assignment2

December 22, 2018

AMAZON FINE FOOD REVIEWS ANALYSIS Objective:
1.Get the vector representation for each of the reviews.For this , use 1)BoW 2)TfIdf 3)Avg W2V 4)TfIdf Weighted W2V

2. Use all the 4 methods and apply T-sneto get a plot such that every review is represntated by a point and such that positive and negative reviews get separated by a hyperplane.(supposedly)Assign positive reviews blue and negative reviews red colour. Compare them.Conclude. Using 3k datapoints for computation.

Score 1: Used for positive reviews. Score 0: Used for negative reviews.

In [1]:
```
#importing libraries
import warnings
warnings.filterwarnings("ignore")
import sqlite3
import numpy as np
import pandas as pd
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
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
```

```
C:\Users\shubh\Anaconda3\lib\site-packages\gensim\utils.py:1212: UserWarning: detected Windows
  warnings.warn("detected Windows; aliasing chunkize to chunkize_serial")
```

```
In [2]: #importing dataset using sqlite
        con = sqlite3.connect(r'C:\Users\shubh\Desktop\amazon-fine-food-reviews\database.sqlit
```

1 using r before string to convert normal string into raw string.

2 Cannot import dataset directly without using r. Or try '/' instead of ''.

3 filter positive and negative values.

4 drop values of score=3

```
In [3]: filtered_data = pd.read_sql_query("""
        SELECT * FROM REVIEWS where Score!=3
        """,con)
```

```
In [4]: filtered_data.shape
        filtered_data.head(3)
```

```
Out[4]:    Id   ProductId          UserId                      ProfileName  \
        0   1  B001E4KFG0  A3SGXH7AUHU8GW                       delmartian
        1   2  B00813GRG4  A1D87F6ZCVE5NK                           dll pa
        2   3  B000LQOCH0   ABXLMWJIXXAIN  Natalia Corres "Natalia Corres"

           HelpfulnessNumerator  HelpfulnessDenominator  Score        Time  \
        0                     1                       1      5  1303862400
        1                     0                       0      1  1346976000
        2                     1                       1      4  1219017600

                        Summary                                                Text
        0  Good Quality Dog Food  I have bought several of the Vitality canned d...
        1      Not as Advertised  Product arrived labeled as Jumbo Salted Peanut...
        2  "Delight" says it all  This is a confection that has been around a fe...
```

```
In [5]: #originally its contains 525814 reviews in total(excluding socer point of 3)
        #change scores to 0 and 1
        #using lambda function
        filtered_data['Score']=filtered_data['Score'].map(lambda x:0 if x<3 else 1)
```

```
In [6]: filtered_data.head(3)
```

```
Out[6]:    Id   ProductId          UserId                      ProfileName  \
        0   1  B001E4KFG0  A3SGXH7AUHU8GW                       delmartian
        1   2  B00813GRG4  A1D87F6ZCVE5NK                           dll pa
        2   3  B000LQOCH0   ABXLMWJIXXAIN  Natalia Corres "Natalia Corres"

           HelpfulnessNumerator  HelpfulnessDenominator  Score        Time  \
        0                     1                       1      1  1303862400
        1                     0                       0      0  1346976000
        2                     1                       1      1  1219017600

                        Summary                                                Text
        0  Good Quality Dog Food  I have bought several of the Vitality canned d...
        1      Not as Advertised  Product arrived labeled as Jumbo Salted Peanut...
        2  "Delight" says it all  This is a confection that has been around a fe...
```

```
In [7]: #Score values successfully changed
        filtered_data['Score'].value_counts()
```

```
Out[7]: 1    443777
        0     82037
        Name: Score, dtype: int64
```

```
In [8]: #there are 443777 positive reviews and 82037 negative reviews.
        #Deduplication
        #Sorting by product id
        sorted_data=filtered_data.sort_values('ProductId', axis=0, ascending=True, inplace=Fals
```

```
In [9]: #Entries deduplication
        final = sorted_data.drop_duplicates(subset={"UserId","ProfileName","Time","Text"},keep=
        final.shape
```

```
Out[9]: (364173, 10)
```

```
In [10]: #TOtal reviews reduced to 364173
         #also given the helpfulness num< helpfullness denom
         #HENCE
         final=final[final.HelpfulnessNumerator<=final.HelpfulnessDenominator]
         final.shape
```

```
Out[10]: (364171, 10)
```

```
In [11]: #TOtal reviews reduced to 364173
         final['Score'].value_counts()
```

```
Out[11]: 1    307061
         0     57110
         Name: Score, dtype: int64
```

307061 reviews are positive 57110 reviews are negative
Starting with preprocessing of Data

```
In [12]: from nltk.corpus import stopwords
         stop = set(stopwords.words('english')) #set of stopwords
         sno = nltk.stem.SnowballStemmer('english') #initialising the snowball stemmer

         def cleanhtml(sentence): #function to clean the word of any html-tags
             cleanr = re.compile('<.*?>')
             cleantext = re.sub(cleanr, ' ', sentence)
             return cleantext
         def cleanpunc(sentence): #function to clean the word of any punctuation or special ch
             cleaned = re.sub(r'[?|!|\'|"|#]',r'',sentence)
             cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
             return  cleaned
```

Implementing the step-by step checks for stop word removal, html removal, alphanumeric, lowercase conversion,etc

```
In [13]: #Code for implementing step-by-step the checks mentioned in the pre-processing phase
         # this code takes a while to run as it needs to run on 500k sentences.
         if not os.path.isfile('final.sqlite'):
             final_string=[]
             all_positive_words=[] # store words from +ve reviews here
             all_negative_words=[] # store words from -ve reviews here.
             for i, sent in enumerate(tqdm(final['Text'].values)):
                 filtered_sentence=[]
                 #print(sent);
                 sent=cleanhtml(sent) # remove HTMl tags
                 for w in sent.split():
                     # we have used cleanpunc(w).split(), one more split function here because
                     # if we dont use .split() function then we will be considring "abc def" a
                     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)
                                 if (final['Score'].values)[i] == 1:
                                     all_positive_words.append(s) #list of all words used to d
                                 if(final['Score'].values)[i] == 0:
                                     all_negative_words.append(s) #list of all words used to d
                 str1 = b" ".join(filtered_sentence) #final string of cleaned words
                 #print("*****************************************************************
                 final_string.append(str1)

             ##############---- storing the data into .sqlite file ------#####################
             final['CleanedText']=final_string #adding a column of CleanedText which displays
             final['CleanedText']=final['CleanedText'].str.decode("utf-8")
                 # store final table into an SQlLite table for future.
             conn = sqlite3.connect('final.sqlite')
             c=conn.cursor()
```

```
            conn.text_factory = str
            final.to_sql('Reviews', conn,  schema=None, if_exists='replace', \
                         index=True, index_label=None, chunksize=None, dtype=None)
            conn.close()


            with open('positive_words.pkl', 'wb') as f:
                pickle.dump(all_positive_words, f)
            with open('negitive_words.pkl', 'wb') as f:
                pickle.dump(all_negative_words, f)
```

```
100%|| 364171/364171 [20:48<00:00, 291.77it/s]
```

Connect to final.sqlite

```
In [14]: conn = sqlite3.connect('final.sqlite')
```

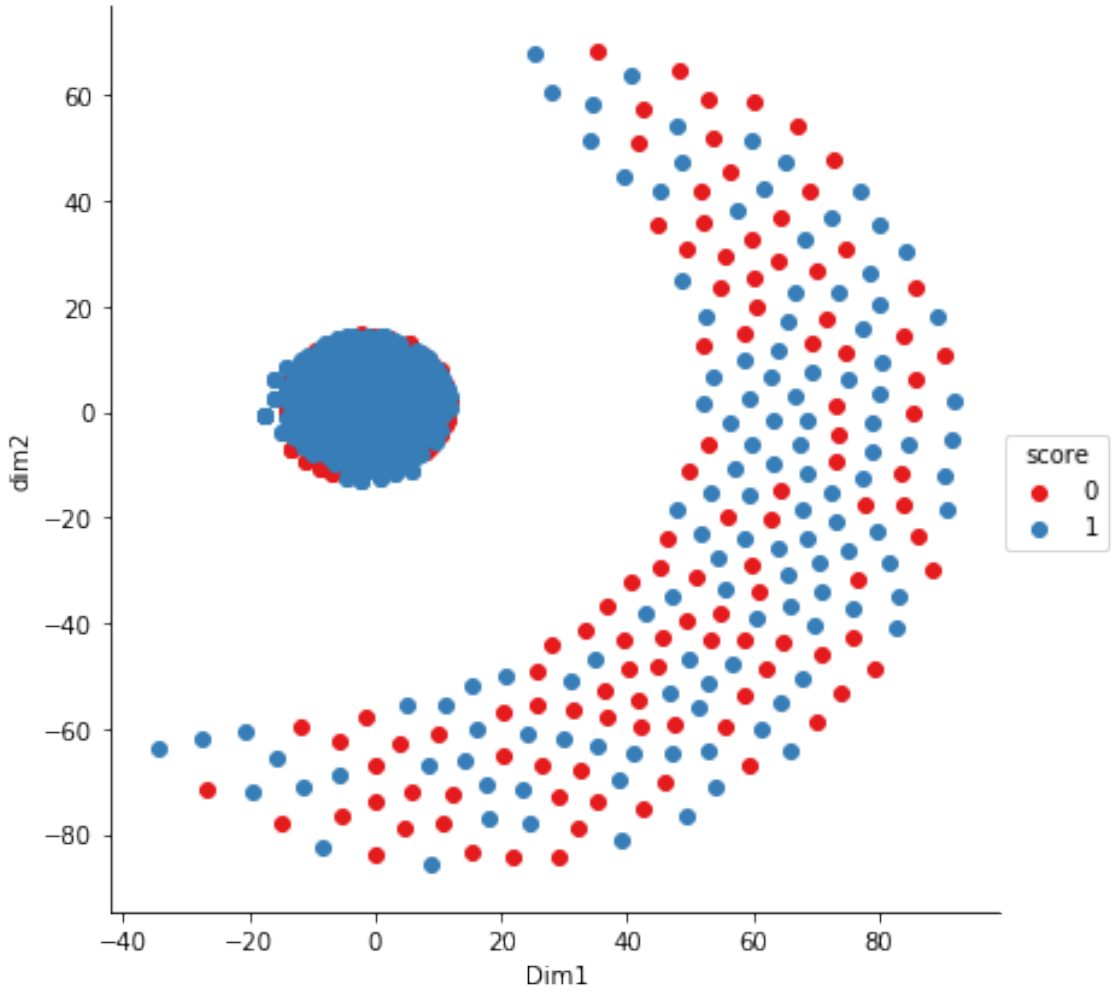
Using First method to convert words to vector: BoW

```
In [15]: finalp = final[final.Score == 1]
         finaln = final[final.Score == 0]
         #Creating balanced dataset by equalising datapoints of positive and negative reviews.

In [16]: datap = finalp.iloc[0:1500,:]
         datan = finaln.iloc[0:1500,:]
         datap.shape,datan.shape

Out[16]: ((1500, 11), (1500, 11))

In [17]: final_final = pd.concat([datap,datan],ignore_index=True)

In [18]: final_final.columns

Out[18]: Index(['Id', 'ProductId', 'UserId', 'ProfileName', 'HelpfulnessNumerator',
                'HelpfulnessDenominator', 'Score', 'Time', 'Summary', 'Text',
                'CleanedText'],
               dtype='object')

In [19]: #final_final contains a balanced dataset of positive and negative reviews.

In [21]: #BoW#Using bi_grams, since we know there important words like 'not' in the dataset.
         count_vect = CountVectorizer(ngram_range=(1,2))
         final_counts = count_vect.fit_transform(final_final['CleanedText'].values)

In [22]: 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  (3000, 105115)
the number of unique words are  105115
```

Apply TSNE for BoW:

```
In [23]: #taking first 3k datapoints
         data = final_counts
         score = final_final['Score'][0:3000]

In [24]: from sklearn.preprocessing import StandardScaler
         standardized_data = StandardScaler(with_mean=False).fit_transform(data)

C:\Users\shubh\Anaconda3\lib\site-packages\sklearn\utils\validation.py:475: DataConversionWarni
  warnings.warn(msg, DataConversionWarning)
C:\Users\shubh\Anaconda3\lib\site-packages\sklearn\utils\validation.py:475: DataConversionWarni
  warnings.warn(msg, DataConversionWarning)


In [25]: standardized_data.shape
         #standardised with mean=flase since it gives for sparse matrix wouldnt be sparse if s

Out[25]: (3000, 105115)

In [26]: std_data = standardized_data.todense()
         std_data.shape

Out[26]: (3000, 105115)

In [27]: #TSNE
         from sklearn.manifold import TSNE
         model = TSNE(n_components=2, random_state=0)
         tsne_data = model.fit_transform(std_data)
         tsne_data = np.vstack((tsne_data.T,score)).T
         tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim1","dim2","score"))

In [28]: #result
         sns.FacetGrid(tsne_df,hue="score",palette="Set1",hue_order=[0, 1],size=6).map(plt.sca
         plt.show()
```



Observations: As we can see, we cannot draw a hyperplane to separate the positive and the negative reviews.

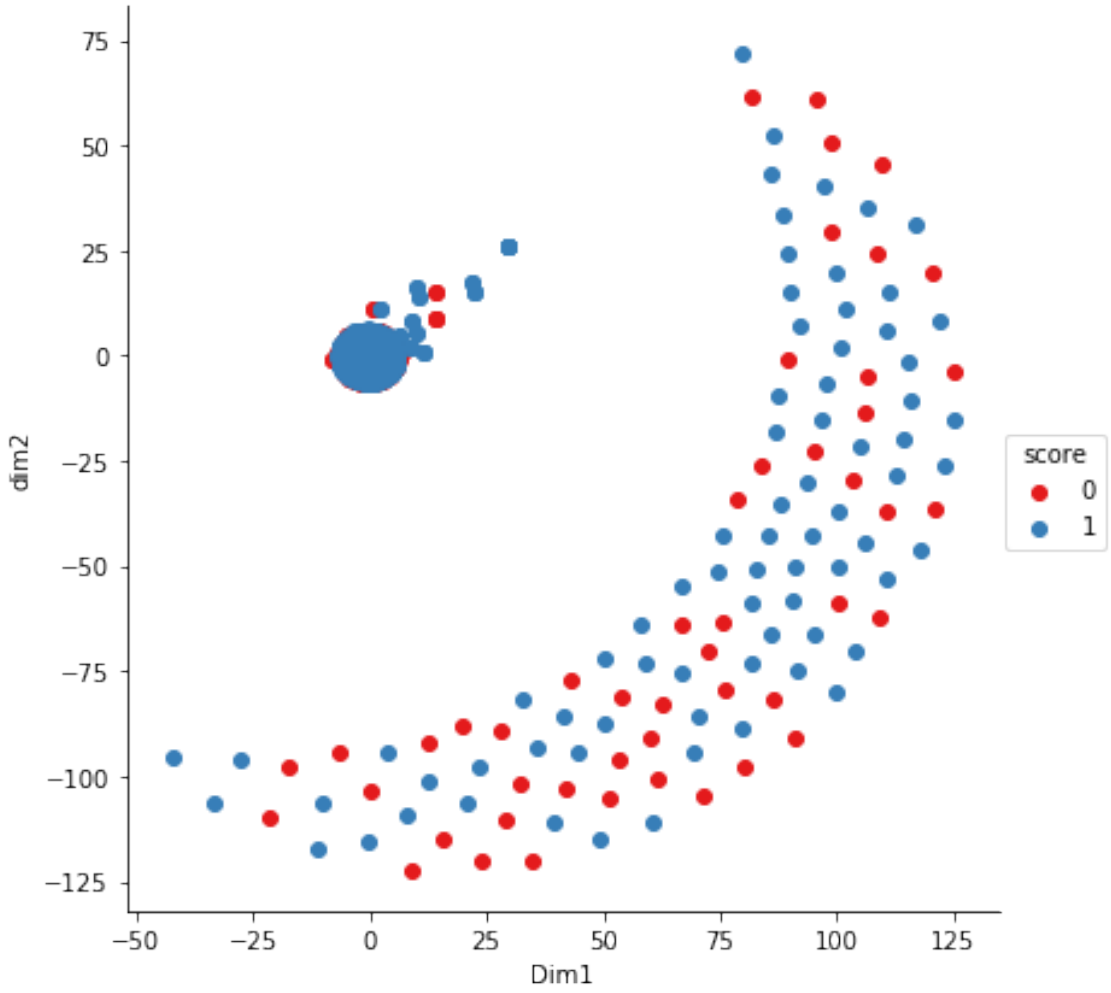
TF_IDF

```
In [29]: #Here too using bi-grams
         tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))
         final_tf_idf = tf_idf_vect.fit_transform(final_final['CleanedText'].values)
         print("the type of count vectorizer ",type(final_tf_idf))
         print("the shape of out text TFIDF vectorizer ",final_tf_idf.get_shape())
         print("the number of unique words including both unigrams and bigrams ", final_tf_idf
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text TFIDF vectorizer  (3000, 105115)
the number of unique words including both unigrams and bigrams  105115
```

Apply TSNE

```
In [30]: std_data = StandardScaler(with_mean=False).fit_transform(final_tf_idf)

         std_data= std_data.todense()
         std_data.shape

Out[30]: (3000, 105115)

In [31]: #Tfidf Data successfully standardised
         model = TSNE(n_components=2,random_state=0)
         tsne_data = model.fit_transform(std_data)
         tsne_data = np.vstack((tsne_data.T, score)).T
         tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim1","dim2","score"))

In [32]: sns.FacetGrid(tsne_df,hue="score",palette="Set1",hue_order=[0, 1],size=6).map(plt.sca
         plt.show()
```



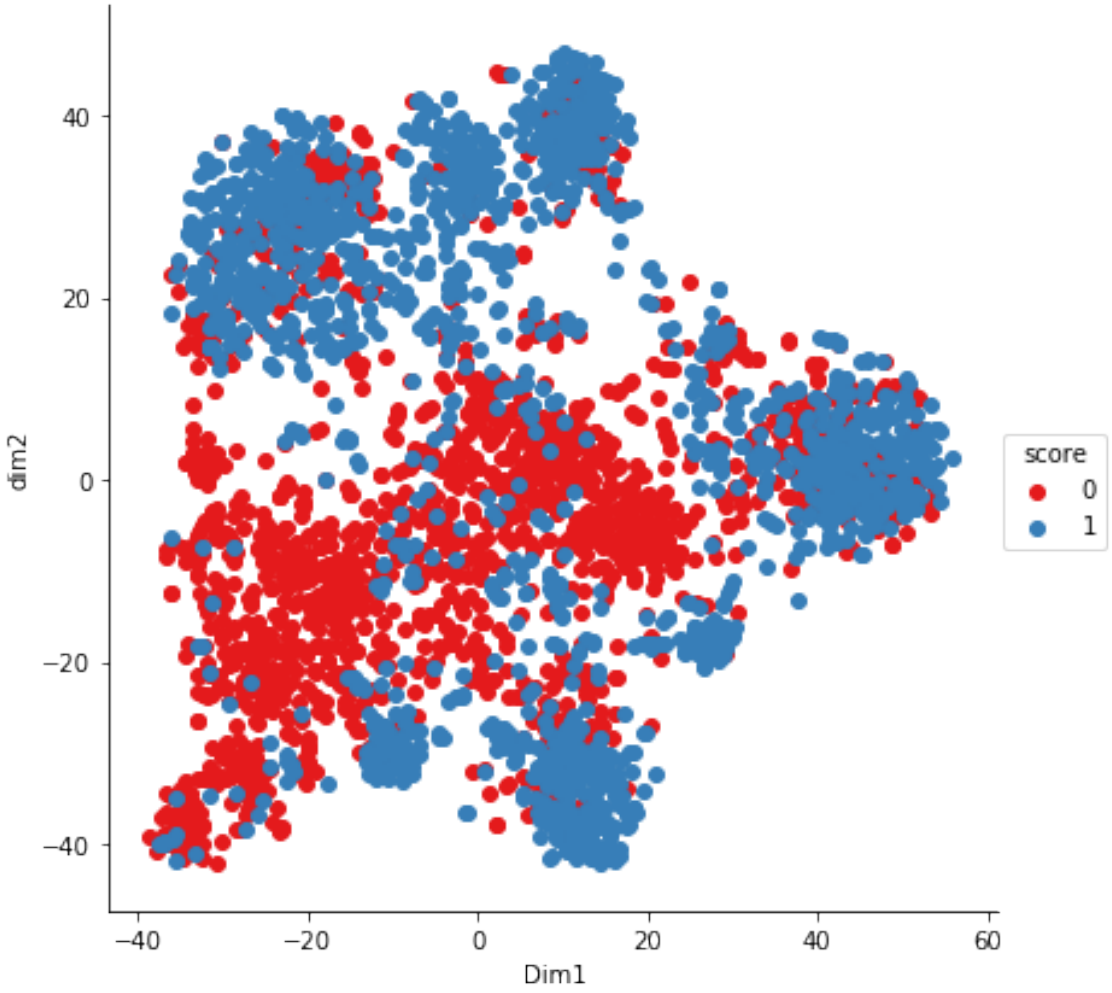
Observation: Here too, the shape is not feasible to draw a hyperplane in between.
For W2V: Training own model.

```
In [33]: i=0
         list_of_sent=[]
         for sent in final['CleanedText'].values:
             list_of_sent.append(sent.split())

In [34]: w2v_model=Word2Vec(list_of_sent,min_count=5,size=50,workers=4)

In [35]: w2v_words = list(w2v_model.wv.vocab)

In [36]: w2v_model.wv.most_similar('tasti')

Out[36]: [('delici', 0.8105766773223877),
          ('yummi', 0.7880966663360596),
          ('tastey', 0.7621139883995056),
          ('good', 0.6815287470817566),
          ('nice', 0.6814108490943909),
          ('satisfi', 0.6620628833770752),
          ('hearti', 0.6552608013153076),
          ('nutriti', 0.6348538398742676),
          ('great', 0.6285862922668457),
          ('terrif', 0.6238007545471191)]

In [37]: #model trained successfully.
         #avgw2v
         i=0
         list_of_sent=[]
         for sent in final_final['CleanedText'].values:
             list_of_sent.append(sent.split())



In [38]: #Avgw2v
         sent_vectors = []
         for sent in tqdm(list_of_sent):
             sent_vec = np.zeros(50)
             cnt_words=0
             for word in sent:
                 if word in w2v_words:
                     vec = w2v_model.wv[word]
                     sent_vec += vec
                     cnt_words += 1
             if cnt_words != 0:
                 sent_vec /= cnt_words
             sent_vectors.append(sent_vec)

100%|| 3000/3000 [00:06<00:00, 446.35it/s]


In [39]: print(len(sent_vectors))
         print(len(sent_vectors[0]))
```

```
3000
50
```

Applying TSNE on AVG W2V

```
In [40]: model = TSNE(n_components=2,random_state=0)
         tsne_data = model.fit_transform(sent_vectors)
         tsne_data = np.vstack((tsne_data.T, score)).T
         tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim1","dim2","score"))
         sns.FacetGrid(tsne_df,hue="score",palette="Set1",hue_order=[0, 1],size=6).map(plt.sca
         plt.show()
```



Observation: Surely, the visualisation is better than the both methods above. Yet the points overlapping is much more. Cannot draw a hyperplane.

```
In [41]: #TFIDF WEIGHTEDMATRIX
         model = TfidfVectorizer()
```

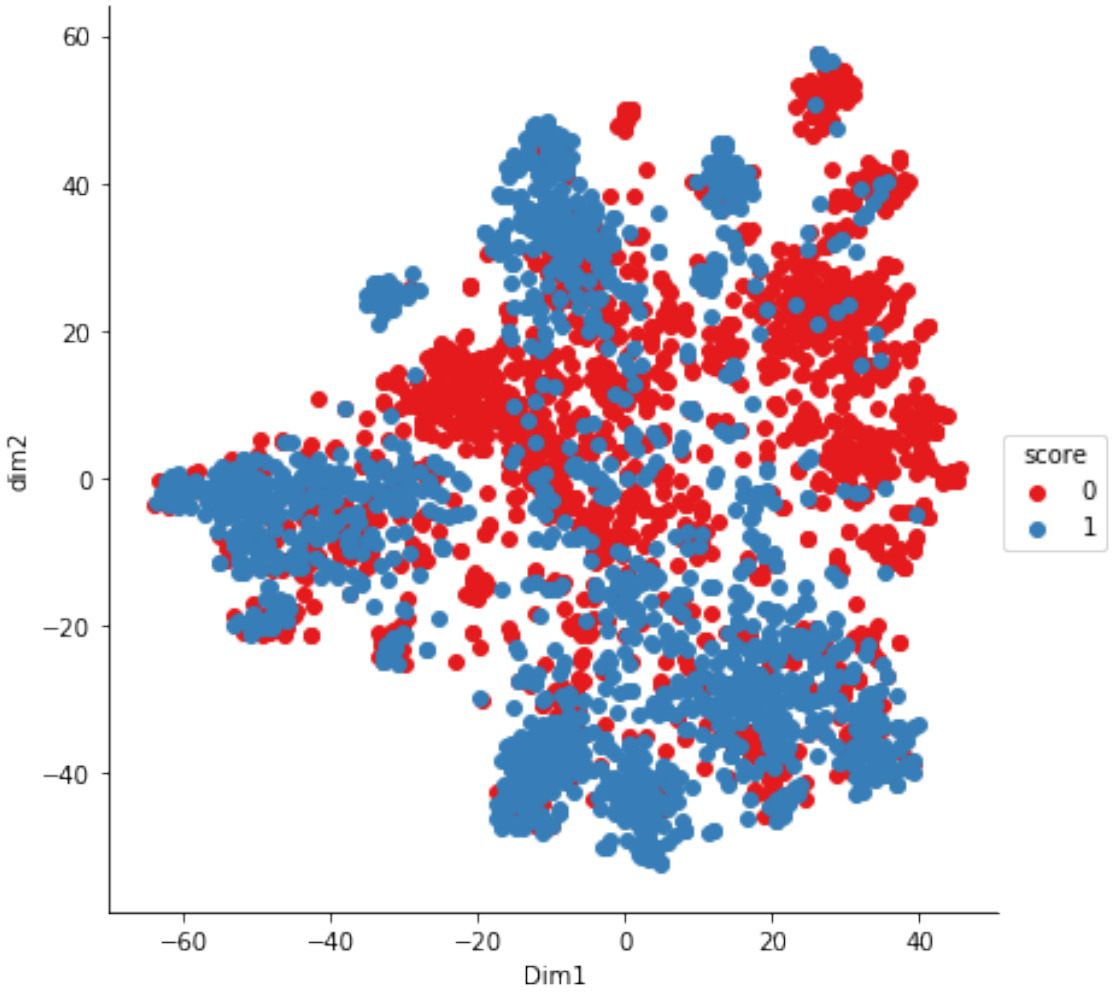
```
        tf_idf_matrix = model.fit_transform(final_final['CleanedText'].values)
        dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
```

In [42]:
```
tfidf_feat = model.get_feature_names()
tfidf_sent_vectors = [];
row=0;
for sent in tqdm(list_of_sent):
    sent_vec = np.zeros(50)
    weight_sum =0;
    for word in sent:
        if word in w2v_words:
            vec = w2v_model.wv[word]
            tf_idf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tf_idf)
            weight_sum += tf_idf
    if weight_sum != 0:
        sent_vec /= weight_sum
    tfidf_sent_vectors.append(sent_vec)
    row += 1
```

```
100%|| 3000/3000 [00:07<00:00, 426.69it/s]
```

Applying TSNE

In [43]:
```
model = TSNE(n_components=2,random_state=0)
tsne_data = model.fit_transform(tfidf_sent_vectors)
tsne_data = np.vstack((tsne_data.T, score)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim1","dim2","score"))
sns.FacetGrid(tsne_df,hue="score",palette="Set1",hue_order=[0, 1],size=6).map(plt.sca
plt.show()
```



Final Conclusions: As we can observe, there is multiple overlapping of points in AVGW2V as well as TFIDF weighted average. It is not possible to put a hyperplane in between positive and negative reviews and separate them.