KNN Brute algorithm on Amazon fine food dataset

Data Source: https://www.kaggle.com/snap/amazon-fine-food-reviews (https://www.kaggle.com/snap/amazon-fine-food-reviews)

The Amazon Fine Food Reviews dataset consists of reviews of fine foods from Amazon.

Number of reviews: 568,454
Number of users: 256,059
Number of products: 74,258
Timespan: Oct 1999 - Oct 2012
Number of Attributes/Columns in data: 10

Attribute Information:

1. Id
2. ProductId - unique identifier for the product
3. UserId - unqiue identifier for the user
4. ProfileName
5. HelpfulnessNumerator - number of users who found the review helpful
6. HelpfulnessDenominator - number of users who indicated whether they found the review helpful or not
7. Score - rating between 1 and 5
8. Time - timestamp for the review
9. Summary - brief summary of the review
10. Text - text of the review

Objective:

To perform KNN brute algorithm on different vectors like BOW, Tf-idf, Avg-W2vec & Tf-idf_W2vec.

```
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")

import sqlite3
import pandas as pd
import numpy as np
import nltk
import string
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

import re

import string
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


#Importing Cleaned & Deduped dataset
# using the SQLite Table to read data.
```

```
con = sqlite3.connect('C:/Users/deepak/Documents/Applied AI assignments/3. Tsne on Amazon fine food/final.sq
```

```
Data = pd.read_sql_query(""" SELECT * FROM Reviews""", con)
```

```
Data.head(5)
```

	index	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator
0	138706	150524	0006641040	ACITT7DI6IDDL	shari zychinski	0	0
1	138688	150506	0006641040	A2IW4PEEKO2R0U	Tracy	1	1
2	138689	150507	0006641040	A1S4A3IQ2MU7V4	sally sue "sally sue"	1	1
3	138690	150508	0006641040	AZGXZ2UUK6X	Catherine Hallberg " (Kate)"	1	1
4	138691	150509	0006641040	A3CMRKGE0P909G	Teresa	3	4

```
Data['Score'].value_counts()
```

```
positive    307061
negative     57110
Name: Score, dtype: int64
```

```
#Doing Time based splitting
data_amazon_fine=Data.sort_values("Time",ascending = True)
```

```
#Using sample 100K points for doing KNN
# 80K points for train and 20K for test
train_data=data_amazon_fine.iloc[:80000]
test_data=data_amazon_fine.iloc[80000:100000]
```

```
train_data.shape
```

```
(80000, 12)
```

```
train_data['Score'].value_counts()
```

```
positive    70407
negative     9593
Name: Score, dtype: int64
```

```
test_data.shape
```

```
(20000, 12)
```

```
test_data['Score'].value_counts()
```

```
positive    17322
negative     2678
Name: Score, dtype: int64
```

```
#Storing Train and test data for further assignments
train_data.to_csv("E:/Applied AI assignments/Amazon_fine_train_data.csv")
test_data.to_csv("E:/Applied AI assignments/Amazon_fine_test_data.csv")
```

```
train_data=pd.read_csv("E:/Applied AI assignments/Amazon_fine_train_data.csv")
test_data=pd.read_csv("E:/Applied AI assignments/Amazon_fine_test_data.csv")
```

```
train_data=train_data.astype(str)
tesdt_data=test_data.astype(str)
```

```
#Train data
y_train = train_data['Score']
x_train = train_data['CleanedText']

#Test data
y_test = test_data['Score']
x_test = test_data['CleanedText']
```

Binary Bow

```
count_vect = CountVectorizer(binary=True)

#Train data
vocabulary = count_vect.fit(x_train) #in scikit-learn
Bow_x_train= count_vect.transform(x_train)
print("the type of count vectorizer ",type(Bow_x_train))
print("the shape of out text BOW vectorizer ",Bow_x_train.get_shape())
print("the number of unique words ", Bow_x_train.get_shape()[1])
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (80000, 33433)
the number of unique words  33433
```

```
#Test data
Bow_x_test = count_vect.transform(x_test)
print("the type of count vectorizer ",type(Bow_x_test))
print("the shape of out text BOW vectorizer ",Bow_x_test.get_shape())
print("the number of unique words ", Bow_x_test.get_shape()[1])
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (20000, 33433)
the number of unique words  33433
```

```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import accuracy_score
from sklearn.cross_validation import cross_val_score
from collections import Counter
from sklearn.metrics import accuracy_score
from sklearn import cross_validation
```

```
C:\Users\deepak\Anaconda3\lib\site-packages\sklearn\cross_validation.py:41: DeprecationWarning: This module was deprecated
in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. Also
note that the interface of the new CV iterators are different from that of this module. This module will be removed in 0.2
0.
  "This module will be removed in 0.20.", DeprecationWarning)
```

Running Gridsearch CV

```
myList = list(range(0,50))
k_range=list(filter(lambda x: x % 2 != 0, myList))
weight_options=['uniform','distance']

param_grid = dict(n_neighbors=k_range, weights=weight_options)
print(param_grid)

# instantiate and fit the grid
grid = GridSearchCV(KNeighborsClassifier(algorithm='brute'), param_grid, cv=5, scoring='accuracy', return_tra
```

```
{'n_neighbors': [1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49], 'weights':
['uniform', 'distance']}
```

Fitting Gridsearch on BOW

```
grid.fit(Bow_x_train, y_train)

# examine the best model
print(grid.best_score_)
print(grid.best_params_)
```

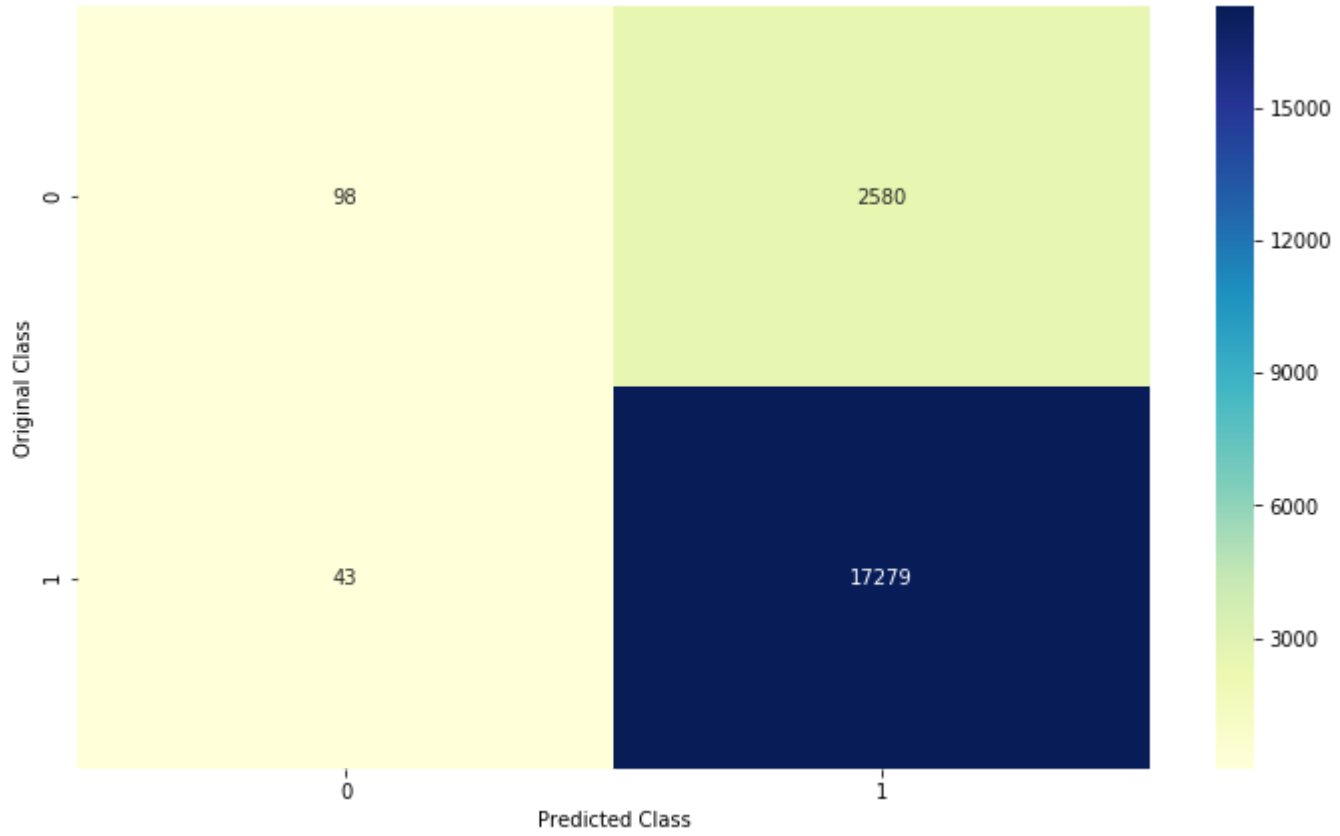
```
0.8817625
{'n_neighbors': 7, 'weights': 'distance'}
```

```
# KNN WITH BRUTE ALGO & UNIFORM WEIGHTS

knn_optimal = KNeighborsClassifier(n_neighbors=7,algorithm='brute',weights='distance',n_jobs=1)

# fitting the model
knn_optimal.fit(Bow_x_train, y_train)

# predict the response
pred_bow = knn_optimal.predict(Bow_x_test)

# evaluate accuracy
acc = accuracy_score(y_test, pred_bow) * 100
print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (7, acc))
```

```
The accuracy of the knn classifier for k = 7 is 86.885000%
```

```
#Confusion matrix
CM=confusion_matrix(y_test, pred_bow)
labels = [0,1]
print("-"*20, "Confusion matrix", "-"*20)
plt.figure(figsize=(12,7))
sns.heatmap(CM, annot=True, cmap="YlGnBu", fmt="g", xticklabels=labels, yticklabels=labels)
plt.xlabel('Predicted Class')
plt.ylabel('Original Class')
plt.show()
```

```
-------------------- Confusion matrix --------------------
```



Tf-Idf

```
#Initiating Vectorizer
count_vect = CountVectorizer(ngram_range=(1,2))

#Train data
vocabulary = count_vect.fit(x_train)
Tfidf_x_train= count_vect.transform(x_train)
print("the type of count vectorizer ",type(Tfidf_x_train))
print("the shape of out text BOW vectorizer ",Tfidf_x_train.get_shape())
print("the number of unique words ", Tfidf_x_train.get_shape()[1])
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (80000, 1013943)
the number of unique words  1013943
```

```
#Test data
Tfidf_x_test= count_vect.transform(x_test)
print("the type of co unt vectorizer ",type(Tfidf_x_test))
print("the shape of out text BOW vectorizer ",Tfidf_x_test.get_shape())
print("the number of unique words ", Tfidf_x_test.get_shape()[1])
```

```
the type of co unt vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (20000, 1013943)
the number of unique words  1013943
```

Fitting gridsearch on Tf-IDf

```
grid.fit(Tfidf_x_train, y_train)

# examine the best model
print(grid.best_score_)
print(grid.best_params_)
```

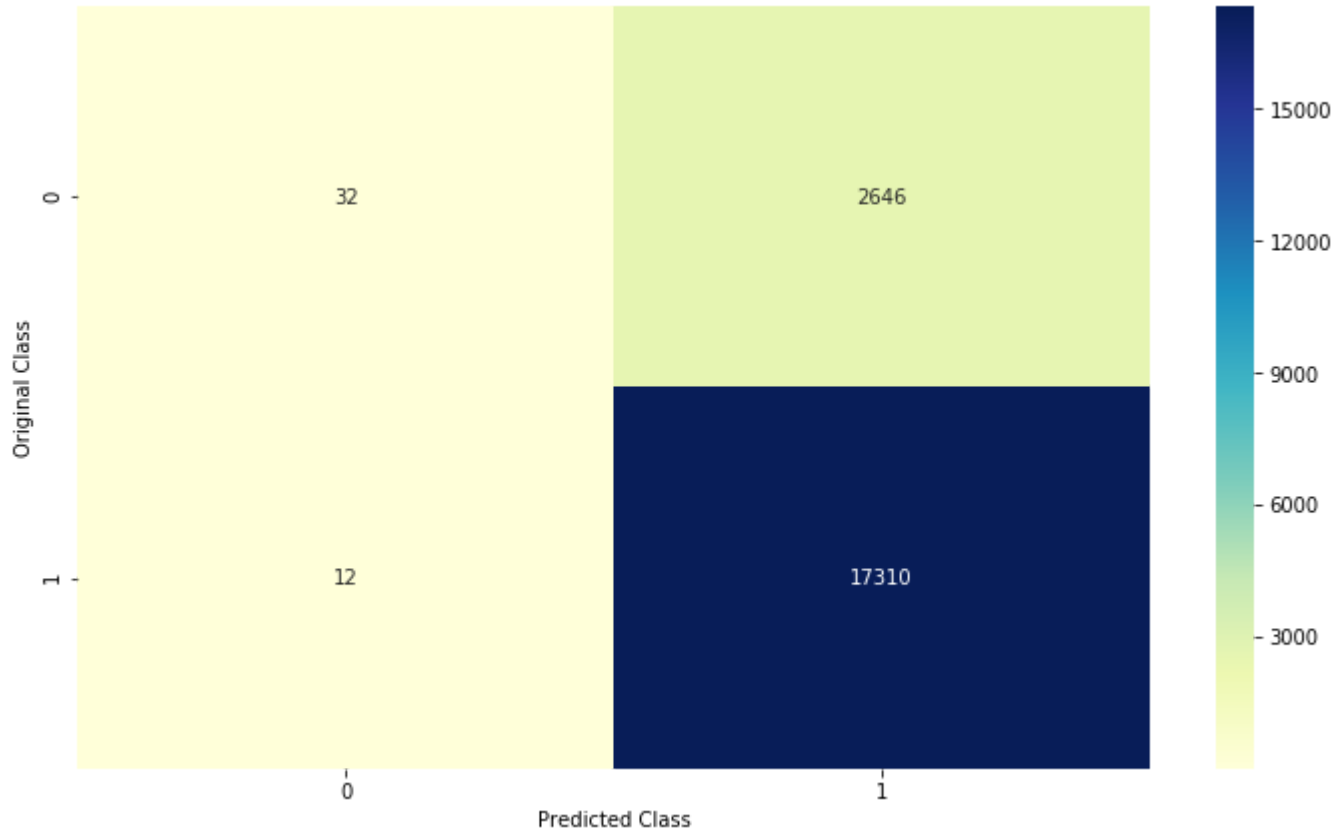
```
0.88045
{'n_neighbors': 15, 'weights': 'distance'}
```

```
# KNN WITH BRUTE ALGO & DISTANCE WEIGHTS

knn_optimal = KNeighborsClassifier(n_neighbors=15,algorithm='brute',weights='distance',n_jobs=1)

# fitting the model
knn_optimal.fit(Tfidf_x_train, y_train)

# predict the response
pred_tfidf = knn_optimal.predict(Tfidf_x_test)

# evaluate accuracy
acc = accuracy_score(y_test, pred_tfidf) * 100
print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (15, acc))
```

```
The accuracy of the knn classifier for k = 15 is 86.710000%
```

```
#Confusion matrix
CM=confusion_matrix(y_test, pred_tfidf)
labels = [0,1]
print("-"*20, "Confusion matrix", "-"*20)
plt.figure(figsize=(12,7))
sns.heatmap(CM, annot=True, cmap="YlGnBu", fmt="g", xticklabels=labels, yticklabels=labels)
plt.xlabel('Predicted Class')
plt.ylabel('Original Class')
plt.show()
```

```
-------------------- Confusion matrix --------------------
```



W2V

```
#W2V list of Training data
i=0
list_of_sent_train=[]
for sent in train_data['CleanedText'].values:
    list_of_sent_train.append(sent.split())
```

```
#W2V List of Test data
i=0
list_of_sent_test=[]
for sent in test_data['CleanedText'].values:
    list_of_sent_test.append(sent.split())
```

```
#Training W2V train model
# min_count = 5 considers only words that occured atleast 5 times
w2v_model_train=Word2Vec(list_of_sent_train,min_count=5,size=50, workers=6)
```

```
w2v_words_train = list(w2v_model_train.wv.vocab)
print("number of words that occured minimum 5 times ",len(w2v_words_train))
print("sample words ", w2v_words_train[0:50])
```

```
number of words that occured minimum 5 times  11361
sample words  ['witti', 'littl', 'book', 'make', 'son', 'laugh', 'loud', 'car', 'drive', 'along', 'alway', 'sing', 'refrai
n', 'hes', 'learn', 'whale', 'india', 'droop', 'love', 'new', 'word', 'introduc', 'silli', 'classic', 'will', 'bet', 'stil
l', 'abl', 'memori', 'colleg', 'rememb', 'see', 'show', 'air', 'televis', 'year', 'ago', 'child', 'sister', 'later', 'bough
t', 'day', 'thirti', 'someth', 'use', 'seri', 'song', 'student', 'teach', 'preschool']
```

Avg W2V

```
#Train data
# average Word2Vec
# compute average word2vec for each review.
sent_vectors_train_avgw2v = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent_train: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words_train:
            vec = w2v_model_train.wv[word]
            sent_vec += vec
            cnt_words += 1
    if cnt_words != 0:
        sent_vec /= cnt_words
    sent_vectors_train_avgw2v.append(sent_vec)
print(len(sent_vectors_train_avgw2v))
print(len(sent_vectors_train_avgw2v[0]))
```

```
80000
50
```

```
#Test data
# average Word2Vec
# compute average word2vec for each review.
sent_vectors_test_avgw2v = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent_test: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words_train:
            vec = w2v_model_train.wv[word]
            sent_vec += vec
            cnt_words += 1
    if cnt_words != 0:
        sent_vec /= cnt_words
    sent_vectors_test_avgw2v.append(sent_vec)
print(len(sent_vectors_test_avgw2v))
print(len(sent_vectors_test_avgw2v[0]))
```

```
20000
50
```

Fitting gridearch on Avg-W2v

```
grid.fit(sent_vectors_train_avgw2v, y_train)

# examine the best model
print(grid.best_score_)
print(grid.best_params_)
```

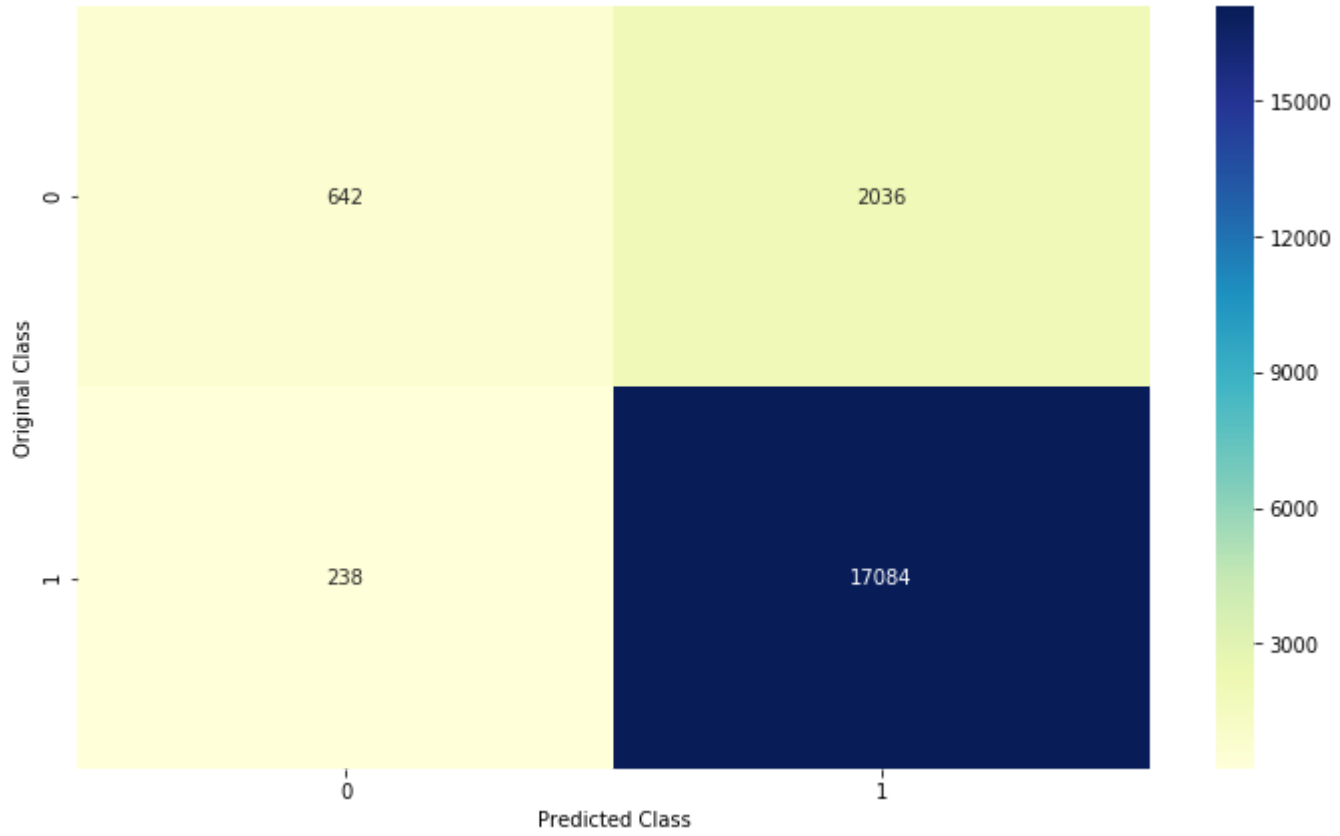
```
0.8967375
{'n_neighbors': 13, 'weights': 'distance'}
```

```
# KNN WITH BRUTE ALGO & DISTANCE WEIGHTS

knn_optimal = KNeighborsClassifier(n_neighbors=13,algorithm='brute',weights='distance',n_jobs=1)

# fitting the model
knn_optimal.fit(sent_vectors_train_avgw2v, y_train)

# predict the response
pred_Avgw2v = knn_optimal.predict(sent_vectors_test_avgw2v)

# evaluate accuracy
acc = accuracy_score(y_test, pred_Avgw2v) * 100
print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (13, acc))
```

```
The accuracy of the knn classifier for k = 13 is 88.630000%
```

```
#Confusion matrix
CM=confusion_matrix(y_test, pred_Avgw2v)
labels = [0,1]
print("-"*20, "Confusion matrix", "-"*20)
plt.figure(figsize=(12,7))
sns.heatmap(CM, annot=True, cmap="YlGnBu", fmt="g", xticklabels=labels, yticklabels=labels)
plt.xlabel('Predicted Class')
plt.ylabel('Original Class')
plt.show()
```

```
-------------------- Confusion matrix --------------------
```



Tfidf_w2v

```
tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))
vocabulary = tf_idf_vect.fit(train_data['CleanedText'])
final_tf_idf= tf_idf_vect.transform(train_data['CleanedText'])
```

```
# TF-IDF weighted Word2Vec
tfidf_feat = tf_idf_vect.get_feature_names()# tfidf words/col-names
# final_tf_idf is the sparse matrix with row= sentence, col=word and cell_val = tfidf

tfidf_w2v_sent_vectors_train = []; # the tfidf-w2v for each sentence/review is stored in this list
row=0;
for sent in list_of_sent_train: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words_train:
            vec = w2v_model_train.wv[word]
            # obtain the tf_idfidf of a word in a sentence/review
            tf_idf = final_tf_idf[row, tfidf_feat.index(word)]
            sent_vec += (vec * tf_idf)
            weight_sum += tf_idf
    if weight_sum != 0:
        sent_vec /= weight_sum
    tfidf_w2v_sent_vectors_train.append(sent_vec)
    row += 1
```

```
final_tf_idf= tf_idf_vect.transform(test_data['CleanedText'])

tfidf_w2v_sent_vectors_test = []; # the tfidf-w2v for each sentence/review is stored in this list
row=0;
for sent in list_of_sent_test: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words_train:
            vec = w2v_model_train.wv[word]
            # obtain the tf_idfidf of a word in a sentence/review
            tf_idf = final_tf_idf[row, tfidf_feat.index(word)]
            sent_vec += (vec * tf_idf)
            weight_sum += tf_idf
    if weight_sum != 0:
        sent_vec /= weight_sum
    tfidf_w2v_sent_vectors_test.append(sent_vec)
    row += 1
```

Fitting gridsearch on Tfidf-W2vec

```
grid.fit(tfidf_w2v_sent_vectors_train, y_train)

# examine the best model
print(grid.best_score_)
print(grid.best_params_)
```

```
0.8924
{'n_neighbors': 25, 'weights': 'distance'}
```

```
# KNN WITH BRUTE ALGO & DISTANCE WEIGHTS

knn_optimal = KNeighborsClassifier(n_neighbors=25,algorithm='brute',weights='distance',n_jobs=1)

# fitting the model
knn_optimal.fit(tfidf_w2v_sent_vectors_train, y_train)

# predict the response
pred_tfidf_w2v = knn_optimal.predict(tfidf_w2v_sent_vectors_test)

# evaluate accuracy
acc = accuracy_score(y_test, pred_tfidf_w2v) * 100
print('\nThe accuracy of the knn classifier for k = %d is %f%%' % (25, acc))
```

```
The accuracy of the knn classifier for k = 25 is 87.900000%
```

```
#Confusion matrix
CM=confusion_matrix(y_test, pred_tfidf_w2v)
labels = [0,1]
print("-"*20, "Confusion matrix", "-"*20)
plt.figure(figsize=(12,7))
sns.heatmap(CM, annot=True, cmap="YlGnBu", fmt="g", xticklabels=labels, yticklabels=labels)
plt.xlabel('Predicted Class')
plt.ylabel('Original Class')
plt.show()
```

```
-------------------- Confusion matrix --------------------
```