
1237075000
```

Creating WordCloud

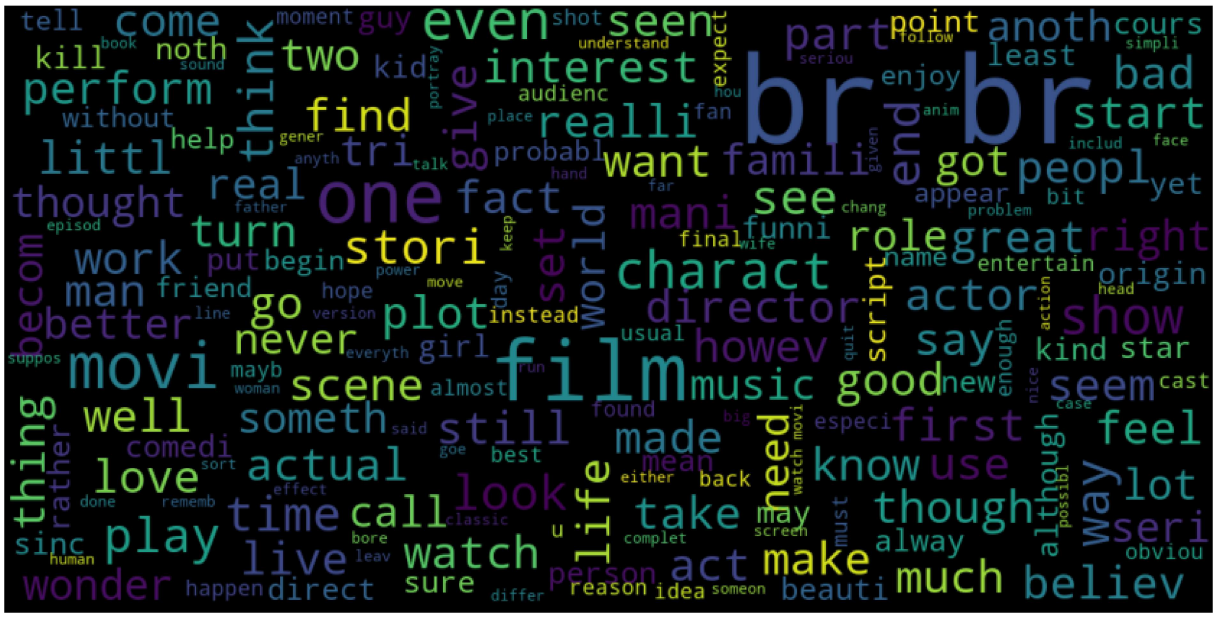
In [17]:
```
from wordcloud import WordCloud, STOPWORDS
stopwords = set(STOPWORDS)

def show_wordcloud(data, title = None):
    wordcloud = WordCloud(background_color='black', stopwords=stopwords,
        max_words=200,
        max_font_size=40,
        scale=3,
        random_state=1 # chosen at random by flipping a coin; it was heads
).generate(str(data))

    fig = plt.figure(1, figsize=(15, 15))
    plt.axis('off')
    if title:
        fig.suptitle(title, fontsize=20)
        fig.subplots_adjust(top=2.3)

    plt.imshow(wordcloud)
    plt.show()

show_wordcloud(clean_reviews_corpus)
```



Applying Classification

- **Input** = Prepared Sparse Matrix / Vectors for each message

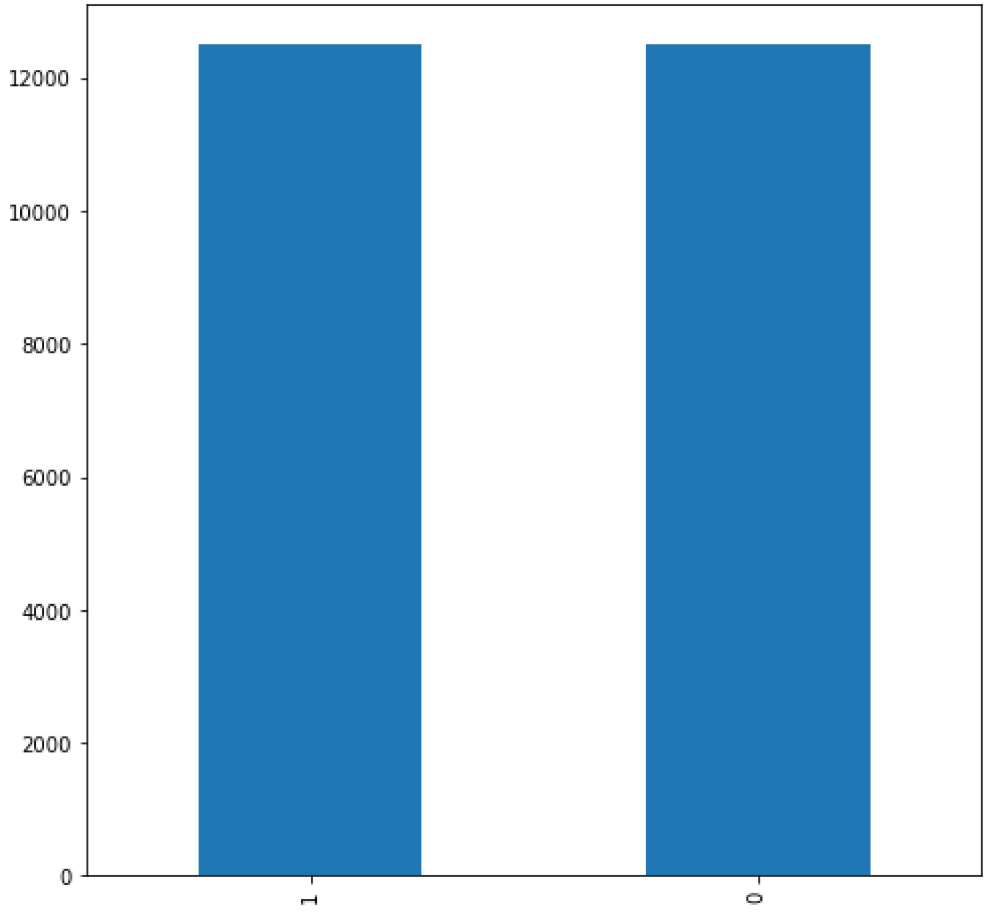
- **Output** = Negative or Positive Sentiment

In [18]:
```
data_output = data['sentiment']
print (data_output.value_counts())
```

```
1    12500
0    12500
Name: sentiment, dtype: int64
```

In [19]:
```
plt.figure(figsize = (8, 8))
data['sentiment'].value_counts().plot.bar()
```

Out[19]: <AxesSubplot:>



Splitting data for Training and Testing

In [20]:
```
from sklearn.model_selection import train_test_split
train_x, test_x, train_y, test_y = train_test_split(data_input, data_output,test_
```

Preparing ML Models

Training

In [21]:
```
model_nvb = GaussianNB()
model_nvb.fit(train_x, train_y)

model_rf = RandomForestClassifier(n_estimators=1000, random_state=0)
model_rf.fit(train_x, train_y)

model_dt = tree.DecisionTreeClassifier()
model_dt.fit(train_x, train_y)
```

Out[21]:
```
DecisionTreeClassifier()
```

Prediction

In [22]:
```
prediction_nvb = model_nvb.predict(test_x)
prediction_rf = model_rf.predict(test_x)
prediction_dt = model_dt.predict(test_x)
```

Results Naive Bayes

In [23]:
```
print ("Accuracy for Naive Bayes : %0.5f \n\n" % accuracy_score(test_y, predictio
print ("Classification Report Naive bayes: \n", classification_report(test_y, pre
```

```
Accuracy for Naive Bayes : 0.66120


Classification Report Naive bayes:
               precision    recall  f1-score   support

           0       0.63      0.82      0.71      2548
           1       0.72      0.50      0.59      2452

    accuracy                           0.66      5000
   macro avg       0.68      0.66      0.65      5000
weighted avg       0.68      0.66      0.65      5000
```

Results Decision Tree

In [24]:
```
print ("Accuracy for Decision Tree: %0.5f \n\n" % accuracy_score(test_y, predicti
print ("Classification Report Decision Tree: \n", classification_report(test_y, p
```

```
Accuracy for Decision Tree: 0.71800


Classification Report Decision Tree:
               precision    recall  f1-score   support

           0       0.73      0.72      0.72      2548
           1       0.71      0.72      0.71      2452

    accuracy                           0.72      5000
   macro avg       0.72      0.72      0.72      5000
weighted avg       0.72      0.72      0.72      5000
```

Results Random Forest

In [25]:
```
print ("Accuracy for Random Forest: %0.5f \n\n" % accuracy_score(test_y, predicti
print ("Classification Report Random Forest: \n", classification_report(test_y, p
```

```
Accuracy for Random Forest: 0.87000


Classification Report Random Forest:
               precision    recall  f1-score   support

           0       0.89      0.86      0.87      2548
           1       0.86      0.88      0.87      2452

    accuracy                           0.87      5000
   macro avg       0.87      0.87      0.87      5000
weighted avg       0.87      0.87      0.87      5000
```