assign3

December 29, 2018

1 Assignment 3:

1.1 Objective :

1.1.1 Apply Brute force KNN and KDTree on BoW,TFIDF,AVGW2V and Weighted TFIDF.

1.1.2 Get the conclusion table.

In [1]:
```
import warnings
warnings.filterwarnings("ignore")
import sqlite3
import numpy as np
import pandas as pd
import nltk
import string
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
from sklearn.model_selection import cross_val_score
from collections import Counter
from sklearn.metrics import accuracy_score
from sklearn import model_selection
from sklearn.metrics import f1_score
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics import confusion_matrix
from sklearn import metrics
from sklearn.metrics import roc_curve, auc
from nltk.stem.porter import PorterStemmer
from sklearn.metrics import classification_report,confusion_matrix
import re
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer
```

```
from gensim.models import Word2Vec
from gensim.models import KeyedVectors
import pickle
from tqdm import tqdm
import os

import sqlite3
from google.colab import drive
drive.mount('/content/drive/')
```

```
Drive already mounted at /content/drive/; to attempt to forcibly remount, call drive.mount("/c
```

2 Data Preprocessing

```
In [0]: os.chdir("/content/drive/My Drive/Colab Notebooks")
```

```
In [0]: con = sqlite3.connect("final.sqlite")
```

```
In [0]: import pandas as pd
        filtered_data = pd.read_sql_query("""
        SELECT * FROM REVIEWS
        """,con)
```

```
In [5]: filtered_data.shape
```

```
Out[5]: (364171, 12)
```

```
In [0]: filtered_data.set_index = filtered_data.index
```

```
In [0]: filtered_data.drop(['index'],axis=1)
        #dropping index value from columns
```

```
In [0]: final_data = filtered_data.sample(100000,random_state=2)

        #sampling 100k datapoints
```

```
In [0]: final_data.head(3)
        final_data = final_data.sort_values('Time')
```

```
In [10]: final_data.Score.value_counts()
```

```
Out[10]: 1    84541
         0    15459
         Name: Score, dtype: int64
```

```
In [0]: final_data_kd_tree  = final_data.sample(20000,random_state=2)
        #sampling 20 k points for kd_tree
```

```
In [15]: final_data_kd_tree.Score.value_counts()
```

```
Out[15]: 1    16917
         0     3083
         Name: Score, dtype: int64
```

3 KNN on BoW using KD_Tree

In [0]:
```
count_vect = CountVectorizer(ngram_range=(1,2))
X = final_data_kd_tree['CleanedText'].values

X_tr, X_test = model_selection.train_test_split(X, test_size=0.3, random_state=0)
# split the train data set into cross validation train and cross validation test
#X_tr, X_cv= model_selection.train_test_split(X_1, test_size=0.3, random_state=0)
final_counts = count_vect.fit_transform(X_tr)
```

In [24]:
```
print("the shape of out text BOW vectorizer ",final_counts.shape)
print("the number of unique words are ", final_counts.get_shape()[1])
```

```
the shape of out text BOW vectorizer  (14000, 305221)
the number of unique words are  305221
```

In [25]:
```
#using truncated svd for dimensionality reduction

from sklearn.decomposition import TruncatedSVD
svd = TruncatedSVD(n_components=300)
svd_data=svd.fit_transform(final_counts)
svd_data.shape
```

Out[25]: (14000, 300)

Taking 300 dimensions for KD_TREE. Tried to plot (Explained Variance, No. of features retained), but it gives error for numpy. Says no attribute for explained_variance_.

In [0]:
```
y = final_data_kd_tree['Score'].values

y_tr, y_test = model_selection.train_test_split(y, test_size=0.3, random_state=0)
```

In [0]:
```
#for CV and test data
final_counts_test = count_vect.transform(X_test)
svd_data_test=svd.transform(final_counts_test)
```

In [30]:
```
svd_data_test.shape
```

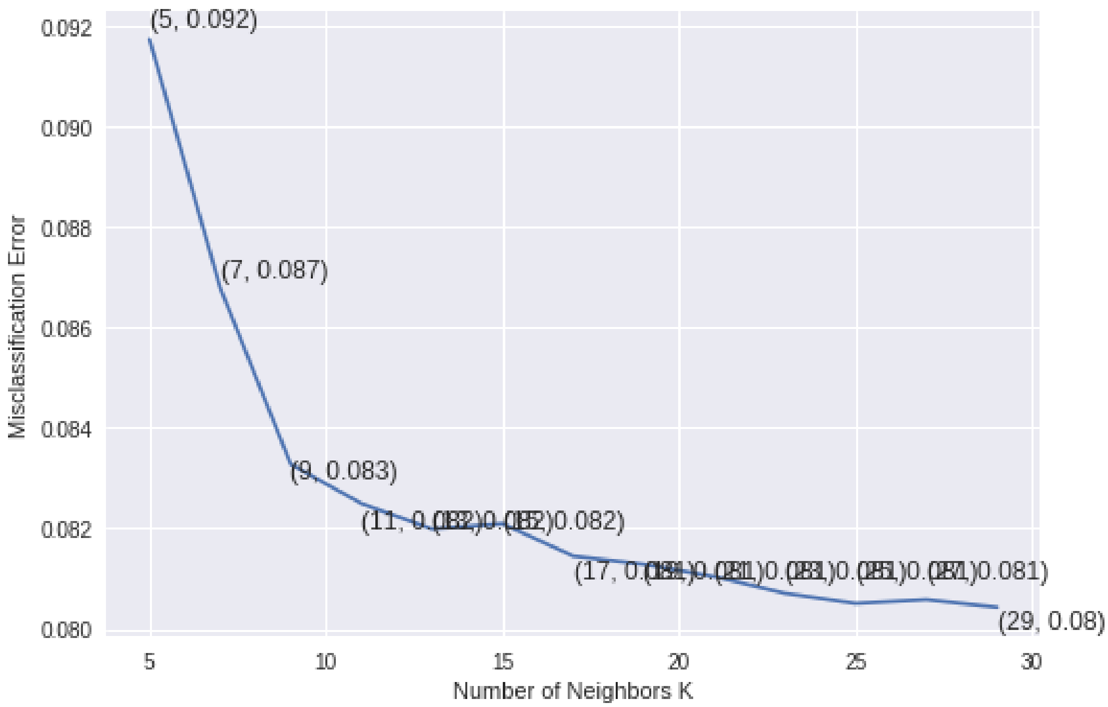
Out[30]: (6000, 300)

Performing 2 cross validation. Finding the optimal k as follows. Using 'f1' score for accuracy.

In [35]:
```
# creating odd list of K for KNN
myList = list(range(5,30))
neighbors = list(filter(lambda x: x % 2 != 0, myList))

# empty list that will hold cv scores
cv_scores = []
```

```python
# perform 2-fold cross validation
for k in neighbors:
    knn = KNeighborsClassifier(n_neighbors=k,algorithm='kd_tree')
    scores = cross_val_score(knn, svd_data, y_tr, cv=2, scoring='f1')
    cv_scores.append(scores.mean())

# changing to misclassification error
MSE = [1 - x for x in cv_scores]

# determining best k
optimal_k = neighbors[MSE.index(min(MSE))]
print('\nThe optimal number of neighbors is %d.' % optimal_k)

# plot misclassification error vs k
plt.plot(neighbors, MSE)

for xy in zip(neighbors, np.round(MSE,3)):
    plt.annotate('(%s, %s)' % xy, xy=xy, textcoords='data')

plt.xlabel('Number of Neighbors K')
plt.ylabel('Misclassification Error')
plt.show()

print("the misclassification error for each k value is : ", np.round(MSE,3))
```

```
The optimal number of neighbors is 29.
```



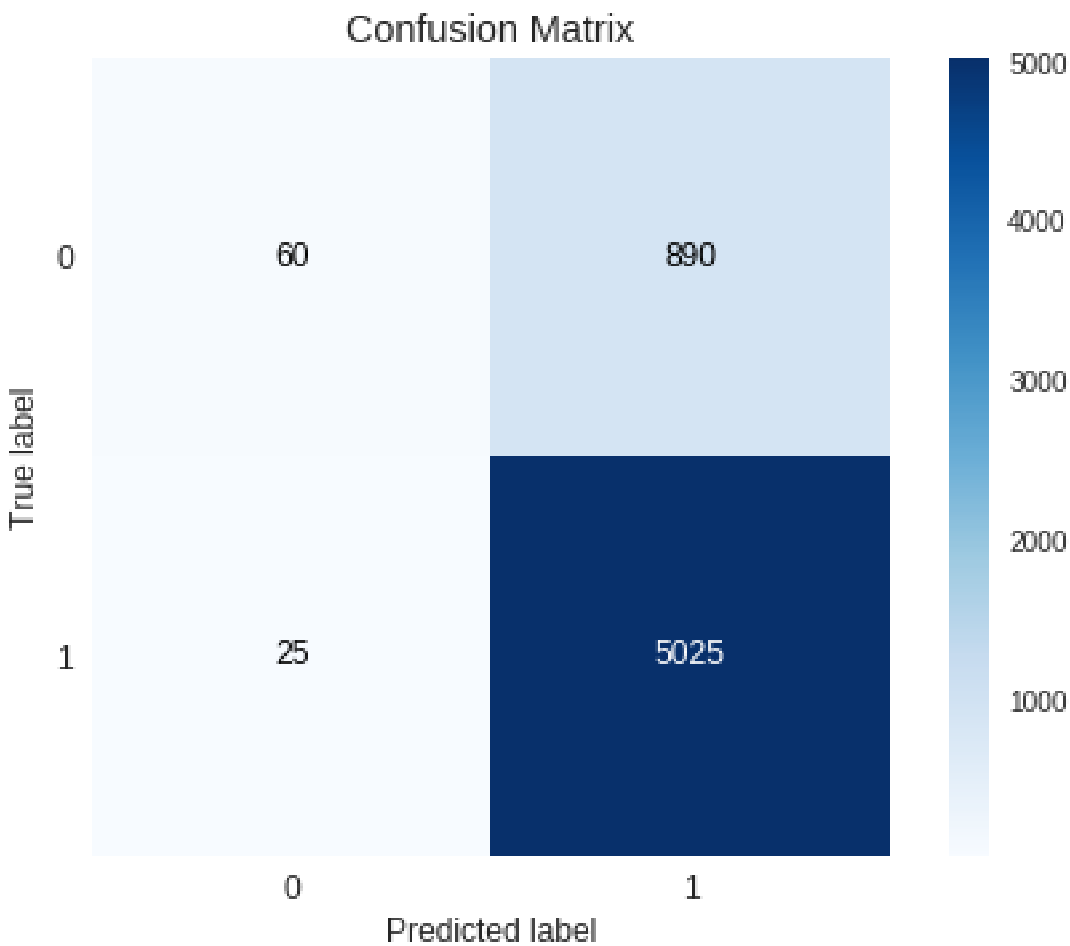

```
the misclassification error for each k value is :  [0.092 0.087 0.083 0.082 0.082 0.082 0.081 0
 0.08 ]
```

```
In [36]: #Performing KNN using kd_tree
         knn = KNeighborsClassifier(n_neighbors=optimal_k,algorithm='kd_tree')
         knn.fit(svd_data,y_tr)
         pred = knn.predict(svd_data_test)
         acc = f1_score(y_test, pred) * float(100)
         print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (optimal_k, acc))
```

```
The accuracy of the knn classifier for k = 29 is 91.655267%
```

```
In [51]: import scikitplot as skplt
         skplt.metrics.plot_confusion_matrix(y_test ,pred)
```

```
Out[51]: <matplotlib.axes._subplots.AxesSubplot at 0x7f06e91f5e80>
```




```
In [52]: print(classification_report(y_test ,pred))

              precision    recall  f1-score   support

           0       0.71      0.06      0.12       950
           1       0.85      1.00      0.92      5050

   micro avg       0.85      0.85      0.85      6000
   macro avg       0.78      0.53      0.52      6000
weighted avg       0.83      0.85      0.79      6000
```

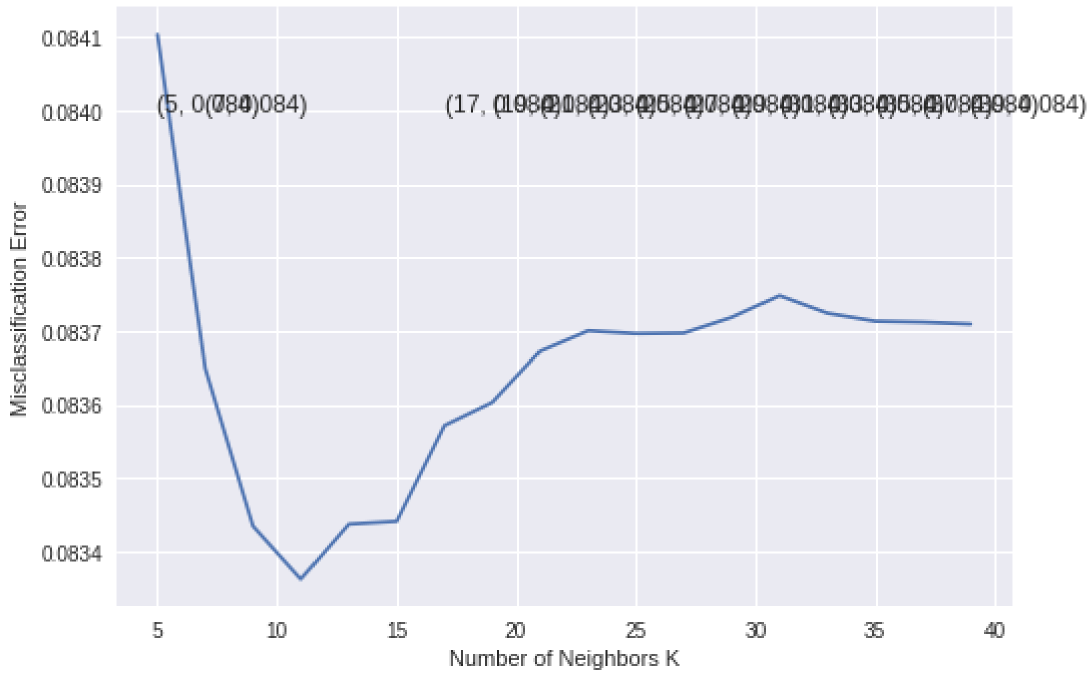
4 KNN using Brute Force on BoW

```
In [0]: #Performing KNN using Brute Force
        # split the data set into train and test
```

```
X = final_data['CleanedText'].values
y = final_data.Score.values
X_tr, X_test, y_tr, y_test = model_selection.train_test_split(X, y, test_size=0.3, ranc
# split the train data set into cross validation train and cross validation test
count_vect = CountVectorizer(ngram_range=(1,2))
X_tr = count_vect.fit_transform(X_tr)
X_test = count_vect.transform(X_test)
```

```
In [58]: #Getting the optimal k

         # creating odd list of K for KNN using Brute Force
         myList = list(range(5,40))
         neighbors = list(filter(lambda x: x % 2 != 0, myList))

         # empty list that will hold cv scores
         cv_scores = []

         # perform 2-fold cross validation
         for k in neighbors:
             knn = KNeighborsClassifier(n_neighbors=k)
             scores = cross_val_score(knn, X_tr, y_tr, cv=2, scoring='f1')
             cv_scores.append(scores.mean())

         # changing to misclassification error
         MSE = [1 - x for x in cv_scores]

         # determining best k
         optimal_k = neighbors[MSE.index(min(MSE))]
         print('\nThe optimal number of neighbors is %d.' % optimal_k)

         # plot misclassification error vs k
         plt.plot(neighbors, MSE)

         for xy in zip(neighbors, np.round(MSE,3)):
             plt.annotate('(%s, %s)' % xy, xy=xy, textcoords='data')

         plt.xlabel('Number of Neighbors K')
         plt.ylabel('Misclassification Error')
         plt.show()

         print("the misclassification error for each k value is : ", np.round(MSE,3))
```

```
The optimal number of neighbors is 11.
```

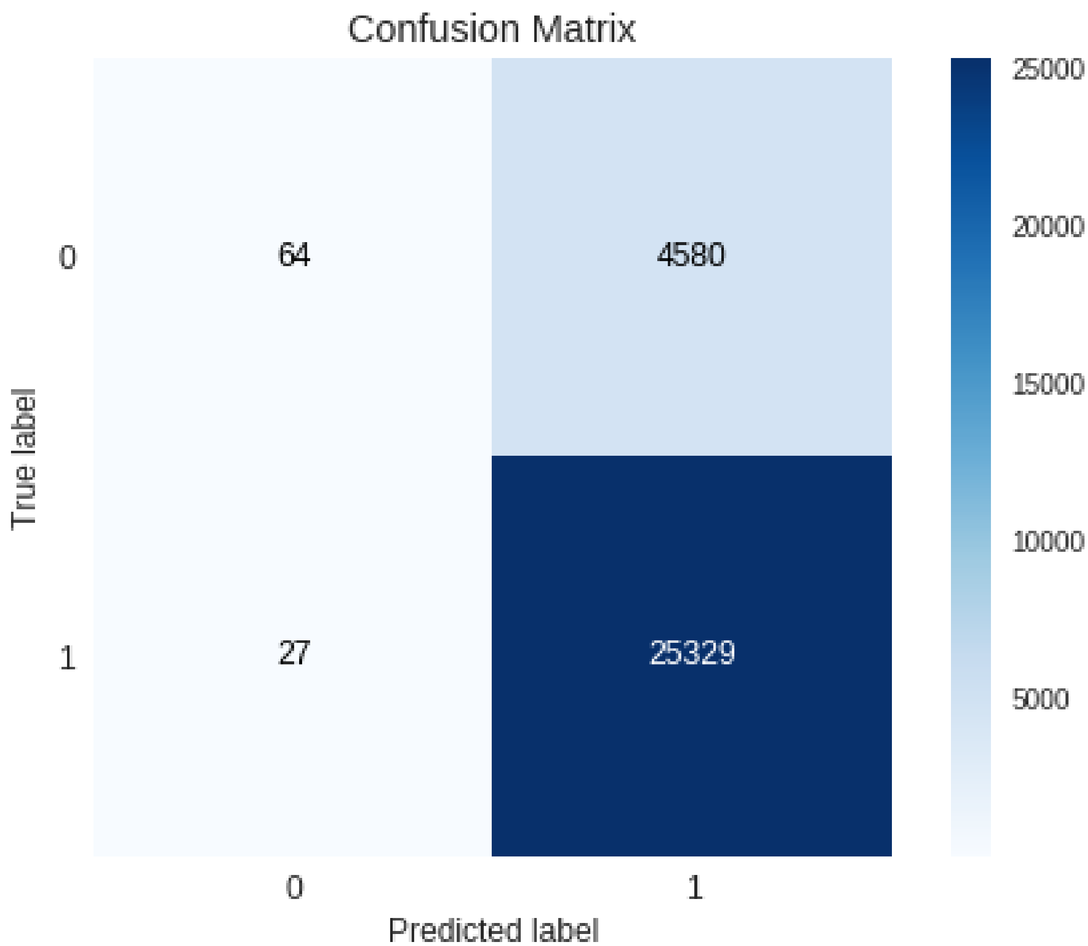



```
the misclassification error for each k value is :  [0.084 0.084 0.083 0.083 0.083 0.083 0.084
 0.084 0.084 0.084 0.084 0.084 0.084]
```

```
In [59]: #Performing KNN using bruteforce
         knn = KNeighborsClassifier(n_neighbors=optimal_k)
         knn.fit(X_tr,y_tr)
         pred = knn.predict(X_test)
         acc = f1_score(y_test, pred) * float(100)
         print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (optimal_k, acc))
```

```
The accuracy of the knn classifier for k = 11 is 91.663802%
```

```
In [61]: skplt.metrics.plot_confusion_matrix(y_test ,pred)

Out[61]: <matplotlib.axes._subplots.AxesSubplot at 0x7f06d66346d8>
```




```
In [62]: print(classification_report(y_test ,pred))

              precision    recall  f1-score   support

           0       0.70      0.01      0.03      4644
           1       0.85      1.00      0.92     25356

   micro avg       0.85      0.85      0.85     30000
   macro avg       0.78      0.51      0.47     30000
weighted avg       0.82      0.85      0.78     30000
```

5 Knn on TFIDF using KD_tree

```
In [63]: X = final_data_kd_tree['CleanedText'].values
         y = final_data_kd_tree.Score.values
```

```
X_tr, X_test, y_tr, y_test = model_selection.train_test_split(X, y, test_size=0.3, ran
# split the train data set into cross validation train and cross validation test
tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))

X_tr = tf_idf_vect.fit_transform(X_tr)
X_test = tf_idf_vect.transform(X_test)


print("the type of count vectorizer ",type(X_tr))
print("the shape of out text TFIDF vectorizer ",X_tr.get_shape())
print("the number of unique words including both unigrams and bigrams ", X_tr.get_shap
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text TFIDF vectorizer  (14000, 305221)
the number of unique words including both unigrams and bigrams  305221
```

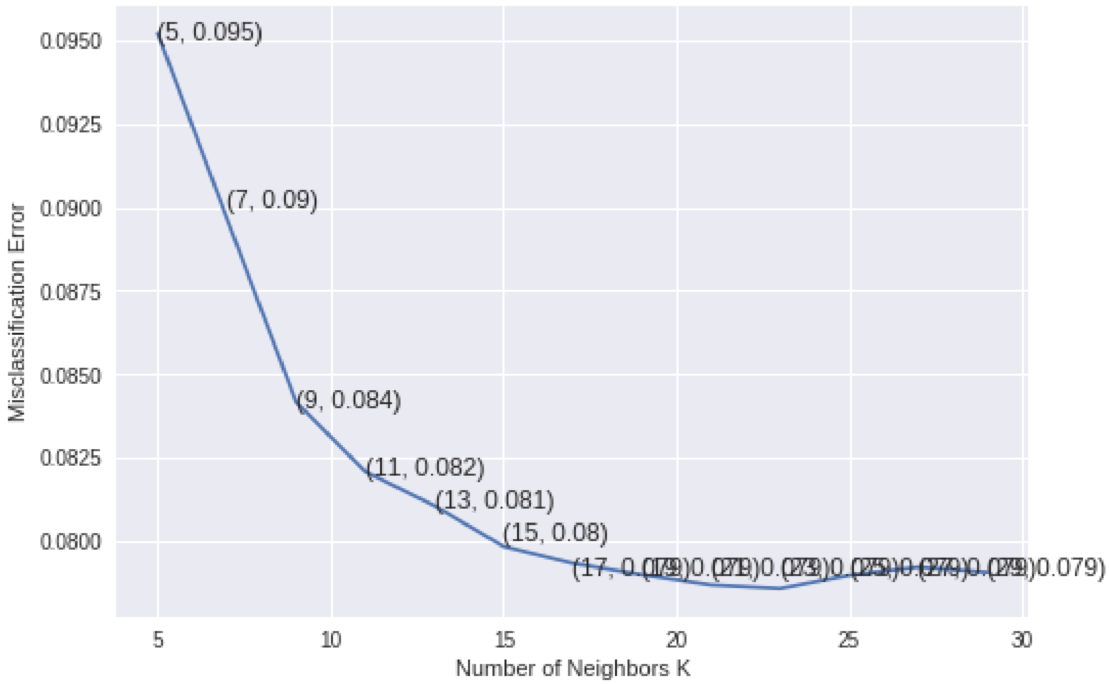
In [64]:
```
#using truncated svd for dimensionality reduction
svd = TruncatedSVD(n_components=300)
X_tr=svd.fit_transform(X_tr)
X_test = svd.transform(X_test)
X_tr.shape
```

Out[64]:
```
(14000, 300)
```

In [65]:
```
#Finding optimal k
# creating odd list of K for KNN
myList = list(range(5,30))
neighbors = list(filter(lambda x: x % 2 != 0, myList))

# empty list that will hold cv scores
cv_scores = []

# perform 2-fold cross validation
for k in neighbors:
    knn = KNeighborsClassifier(n_neighbors=k,algorithm='kd_tree')
    scores = cross_val_score(knn, X_tr, y_tr, cv=2, scoring='f1')
    cv_scores.append(scores.mean())

# changing to misclassification error
MSE = [1 - x for x in cv_scores]

# determining best k
optimal_k = neighbors[MSE.index(min(MSE))]
print('\nThe optimal number of neighbors is %d.' % optimal_k)

# plot misclassification error vs k
plt.plot(neighbors, MSE)
```

```
for xy in zip(neighbors, np.round(MSE,3)):
    plt.annotate('(%s, %s)' % xy, xy=xy, textcoords='data')

plt.xlabel('Number of Neighbors K')
plt.ylabel('Misclassification Error')
plt.show()

print("the misclassification error for each k value is : ", np.round(MSE,3))
```

```
The optimal number of neighbors is 23.
```



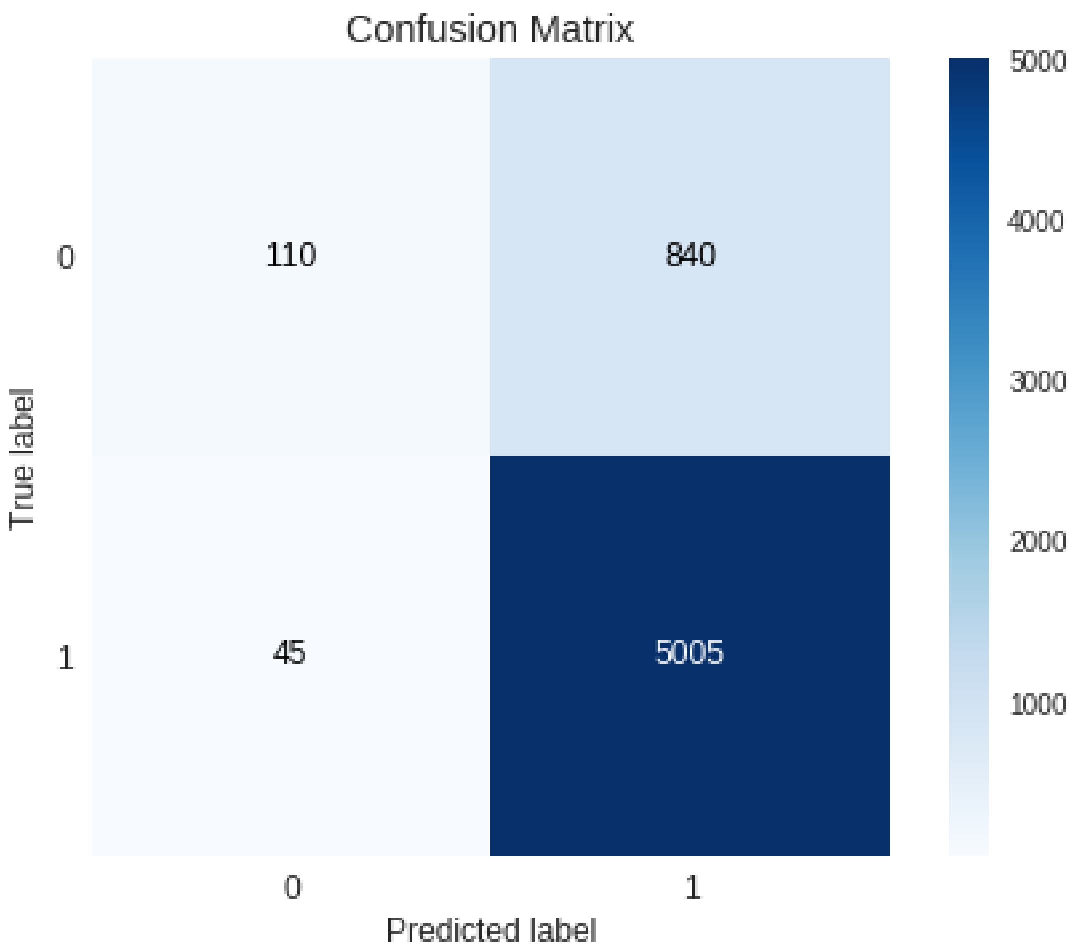

```
the misclassification error for each k value is :  [0.095 0.09  0.084 0.082 0.081 0.08  0.079 0
 0.079]
```

```
In [66]: #Performing KNN using kd_tree
         knn = KNeighborsClassifier(n_neighbors=optimal_k,algorithm='kd_tree')
         knn.fit(X_tr,y_tr)
         pred = knn.predict(X_test)
         acc = f1_score(y_test, pred) * float(100)
         print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (optimal_k, acc))
```

The accuracy of the knn classifier for k = 23 is 91.877008%

```
In [68]: skplt.metrics.plot_confusion_matrix(y_test ,pred)
```

Out[68]: <matplotlib.axes._subplots.AxesSubplot at 0x7f06d7c8bba8>




```
In [69]: print(classification_report(y_test ,pred))
```

```
              precision    recall  f1-score   support

           0       0.71      0.12      0.20       950
           1       0.86      0.99      0.92      5050

   micro avg       0.85      0.85      0.85      6000
   macro avg       0.78      0.55      0.56      6000
weighted avg       0.83      0.85      0.80      6000
```

6 Knn on TFIDF Using Bruteforce

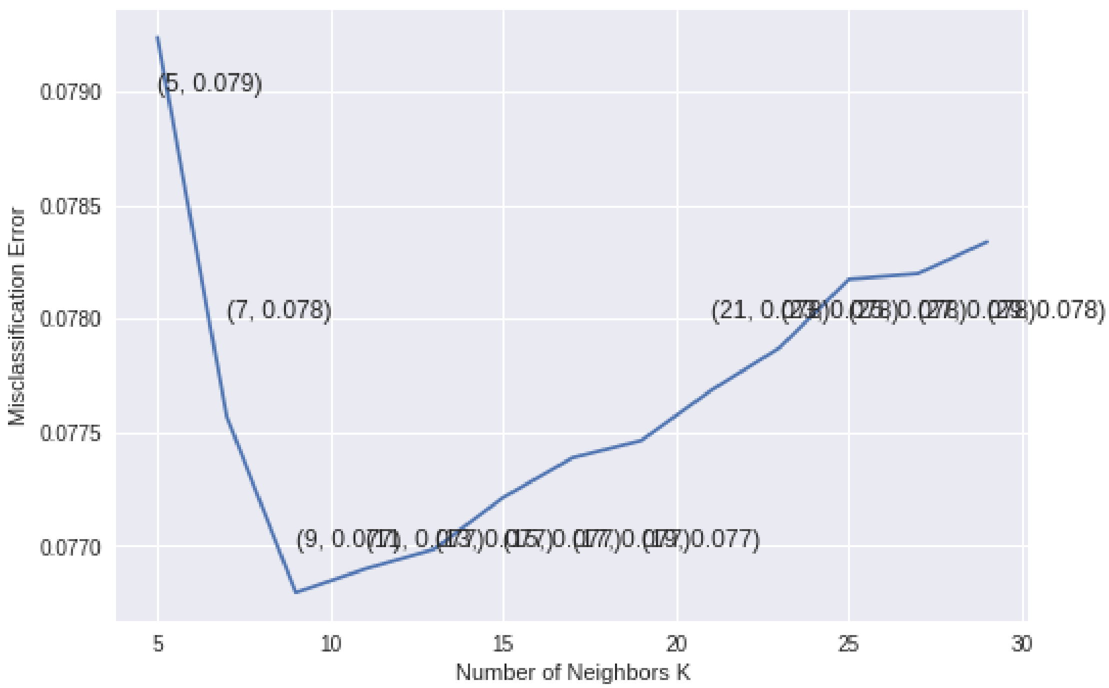
```
In [70]: X = final_data['CleanedText'].values
         y = final_data.Score.values
         X_tr, X_test, y_tr, y_test = model_selection.train_test_split(X, y, test_size=0.3, ra
         # split the train data set into cross validation train and cross validation test
         tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))

         X_tr = tf_idf_vect.fit_transform(X_tr)
         X_test = tf_idf_vect.transform(X_test)
         print("the type of count vectorizer ",type(X_tr))
         print("the shape of out text TFIDF vectorizer ",X_tr.get_shape())
         print("the number of unique words including both unigrams and bigrams ", X_tr.get_sha
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text TFIDF vectorizer  (70000, 993591)
the number of unique words including both unigrams and bigrams  993591
```

```
In [71]: #Finding optimal k

         # creating odd list of K for KNN
         myList = list(range(5,30))
         neighbors = list(filter(lambda x: x % 2 != 0, myList))

         # empty list that will hold cv scores
         cv_scores = []

         # perform 2-fold cross validation
         for k in neighbors:
             knn = KNeighborsClassifier(n_neighbors=k)
             scores = cross_val_score(knn, X_tr, y_tr, cv=2, scoring='f1')
             cv_scores.append(scores.mean())

         # changing to misclassification error
         MSE = [1 - x for x in cv_scores]

         # determining best k
         optimal_k = neighbors[MSE.index(min(MSE))]
         print('\nThe optimal number of neighbors is %d.' % optimal_k)

         # plot misclassification error vs k
         plt.plot(neighbors, MSE)

         for xy in zip(neighbors, np.round(MSE,3)):
             plt.annotate('(%s, %s)' % xy, xy=xy, textcoords='data')

         plt.xlabel('Number of Neighbors K')
```

```
plt.ylabel('Misclassification Error')
plt.show()

print("the misclassification error for each k value is : ", np.round(MSE,3))
```

```
The optimal number of neighbors is 9.
```



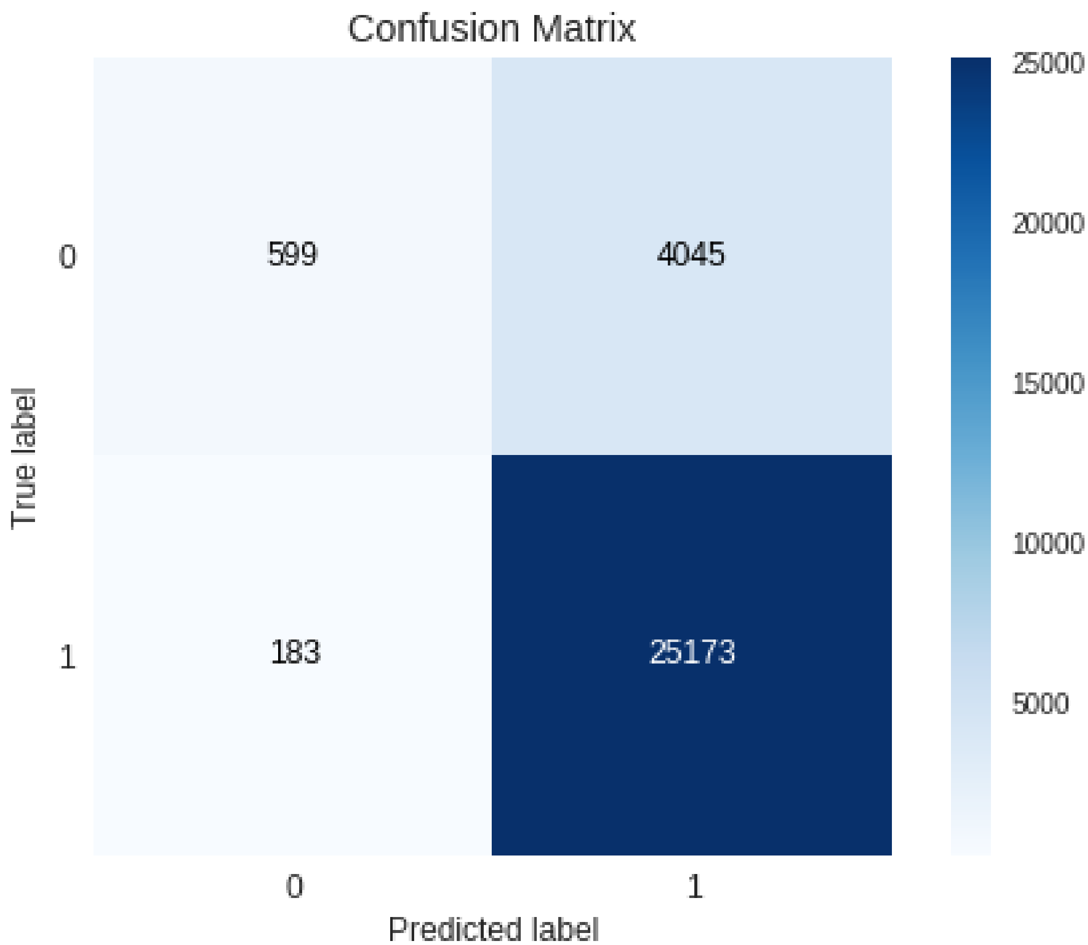

```
the misclassification error for each k value is :  [0.079 0.078 0.077 0.077 0.077 0.077 0.077 0
 0.078]
```

```
In [72]: #Performing KNN using bruteforce
         knn = KNeighborsClassifier(n_neighbors=optimal_k)
         knn.fit(X_tr,y_tr)
         pred = knn.predict(X_test)
         acc = f1_score(y_test, pred) * float(100)
         print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (optimal_k, acc))
```

```
The accuracy of the knn classifier for k = 9 is 92.252721%
```

```
In [73]: skplt.metrics.plot_confusion_matrix(y_test ,pred)
```

Out[73]: <matplotlib.axes._subplots.AxesSubplot at 0x7f06d66821d0>




```
In [74]: print(classification_report(y_test ,pred))

              precision    recall  f1-score   support

           0       0.77      0.13      0.22      4644
           1       0.86      0.99      0.92     25356

   micro avg       0.86      0.86      0.86     30000
   macro avg       0.81      0.56      0.57     30000
weighted avg       0.85      0.86      0.81     30000
```