In [1]:
```
import pandas as pd
```

In [2]:
```
imdb_df = pd.read_csv('IMDB Dataset.csv')
```

In [3]:
```
imdb_df.info() #shows 19999 records with no null values
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19999 entries, 0 to 19998
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   review     19999 non-null  object
 1   sentiment  19999 non-null  object
dtypes: object(2)
memory usage: 312.6+ KB
```

In [4]:
```
imdb_sample_df = imdb_df.sample(n= 15000, random_state= 42)#randomly picking 15000 recor
imdb_sample_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 15000 entries, 10650 to 13861
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   review     15000 non-null  object
 1   sentiment  15000 non-null  object
dtypes: object(2)
memory usage: 351.6+ KB
```

In [5]:
```
imdb_sample_df = imdb_sample_df.reset_index(drop= True)
```

In [8]:
```
imdb_sample_df
```

Out[8]:

	review	sentiment
0	I don't want to bore everyone by reiterating w...	positive
1	I like Wes Studi & especially Adam Beach, but ...	negative
2	I'm sure this was one of those "WOAH!" attract...	negative
3	As a fan of Henriksen (I liked him in the "Mil...	negative
4	Best animated movie ever made. This film explo...	positive
...	...	...
14995	Harlan Knowles (Lance Henriksen) brings a grou...	negative
14996	I can't help thinking that this is Franco's 'h...	negative
14997	The movie starts in spring 2001. A soldier nam...	negative
14998	I found the first bit of stop motion animation...	negative
14999	I haven't read the source, Richard Brooks' nov...	positive

15000 rows × 2 columns

In [9]:
```
imdb_sample_df['sentiment'] = imdb_sample_df['sentiment'].map({'positive': 1, 'negative'
```

In [10]:
```
imdb_sample_df.head()
```

Out[10]:

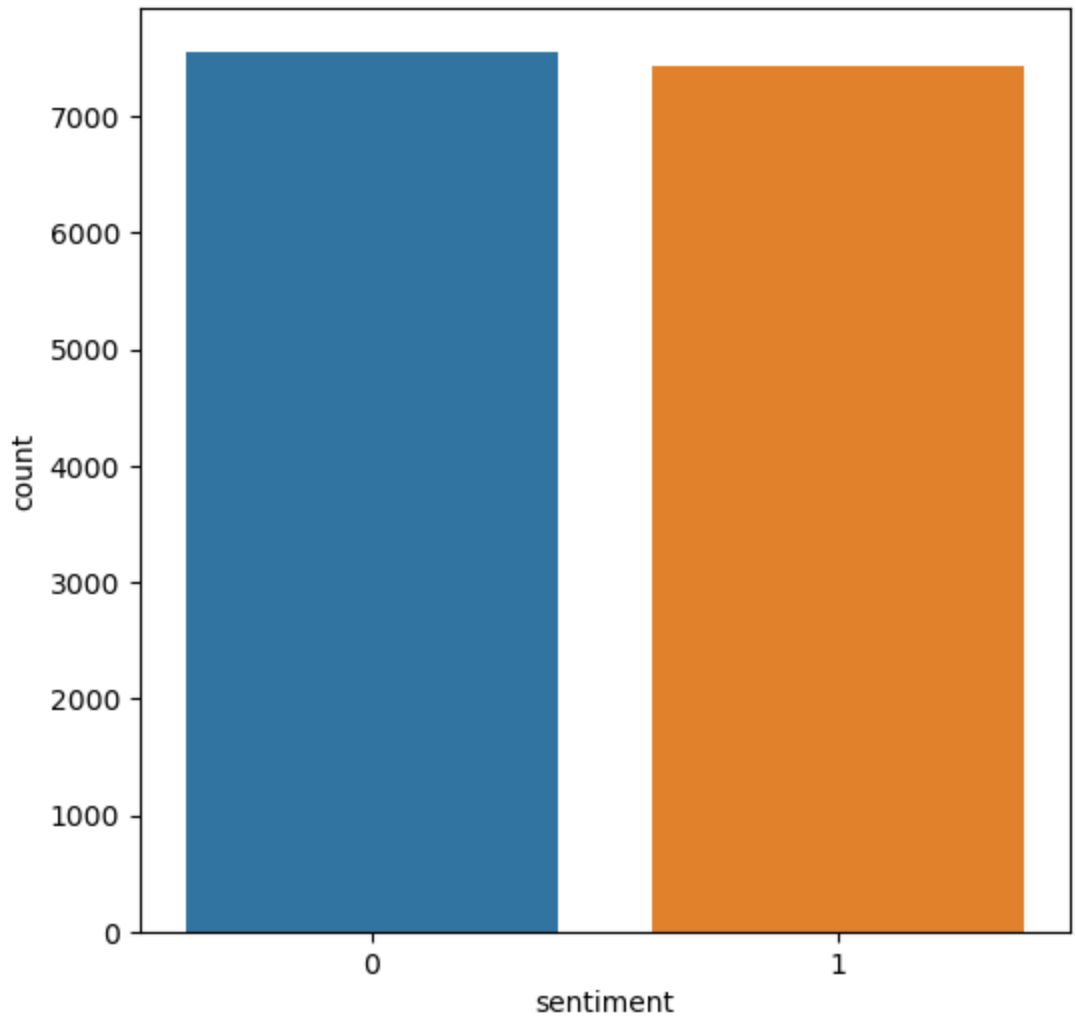
	review	sentiment

0	I don't want to bore everyone by reiterating w...	1
1	I like Wes Studi & especially Adam Beach, but ...	0
2	I'm sure this was one of those "WOAH!" attract...	0
3	As a fan of Henriksen (I liked him in the "Mil...	0
4	Best animated movie ever made. This film explo...	1

In [12]:
```
import matplotlib.pyplot as plt
import seaborn as sn
%matplotlib inline
```

In [21]:
```
plt.figure(figsize=(6,6))
sn.countplot(x= 'sentiment', data= imdb_sample_df)#checking if the positive and negative
#imbalanced
```

Out[21]:
```
<AxesSubplot:xlabel='sentiment', ylabel='count'>
```



In [23]:
```
imdb_sample_df['sentiment'].value_counts(normalize= True)#data is balanced with sentimen
#under-sampling, over-sampling is not required
```

Out[23]:
```
0    0.503933
1    0.496067
Name: sentiment, dtype: float64
```

In [24]:
```
import re
import nltk
```

performing text cleaning and preprocessing

In [25]:
```
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer
from nltk.stem import WordNetLemmatizer
```

In [26]:
```
lemmatizer = WordNetLemmatizer()
```

In [29]:
```
corpus = []
for i in range(0,len(imdb_sample_df)):
    review = re.sub('[^a-zA-Z]', ' ', imdb_sample_df['review'][i])
    review = review.lower()
    review = review.split()#extracting words out of a sentence that is tokens
    review = [lemmatizer.lemmatize(word) for word in review if not word in stopwords.wor
    review = ' '.join(review)#re joining words or tokens to create a sentence
    corpus.append(review)
```

In [30]:
```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer(stop_words= 'english')
X = cv.fit_transform(corpus).toarray()
```

In [31]:
```
Y = imdb_sample_df['sentiment']
Y
```

Out[31]:
```
0        1
1        0
2        0
3        0
4        1
        ..
14995    0
14996    0
14997    0
14998    0
14999    1
Name: sentiment, Length: 15000, dtype: int64
```

finding max_features required

In [32]:
```
import numpy as np
```

In [33]:
```
featurecount = np.sum(X, axis= 0)
```

In [34]:
```
features = cv.get_feature_names_out()
```

In [35]:
```
featurecountdf = pd.DataFrame(dict(features = features, counts = featurecount))
```

In [36]:
```
featurecountdf
```

Out[36]:

	features	counts
0	aa	5
1	aaa	4
2	aaaaahhhh	1
3	aaaarrgh	1
4	aaaggghhhhhhh	1

	...	...
54131	zzzzzzzzzzzz	1
54132	zzzzzzzzzzzzzzzzz	1
54133	zzzzzzzzzzzzzzzzzzzzzzzzzzzzz	1
54134	zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz	1
54135	zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz	1

54136 rows × 2 columns

In [37]:
```
len(featurecountdf[featurecountdf.counts == 1])#checking count of words that occured onl
```

Out[37]:
```
20628
```

performing bag of words

In [38]:
```
cv = CountVectorizer(stop_words= 'english', max_features= 5000)
```

In [39]:
```
X = cv.fit_transform(corpus).toarray()
```

splitting the dataset into train and test

In [40]:
```
from sklearn.model_selection import train_test_split
```

In [41]:
```
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size= 0.3, random_state=
```

performing modeling

In [43]:
```
from sklearn.naive_bayes import MultinomialNB
```

In [44]:
```
mnb = MultinomialNB()
sentiment_detection_model = mnb.fit(X_train, y_train)
```

In [45]:
```
#prediciton
y_pred = sentiment_detection_model.predict(X_test)
```

In [46]:
```
from sklearn.metrics import accuracy_score, classification_report
```

In [47]:
```
score = accuracy_score(y_test, y_pred)
print(score)
```

```
0.8395555555555556
```

In [48]:
```
print(classification_report(y_pred, y_test))
```

```
              precision    recall  f1-score   support

           0       0.85      0.83      0.84      2293
           1       0.83      0.85      0.84      2207

    accuracy                           0.84      4500
```

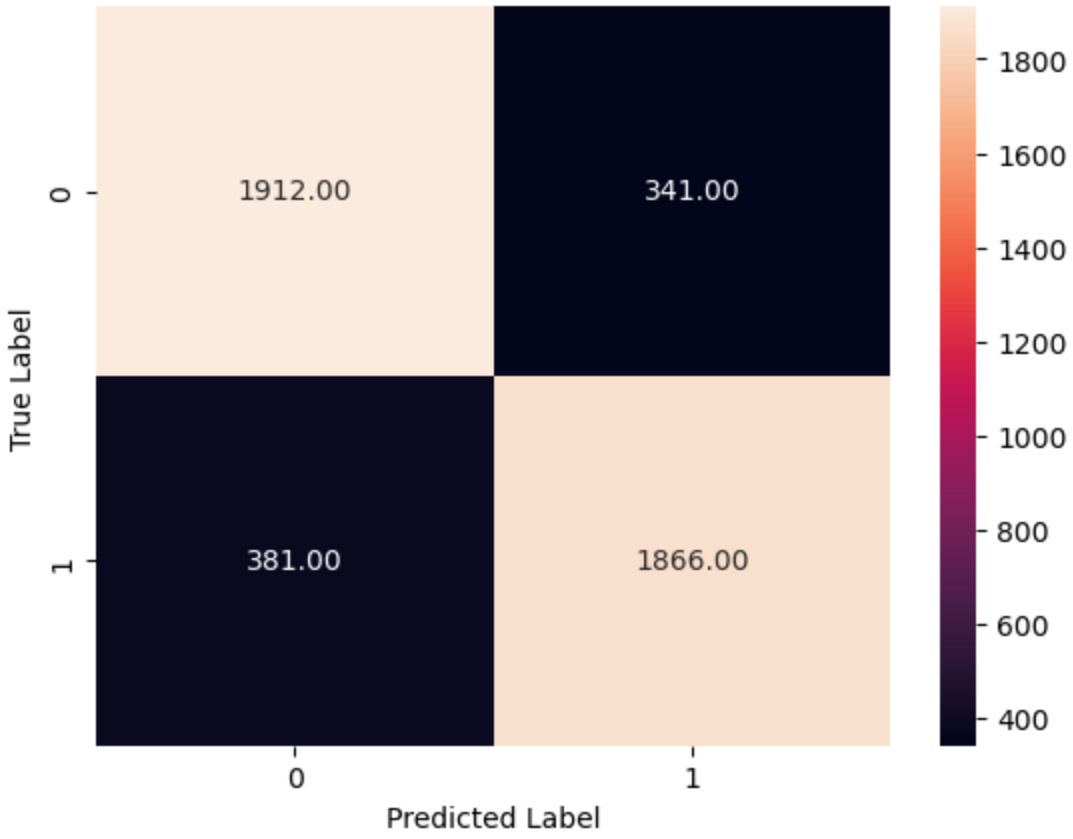
```
   macro avg       0.84      0.84      0.84      4500
weighted avg       0.84      0.84      0.84      4500
```

In [50]:
```
from sklearn.metrics import confusion_matrix
```

In [51]:
```
cm = confusion_matrix(y_test, y_pred)
```

In [52]:
```
sn.heatmap(cm, annot= True, fmt= '.2f')
plt.ylabel('True Label')
plt.xlabel('Predicted Label')
#confusion_matrix shows the true and predicted values are having more accurate numbers
```

Out[52]:
```
Text(0.5, 23.52222222222222, 'Predicted Label')
```



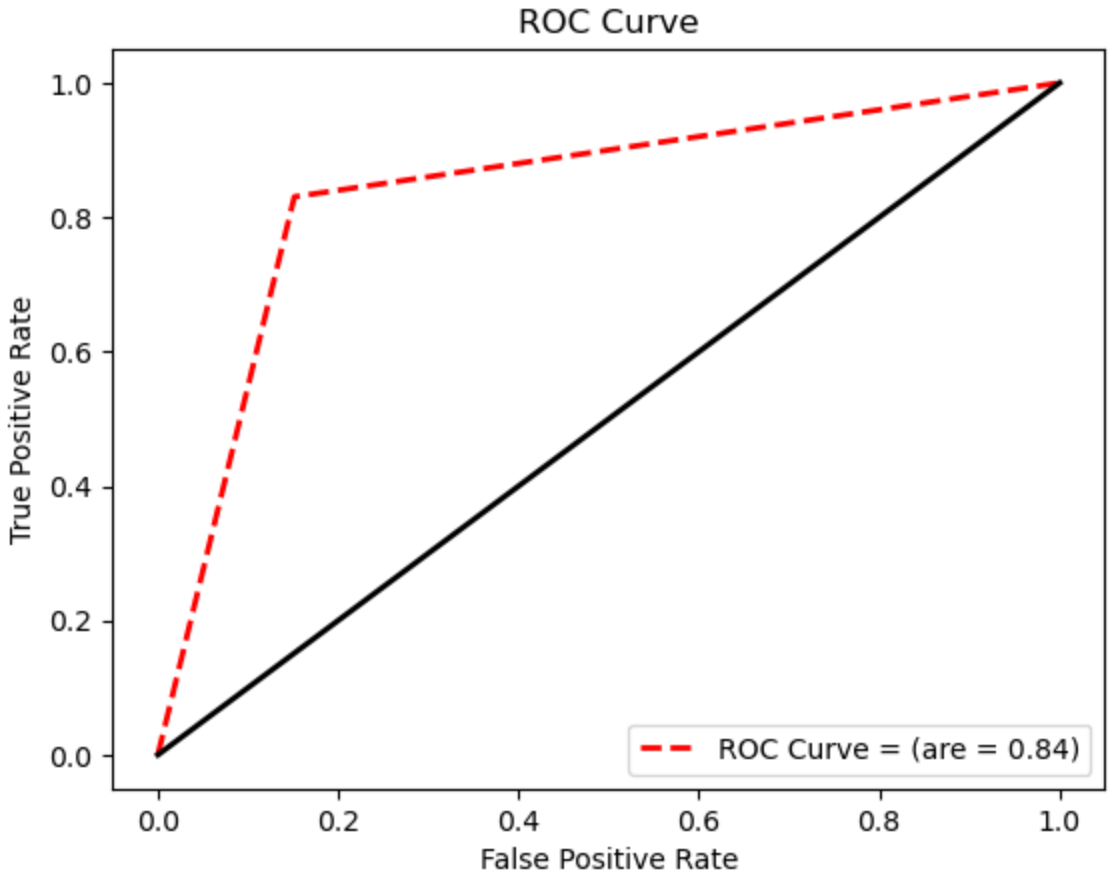
In [57]:
```
from sklearn.metrics import roc_curve, auc
```

In [55]:
```
import matplotlib.pyplot as plt
import seaborn as sn
%matplotlib inline
```

In [58]:
```
fpr, tpr, threshold = roc_curve(y_test, y_pred)
roc_auc = auc(fpr, tpr)
plt.figure()
plt.plot(fpr, tpr, 'k--', color = 'red', label = 'ROC Curve = (are = {0:.2f})'.format(ro
plt.plot([0, 1], [0, 1], color='black', lw=2, linestyle='-')
plt.xlim([-0.05, 1.05])
plt.ylim([-0.05, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC Curve')
plt.legend(loc='lower right')
plt.show()
```

```
/var/folders/3q/2bh9znv97bl09382p2y_xj9m0000gn/T/ipykernel_3905/1878658684.py:4: UserWar
ning: color is redundantly defined by the 'color' keyword argument and the fmt string "k
```

```
--" (-> color='k'). The keyword argument will take precedence.
  plt.plot(fpr, tpr, 'k--', color = 'red', label = 'ROC Curve = (are = {0:.2f})'.format
(roc_auc), lw = 2)
```



testing with reviews

In [65]:
```
def split_words(words):
    review = re.sub('[^a-zA-Z]', ' ', words)
    review = review.lower()
    review = review.split()#extracting words out of a sentence that is tokens
    review = [lemmatizer.lemmatize(word) for word in review if not word in stopwords.wor
    review = ' '.join(review)#re joining words or tokens to create a sentence
    return review
```

In [78]:
```
testreview = {"It is this combination of maximalism, nationalism, fatalism, and two-dime
              "Disappointingly, the film's female characters are given precious little to
              "In sci-fi terms, The Wandering Earth II feels less obviously derivative of
clean_review = []

for i in testreview.keys():
    clean_review.append(split_words(i))
vector_comment = cv.transform(clean_review)
vector_comment = vector_comment.toarray()
```

In [79]:
```
predict = sentiment_detection_model.predict(vector_comment)
result = {1: 'positive', 0: 'negative'}
values = list(testreview.values())
```

In [86]:
```
print("comment num \tpredict \treal")
for i, val in enumerate(predict):
    print(f"comment {i+1} \t{result[val]} \t{values[i]}")
```

```
comment num     predict         real
comment 1       negative        positive
```

```
comment 2       negative        negative
comment 3       positive        positive
```