In [1]:

```
%%time
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
Wall time: 34.1 s
```

In [98]:

```
#loading amazon food review data set
data=pd.read_csv('Reviews.csv')
print("shape",data.shape)
data.head()
```

```
shape (568454, 10)
```

Out[98]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600

In [3]:

```
%%time
data['Score'].value_counts()
```

```
Wall time: 24 ms
```

Out[3]:

```
5    363122
4     80655
1     52268
3     42640
2     29769
Name: Score, dtype: int64
```

In [4]:

```
%%time
#Converting score coloumn to positive or negative review
data['Score'] = data['Score'].apply(lambda x : 'pos' if x > 3 else 'neg')
data.groupby('Score')['Summary'].count()
```

```
Wall time: 652 ms
```

Data cleaning:

In [5]:

```
%%time
#1) Data Deduplication
#Sorting data according to ProductId in ascending order
sorted_data=data.sort_values('ProductId',axis=0,ascending=True,inplace=False,kind='quiksort',na_pos
n='last')
#Deduplication of entries
final=sorted_data.drop_duplicates(subset=
{"UserId","ProfileName","Time","Text"},keep='first',inplace=False)
print("shape of data after Deduplication of entries:", final.shape)
```

```
shape of data after Deduplication of entries: (393933, 10)
Wall time: 3.19 s
```

In [6]:

```
%%time
#2) Helpfullness Numerator Greater than Helpfullness Denominator
final = final[final.HelpfulnessNumerator <= final.HelpfulnessDenominator]
print("shape of data after data duplication:",final.shape)
#seeing how many no.of positive reviews and negative reviews
final['Score'].value_counts()
```

```
shape of data after data duplication: (393931, 10)
Wall time: 241 ms
```

Text Preprocessing: Stemming,Stop-word removal

In [7]:

```
%%time
import re
import nltk
from nltk.corpus import stopwords
from nltk.stem import SnowballStemmer
stop = set(stopwords.words('english'))  #set of stopwords
sno = nltk.stem.SnowballStemmer('english')   #initialising the snowball stemmer
#Function for HTML Tag removal
def cleanhtml(sentence):
    cleanr = re.compile('<.*?>')
    cleantext = re.sub(cleanr, '', sentence)
    return cleantext
#Function for  Punctuations Removal
def cleanpunc(sentence):
    cleaned = re.sub(r'[?|!|\'|"|#]',r'',sentence)
    cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
    cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
    return  cleaned
```

```
Wall time: 13.9 s
```

In [8]:

```
%%time
#sorting the data based on time
final.sort_values('Time',inplace=True)
final = final.reset_index(drop=True)
```

```
Wall time: 620 ms
```

In [9]:

```
%%time
#Taking one lakh points
final_100000 = final[0:100000]
```

```
Wall time: 0 ns
```

In [10]:

```
%%time
#Code for implementing step-by-step the checks mentioned in the pre-processing phase
i=0
str1=' '
final_string=[]
s=''
for sent in final_100000['Text'].values:
    filtered_sentence=[]
    sent=cleanhtml(sent) # remove HTMl tags
    for w in sent.split():
        for cleaned_words in cleanpunc(w).split():
            if((cleaned_words.isalpha()) & (len(cleaned_words)>2)):
                if(cleaned_words.lower() not in stop):
                    s=(sno.stem(cleaned_words.lower())).encode('utf8')
                    filtered_sentence.append(s)
                else:
                    continue
            else:
                continue
    str1 = b" ".join(filtered_sentence).decode('utf8') #final string of cleaned words
    final_string.append(str1)
    i+=1
```

```
Wall time: 2min 1s
```

In [13]:

```
%%time
final_100000['CleanedText'] = final_string
```

```
Wall time: 73 ms
```

In [14]:

```
%%time
#In the Score column, assigning positive as 1 and negative as 0
def pos_neg(x):
    if x == 'pos':
        return 1
    return 0
final_100000['Score'] = final_100000['Score'].map(pos_neg)
```

```
Wall time: 177 ms
```

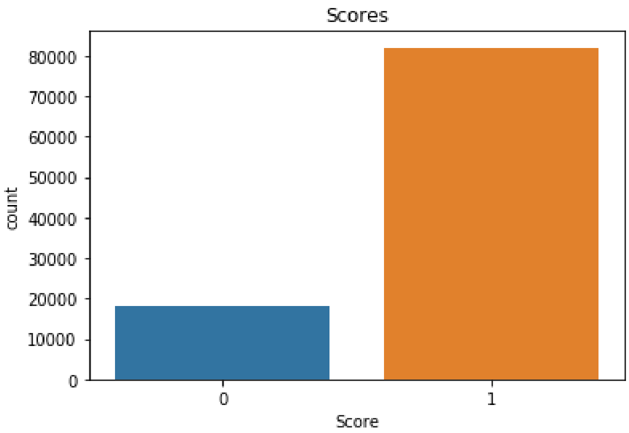
In [15]:

```
%%time
#Making the index from 0 to end
final_100000 = final_100000.reset_index(drop=True)
final_100000.shape
```

```
Wall time: 96.2 ms
```

In [16]:

```
%%time
import seaborn as sns
import matplotlib.pyplot as plt
ax=plt.axes()
sns.countplot(final_100000.Score,ax=ax)
plt.title("Scores")
plt.show()
```



```
Wall time: 935 ms
```

In [17]:

```
%%time
final_100000['Score'].value_counts()
```

```
Wall time: 4.99 ms
```

Out[17]:

```
1    81998
0    18002
Name: Score, dtype: int64
```

In [2]:

```
%%time
# Functions to use and retireve files
import pickle
def savetofile(obj,filename):
   pickle.dump(obj,open(filename,"wb"))
def openfromfile(filename):
   temp = pickle.load(open(filename,"rb"))
   return temp
```

```
Wall time: 0 ns
```

In [6]:

```
%%time
savetofile(final_100000,"prepocessed_data.pickle")
```

```
Wall time: 1.29 s
```

In [3]:

```
%%time
#Loading the variable from file
final_100000 = openfromfile("prepocessed_data.pickle")
```

```
Wall time: 1.18 s
```

In [99]:

```
final_100000.head()
```

Out[99]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Tin
0	150524	0006641040	ACITT7DI6IDDL	shari zychinski	0	0	1	9393408
1	150501	0006641040	AJ46FKXOVC7NR	Nicholas A Mesiano	2	2	1	9408096
2	451856	B00004CXX9	AIUWLEQ1ADEG5	Elizabeth Medina	0	0	1	9440928
3	374359	B00004CI84	A344SMIA5JECGM	Vincent P. Ross	1	2	1	9444384
4	451855	B00004CXX9	AJH6LUC1UT1ON	The Phantom of the Opera	0	0	1	9468576

Splitting data for simple cross validation:

In [4]:

```
%%time
#storing cleanedtext into x and Score into y
x = final_100000['CleanedText']
y = final_100000['Score']
#Splitting the data into train and test data
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=0.2, shuffle=False)
#splitting train data as train as 60% and  cross_validation as 20% and test data as 20%
x_tr, x_cv, y_tr, y_cv = train_test_split(X_train, Y_train, test_size=0.25,shuffle=False)
print(x_tr.shape)
print(x_cv.shape)
print(X_test.shape)
print(y_tr.shape)
print(y_cv.shape)
print(Y_test.shape)
```

```
(60000,)
(20000,)
(20000,)
(60000,)
```

```
(20000,)
(20000,)
Wall time: 3.43 s
```

Splitting data for k fold cross validation:

In [5]:

```
%%time
#storing cleanedtext into x and Score into y
x = final_100000['CleanedText']
y = final_100000['Score']
#Splitting the data into train and test data with 70:30 ratio.
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, shuffle=False)
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(70000,)
(30000,)
(70000,)
(30000,)
Wall time: 24 ms
```

1.BOW:

Vectorising the simple cross validation data:

In [24]:

```
%%time
#Bag of words:
from sklearn.feature_extraction.text import CountVectorizer
count_vect = CountVectorizer()
#vectorizing the train data,cross validate data and test data.
bow = count_vect.fit_transform(x_tr)
bow1 = count_vect.transform(x_cv)
bow2 = count_vect.transform(X_test)
#preprocessing the train data,cross validate data and test data.
from sklearn import preprocessing
tr_bow_x = preprocessing.normalize(bow)
cv_bow_x = preprocessing.normalize(bow1)
te_bow_x = preprocessing.normalize(bow2)
savetofile(tr_bow_x,"tr_bow_x.pickle")
savetofile(cv_bow_x,"cv_bow_x.pickle")
savetofile(te_bow_x,"te_bow_x.pickle")
```

```
Wall time: 5.25 s
```

In [26]:

```
%%time
#conversting sparse data into dense data
from sklearn.decomposition import TruncatedSVD
svd = TruncatedSVD(n_components=300, n_iter=5)
dense_tr_bow_x=svd.fit_transform(tr_bow_x)
dense_cv_bow_x=svd.transform(cv_bow_x)
dense_te_bow_x=svd.transform(te_bow_x)
savetofile(dense_tr_bow_x,"dense_tr_bow_x.pickle")
savetofile(dense_cv_bow_x,"dense_cv_bow_x.pickle")
savetofile(dense_te_bow_x,"dense_te_bow_x.pickle")
```

```
Wall time: 25.9 s
```

Vectorising the K-fold cross validation data:

In [27]:

```
%%time
#Bag of words:
from sklearn.feature_extraction.text import CountVectorizer
count_vect = CountVectorizer()
#vectorizing the train data and test data.
bow1 = count_vect.fit_transform(x_train)
bow2 = count_vect.transform(x_test)
#preprocessing the train data and test data.
from sklearn import preprocessing
kfold_tr_bow_x = preprocessing.normalize(bow1)
kfold_te_bow_x = preprocessing.normalize(bow2)
savetofile(kfold_tr_bow_x,"kfold_tr_bow_x.pickle")
savetofile(kfold_te_bow_x,"kfold_te_bow_x.pickle")
```

```
Wall time: 5.36 s
```

In [28]:

```
%%time
#conversting sparse data into dense data
from sklearn.decomposition import TruncatedSVD
svd = TruncatedSVD(n_components=300, n_iter=5)
dense_kfold_tr_bow_x=svd.fit_transform(kfold_tr_bow_x)
dense_kfold_te_bow_x=svd.transform(kfold_te_bow_x)
print(dense_kfold_tr_bow_x.shape)
print(dense_kfold_te_bow_x.shape)
savetofile(dense_kfold_tr_bow_x,"dense_kfold_tr_bow_x.pickle")
savetofile(dense_kfold_te_bow_x,"dense_kfold_te_bow_x.pickle")
```

```
(70000, 300)
(30000, 300)
Wall time: 29.5 s
```

2.TF-IDF:

Vectorising the simple cross validation data:

In [7]:

```
%%time
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf = TfidfVectorizer()
#vectorizing the train data,cross validate data and test data.
tfidf1 = tfidf.fit_transform(x_tr)
tfidf2 = tfidf.transform(x_cv)
tfidf3 = tfidf.transform(X_test)
#preprocessing the train data,cross validate data and test data.
from sklearn import preprocessing
tr_tfidf_x = preprocessing.normalize(tfidf1)
cv_tfidf_x= preprocessing.normalize(tfidf2)
te_tfidf_x= preprocessing.normalize(tfidf3)
savetofile(tr_tfidf_x,"tr_tfidf_x.pickle")
savetofile(cv_tfidf_x,"cv_tfidf_x.pickle")
savetofile(te_tfidf_x,"te_tfidf_x.pickle")
```

```
Wall time: 7.48 s
```

In [8]:

```
%%time
#Loading the variable from file
tr_tfidf_x= openfromfile("tr_tfidf_x.pickle")
cv_tfidf_x= openfromfile("cv_tfidf_x.pickle")
te_tfidf_x= openfromfile("te_tfidf_x.pickle")
```

```
Wall time: 176 ms
```

In [10]:

```
%%time
#conversting sparse data into dense data
from sklearn.decomposition import TruncatedSVD
svd = TruncatedSVD(n_components=300, n_iter=5)
dense_tr_tfidf_x =svd.fit_transform(tr_tfidf_x)
dense_cv_tfidf_x =svd.transform(cv_tfidf_x)
dense_te_tfidf_x =svd.transform(te_tfidf_x)
```

```
Wall time: 31.1 s
```

In [11]:

```
print(dense_tr_tfidf_x.shape)
print(dense_cv_tfidf_x.shape)
print(dense_te_tfidf_x.shape)
savetofile(dense_tr_tfidf_x,"dense_tr_tfidf_x.pickle")
savetofile(dense_cv_tfidf_x,"dense_cv_tfidf_x.pickle")
savetofile(dense_te_tfidf_x,"dense_te_tfidf_x.pickle")
```

```
(60000, 300)
(20000, 300)
(20000, 300)
```

Vectorising the K-fold cross validation data:

In [13]:

```
%%time
#TFIDF:
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf = TfidfVectorizer()
#vectorizing the train data and test data.
tfidf1 = tfidf.fit_transform(x_train)
tfidf2 = tfidf.transform(x_test)
#preprocessing the train data test data.
from sklearn import preprocessing
kfold_tr_tfidf_x = preprocessing.normalize(tfidf1)
kfold_te_tfidf_x= preprocessing.normalize(tfidf2)
```

```
Wall time: 7.24 s
```

In [92]:

```
%%time
savetofile(kfold_tr_tfidf_x,"kfold_tr_tfidf_x.pickle")
savetofile(kfold_te_tfidf_x,"kfold_te_tfidf_x.pickle")
```

```
Wall time: 421 ms
```

In [14]:

```
%%time
#conversting sparse data into dense data
from sklearn.decomposition import TruncatedSVD
svd = TruncatedSVD(n_components=300, n_iter=5)
dense_kfold_tr_tfidf_x=svd.fit_transform(kfold_tr_tfidf_x)
dense_kfold_te_tfidf_x=svd.transform(kfold_te_tfidf_x)
print(dense_kfold_tr_tfidf_x.shape)
print(dense_kfold_te_tfidf_x.shape)
savetofile(dense_kfold_tr_tfidf_x,"dense_kfold_tr_tfidf_x.pickle")
savetofile(dense_kfold_te_tfidf_x,"dense_kfold_te_tfidf_x.pickle")
```

```
(70000, 300)
(30000, 300)
Wall time: 40 s
```

3.Avg-W2V:

Vectorising the simple cross validation data:

In [37]:

```
%%time
# converting train data into avg_w2vec data
list_of_sent_tr=[]
for sent in x_tr.values:
    list_of_sent_tr.append(sent.split())
```

```
Wall time: 578 ms
```

In [38]:

```
%%time
#training w2vec model on train data
import gensim
from gensim.models import Word2Vec
w2v_model_tr=gensim.models.Word2Vec(list_of_sent_tr,min_count=5,size=50, workers=4)
words_tr = list(w2v_model_tr.wv.vocab)
print(len(words_tr))
```

```
9986
Wall time: 12.3 s
```

In [39]:

```
%%time
#finding avg w2v of train data
sent_vectors_tr = [];
for sent in list_of_sent_tr:
    sent_vec = np.zeros(50)
    cnt_words =0;
    for word in sent:
        try:
            vec = w2v_model_tr.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_tr.append(sent_vec)
print(len(sent_vectors_tr))
print(len(sent_vectors_tr[0]))
```

```
60000
50
Wall time: 10.5 s
```

In [40]:

```
%%time
#preprocessing avg w2v of train data
from sklearn import preprocessing
avg_w2v_tr=preprocessing.scale(sent_vectors_tr)
print("standardized data shape is",avg_w2v_tr.shape)
```

```
standardized data shape is (60000, 50)
Wall time: 173 ms
```

In [50]:

```
%%time
savetofile(avg_w2v_tr,'avg_w2v_tr.pickle')
```

```
Wall time: 506 ms
```

In [21]:

```
%%time
#converting cv data into avg_w2vec data
list_of_sent_cv=[]
for sent in x_cv.values:
    list_of_sent_cv.append(sent.split())
```

```
Wall time: 138 ms
```

In [23]:

```
%%time
#finding avg w2v of cv data
sent_vectors_cv = [];
for sent in list_of_sent_cv:
    sent_vec = np.zeros(50)
    cnt_words =0;
    for word in sent:
        try:
            vec = w2v_model_tr.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_cv.append(sent_vec)
print(len(sent_vectors_cv))
print(len(sent_vectors_cv[0]))
```

```
20000
50
Wall time: 3.91 s
```

In [24]:

```
%%time
#preprocessing avg w2v of cv data
from sklearn import preprocessing
avg_w2v_cv=preprocessing.scale(sent_vectors_cv)
print("standardized data shape is",avg_w2v_cv.shape)
```

```
standardized data shape is (20000, 50)
Wall time: 64 ms
```

In [51]:

```
%%time
savetofile(avg_w2v_cv,'avg_w2v_cv.pickle')
```

```
Wall time: 35 ms
```

In [78]:

```
%%time
#converting test data into avg_w2vec data
list_of_sent_te=[]
for sent in X_test.values:
    list_of_sent_te.append(sent.split())
```

```
Wall time: 251 ms
```

In [79]:

```
print(len( list_of_sent_te))
```

```
20000
```

In [30]:

```
%%time
#finding avg w2v of test data
sent_vectors_te = [];
for sent in list_of_sent_te:
    sent_vec = np.zeros(50)
    cnt_words =0;
    for word in sent:
        try:
            vec = w2v_model_tr.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_te.append(sent_vec)
print(len(sent_vectors_te))
print(len(sent_vectors_te[0]))
```

```
20000
50
Wall time: 3.95 s
```

In [31]:

```
%%time
#preprocessing avg w2v of test data
from sklearn import preprocessing
avg_w2v_te=preprocessing.scale(sent_vectors_te)
print("standardized data shape is",avg_w2v_te.shape)
```

```
standardized data shape is (20000, 50)
Wall time: 61 ms
```

In [52]:

```
%%time
savetofile(avg_w2v_te,'avg_w2v_te.pickle')
```

```
Wall time: 35 ms
```

Vectorising the K-fold cross validation data:

In [54]:

```
%%time
# converting train data into avg_w2vec data
list_of_sent_tr_kfold=[]
for sent in x_train.values:
    list_of_sent_tr_kfold.append(sent.split())
```

```
Wall time: 1.07 s
```

In [55]:

```
%%time
#training w2vec model on train data
import gensim
from gensim.models import Word2Vec
w2v_model_tr_kfold=gensim.models.Word2Vec(list_of_sent_tr_kfold,min_count=5,size=50, workers=4)
words_tr_kfold = list(w2v_model_tr_kfold.wv.vocab)
print(len(words_tr_kfold))
```

```
10724
Wall time: 14.2 s
Wall time: 14.2 s
```

In [56]:

```
%%time
#finding avg w2v of train data
sent_vectors_tr_kfold = [];
for sent in list_of_sent_tr_kfold:
    sent_vec = np.zeros(50)
    cnt_words =0;
    for word in sent:
        try:
            vec = w2v_model_tr_kfold.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_tr_kfold.append(sent_vec)
print(len(sent_vectors_tr_kfold))
print(len(sent_vectors_tr_kfold[0]))
```

```
70000
50
Wall time: 12.3 s
```

In [57]:

```
%%time
#preprocessing avg w2v of train data
from sklearn import preprocessing
kfold_avg_w2v_tr=preprocessing.scale(sent_vectors_tr_kfold)
print("standardized data shape is",kfold_avg_w2v_tr.shape)
```

```
standardized data shape is (70000, 50)
Wall time: 205 ms
```

In [63]:

```
%%time
savetofile(kfold_avg_w2v_tr,'kfold_avg_w2v_tr.pickle')
```

```
Wall time: 337 ms
```

In [59]:

```
%%time
#converting test data into avg_w2vec data
list_of_sent_te_kfold=[]
for sent in x_test.values:
    list_of_sent_te_kfold.append(sent.split())
```

```
Wall time: 215 ms
```

In [60]:

```
%%time
#finding avg w2v of test data
sent_vectors_te_kfold = [];
for sent in list_of_sent_te_kfold:
    sent_vec = np.zeros(50)
    cnt_words =0;
    for word in sent:
        try:
            vec = w2v_model_tr_kfold.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_te_kfold.append(sent_vec)
    sent_vectors_te_kfold.append(sent_vec)
print(len(sent_vectors_te_kfold))
print(len(sent_vectors_te_kfold[0]))
```

```
30000
50
Wall time: 5.34 s
```

In [61]:

```
%%time
#preprocessing avg w2v of test data
from sklearn import preprocessing
kfold_avg_w2v_te=preprocessing.scale(sent_vectors_te_kfold)
print("standardized data shape is",kfold_avg_w2v_te.shape)
```

```
standardized data shape is (30000, 50)
Wall time: 87 ms
```

In [90]:

```
%%time
savetofile(kfold_avg_w2v_te,'kfold_avg_w2v_te.pickle')
```

```
Wall time: 78 ms
```

4.Tf-idf- W2V

Vectorising the simple cross validation data:

In [48]:

```
#training tfidf model on train data
from sklearn.feature_extraction.text import TfidfVectorizer
tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))
tf_idf_tr = tf_idf_vect.fit_transform(x_tr.values)
dictionary = dict(zip(tf_idf_vect.get_feature_names(), list(tf_idf_vect.idf_)))
print("shape of tf_idf:",tf_idf_tr.shape)
```

```
shape of tf_idf: (60000, 831429)
```

In [49]:

```
%%time
#finding tfidf w2v on train data
features =tf_idf_vect.get_feature_names()
tfidf_w2v_tr = []
row = 0
for sent in list_of_sent_tr:
    sent_vec = np.zeros(50)
    weighted_sum = 0
    for word in sent:
        if(word in words_tr):
            vec = w2v_model_tr.wv[word]
            tfidf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tfidf)
            weighted_sum += tfidf
    if(weighted_sum != 0):
        sent_vec /= weighted_sum
    tfidf_w2v_tr.append(sent_vec)
    row += 1
    if row % 100 == 0:
        print(row,end='\r')
```

```
Wall time: 3min
```

In [64]:

```
%%time
#preprocessing avg w2v of test data
from sklearn import preprocessing
tfidf_w2v_tr=preprocessing.scale(tfidf_w2v_tr)
print("standardized data shape is",tfidf_w2v_tr.shape)
```

```
standardized data shape is (60000, 50)
Wall time: 178 ms
```

In [93]:

```
%%time
savetofile(tfidf_w2v_tr,'tfidf_w2v_tr.pickle')
```

```
Wall time: 317 ms
```

In [69]:

```
%%time
#finding tfidf w2v on cv data
features =tf_idf_vect.get_feature_names()
tfidf_w2v_cv = []
row = 0
for sent in list_of_sent_cv:
    sent_vec = np.zeros(50)
    weighted_sum = 0
    for word in sent:
        if(word in words_tr):
            vec = w2v_model_tr.wv[word]
            tfidf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tfidf)
            weighted_sum += tfidf
    if(weighted_sum != 0):
        sent_vec /= weighted_sum
    tfidf_w2v_cv.append(sent_vec)
    row += 1
    if row % 100 == 0:
        print(row,end='\r')
```

```
Wall time: 1min 6s
```

In [70]:

```
%%time
#preprocessing avg w2v of cv data
from sklearn import preprocessing
tfidf_w2v_cv=preprocessing.scale(tfidf_w2v_cv)
print("standardized data shape is",tfidf_w2v_cv.shape)
```

```
standardized data shape is (20000, 50)
Wall time: 66.9 ms
```

In [94]:

```
%%time
savetofile(tfidf_w2v_cv,'tfidf_w2v_cv.pickle')
```

```
Wall time: 54 ms
```

In [80]:

```
%%time
#finding tfidf w2v on cv data
features =tf_idf_vect.get_feature_names()
tfidf_w2v_te = []
row = 0
for sent in list_of_sent_te:
    sent_vec = np.zeros(50)
    weighted_sum = 0
    weighted_sum = 0
    for word in sent:
        if(word in words_tr):
            vec = w2v_model_tr.wv[word]
            tfidf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tfidf)
            weighted_sum += tfidf
    if(weighted_sum != 0):
        sent_vec /= weighted_sum
    tfidf_w2v_te.append(sent_vec)
    row += 1
    if row % 100 == 0:
        print(row,end='\r')
```

```
Wall time: 1min
```

In [81]:

```
%%time
#preprocessing avg w2v of cv data
from sklearn import preprocessing
tfidf_w2v_te=preprocessing.scale(tfidf_w2v_te)
print("standardized data shape is",tfidf_w2v_te.shape)
```

```
standardized data shape is (20000, 50)
Wall time: 71 ms
```

In [95]:

```
%%time
savetofile(tfidf_w2v_te,'tfidf_w2v_te.pickle')
```

```
Wall time: 46 ms
```

Vectorising the K-fold cross validation data:

In [83]:

```
#training tfidf model on train data
from sklearn.feature_extraction.text import TfidfVectorizer
tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))
kfold_tf_idf_tr = tf_idf_vect.fit_transform(x_train.values)
dictionary = dict(zip(tf_idf_vect.get_feature_names(), list(tf_idf_vect.idf_)))
print("shape of tf_idf:",kfold_tf_idf_tr.shape)
```

```
shape of tf_idf: (70000, 939185)
```

In [84]:

```
%%time
#finding tfidf w2v on train data
features =tf_idf_vect.get_feature_names()
kfold_tfidf_w2v_tr = []
row = 0
for sent in list_of_sent_tr_kfold:
    sent_vec = np.zeros(50)
    weighted_sum = 0
    for word in sent:
        if(word in words_tr_kfold):
            vec = w2v_model_tr_kfold.wv[word]
            tfidf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tfidf)
            weighted_sum += tfidf
    if(weighted_sum != 0):
        sent_vec /= weighted_sum
    kfold_tfidf_w2v_tr.append(sent_vec)
    row += 1
    if row % 100 == 0:
        print(row,end='\r')
```

```
Wall time: 3min 26s
```

In [85]:

```
%%time
#preprocessing avg w2v of train data
from sklearn import preprocessing
kfold_tfidf_w2v_tr=preprocessing.scale(kfold_tfidf_w2v_tr)
print("standardized data shape is",kfold_tfidf_w2v_tr.shape)
```

```
standardized data shape is (70000, 50)
Wall time: 233 ms
```

In [96]:

```
%%time
savetofile(kfold_tfidf_w2v_tr,'kfold_tfidf_w2v_tr.pickle')
```

```
Wall time: 333 ms
```

In [87]:

```
%%time
#finding tfidf w2v on test data
features =tf_idf_vect.get_feature_names()
kfold_tfidf_w2v_te = []
row = 0
for sent in list_of_sent_te_kfold:
    sent_vec = np.zeros(50)
    weighted_sum = 0
    for word in sent:
        if(word in words_tr_kfold):
            vec = w2v_model_tr_kfold.wv[word]
            tfidf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tfidf)
            weighted_sum += tfidf
    if(weighted_sum != 0):
        sent_vec /= weighted_sum
    kfold_tfidf_w2v_te.append(sent_vec)
    row += 1
    if row % 100 == 0:
        print(row,end='\r')
```

```
Wall time: 1min 34s
```

In [88]:

```
%%time
#preprocessing avg w2v of test data
from sklearn import preprocessing
kfold_tfidf_w2v_te=preprocessing.scale(kfold_tfidf_w2v_te)
print("standardized data shape is",kfold_tfidf_w2v_te.shape)
```

```
standardized data shape is (30000, 50)
Wall time: 98 ms
```

In [97]:

```
%%time
savetofile(kfold_tfidf_w2v_te,'kfold_tfidf_w2v_te.pickle')
```

```
Wall time: 46 ms
```