AMAZON FOOD REVIEW

November 22, 2018

1 OBJECTIVE

In this assignment I was asked to have TSNE plot for the POSITIVE and NEGATIVE reviews of the customer using the following technigues :

1) BAG OF WORDS
2) TFIDF W2V
3) AVG W2V
4) TFIDF

2 STEPS THAT I HAVE FOLLOWED

In this assignment I was asked to have TSNE plot for the POSITIVE and NEGATIVE reviews of the customer using the following technigues :

1) BAG OF WORDS
2) TFIDF W2V
3) AVG W2V
4) TFIDF

STEP ARE AS FOLLOWS :

1) I have imported all the modules that i might required
2) Connected the notebook with "database.sqlit"
3) Changed all the scores with more than 3 to 'positive' and less than 3 to 'negative' and did not consider score 3
4) Removed all the dublicates or information that are irrelevant and got the FINAL dataset
5) Text processing to clean the text using STOPWORDS and finaly got CLEANEDTEXT

FOR BOW

1) Using count_vectoriser() transform final['CleanedText'] to find "final_counts"
2) Standerdising the data using " final_count.toarray()
3) using the standerdised data and score ploted the tsne plot

FOR TFIDF

1) Using tdidfVectoriser() transform final['CleanedText'] to find "final_tf_idf"

2) Standerdising the data using "final_tf_idf.toarray()"
3) using the standerdised data and score ploted the tsne plot

FOR AVGW2V

1)Appling word 2 vector got list of words(w2v_words) with 50 dimention 2)applied avgw2v to find the sentence_vector 3)used sentence_vector to standerdise the data 4) using the standerdised data and score ploted the tsne plot

FOR TFIDF_W2V

1)Created the model using "tdidfVectoriser()" 2)applied tdfidf avg using the model to find tfidf_sent_vectors 3)used tdidf_sent_vector to standerdise the data 4) using the standerdised data and score ploted the tsne plot

3 IMPORTING MODULES

In [2]:
```
#warnings.filterwarnings("ignore")
%matplotlib inline
import warnings
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
# Tutorial about Python regular expressions: https://pymotw.com/2/re/
import string
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer
import gensim
from gensim.models import Word2Vec
from gensim.models import KeyedVectors
import pickle

from tqdm import tqdm
import os
```

```
D:\python\lib\site-packages\gensim\utils.py:1212: UserWarning: detected Windows; aliasing chunki
```

```
  warnings.warn("detected Windows; aliasing chunkize to chunkize_serial")
```

4 Using the SQLite Table to read data.

```
In [3]: con = sqlite3.connect('database.sqlite')
        #filtering only positive and negative reviews i.e.
        # not taking into consideration those reviews with Score=3
        filtered_data = pd.read_sql_query(""" SELECT * FROM Reviews WHERE Score != 3 """, con)


        # Give reviews with Score>3 a positive rating, and reviews with a score<3 a negative rat
        def partition(x):
            if x < 3:
                return 'negative'
            return 'positive'

        #changing reviews with score less than 3 to be positive and vice-versa
        actualScore = filtered_data['Score']
        positiveNegative = actualScore.map(partition)
        filtered_data['Score'] = positiveNegative
        print("Number of data points in our data", filtered_data.shape)
        filtered_data.head(3)
```

```
Number of data points in our data (525814, 10)
```

```
Out[3]:    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  positive  1303862400
        1                     0                       0  negative  1346976000
        2                     1                       1  positive  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...
```

5 REMOVING DUBLICATES

```
In [4]: display= pd.read_sql_query("""
        SELECT *
        FROM Reviews
```

```
        WHERE Score != 3 AND UserId="AR5J8UI46CURR"
        ORDER BY ProductID
        """, con)
        display.head()
```

Out[4]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text
0	78445	B000HDL1RQ	AR5J8UI46CURR	Geetha Krishnan	2	2	5	1199577600	LOACKER QUADRATINI VANILLA WAFERS	DELICIOUS WAFERS. I FIND THAT EUROPEAN WAFERS ...
1	138317	B000HDOPYC	AR5J8UI46CURR	Geetha Krishnan	2	2	5	1199577600	LOACKER QUADRATINI VANILLA WAFERS	DELICIOUS WAFERS. I FIND THAT EUROPEAN WAFERS ...
2	138277	B000HDOPYM	AR5J8UI46CURR	Geetha Krishnan	2	2	5	1199577600	LOACKER QUADRATINI VANILLA WAFERS	DELICIOUS WAFERS. I FIND THAT EUROPEAN WAFERS ...
3	73791	B000HDOPZG	AR5J8UI46CURR	Geetha Krishnan	2	2	5	1199577600	LOACKER QUADRATINI VANILLA WAFERS	DELICIOUS WAFERS. I FIND THAT EUROPEAN WAFERS ...
4	155049	B000PAQ75C	AR5J8UI46CURR	Geetha Krishnan	2	2	5	1199577600	LOACKER QUADRATINI VANILLA WAFERS	DELICIOUS WAFERS. I FIND THAT EUROPEAN WAFERS ...

```
In [5]: #Sorting data according to ProductId in ascending order
        sorted_data=filtered_data.sort_values('ProductId', axis=0, ascending=True, inplace=False
```

```
In [6]: #Deduplication of entries
        final=sorted_data.drop_duplicates(subset={"UserId","ProfileName","Time","Text"}, keep='f
        final.shape
```

Out[6]: (364173, 10)

6 Text Preprocessing: Stemming, stop-word removal and Lemmatization.

```
In [7]: # find sentences containing HTML tags
        import re
        i=0;
```

```
        for sent in final['Text'].values:
            if (len(re.findall('<.*?>', sent))):
                print(i)
                print(sent)
                break;
            i += 1;
```

```
6
I set aside at least an hour each day to read to my son (3 y/o). At this point, I consider mysel
```

In [8]:
```
        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 chara
            cleaned = re.sub(r'[?|!|\'|"|#]',r'',sentence)
            cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
            return  cleaned
        print(stop)
        print('************************************')
        print(sno.stem('tasty'))
```

```
{'being', 'i', 'over', 'here', "isn't", 'should', 'you', 'so', 'of', 'weren', 'these', 'out', 'n
************************************
tasti
```

In [9]:
```
        #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 co
                    # if we dont use .split() function then we will be considring "abc def" as o
                    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 desc
                            if(final['Score'].values)[i] == 0:
                                all_negative_words.append(s) #list of all words used to desc
                    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 the
                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)
```

In [10]:
```
if os.path.isfile('final.sqlite'):
    conn = sqlite3.connect('final.sqlite')
    final = pd.read_sql_query(""" SELECT * FROM Reviews WHERE Score != 3 """, conn)
    conn.close()
else:
    print("Please the above cell")
```

7 TAKING 2K POINTS

In [11]:
```
b=final['Score'][:2000].values
F=final['CleanedText'][:2000].values
```

8 Avg W2V

In [12]:
```
#os.path.isfile('google_w2v_for_amazon.pkl'):
with open('google_w2v_for_amazon.pkl', 'rb') as f:
    model = pickle.load(f)
```

In [13]:
```
# Train your own Word2Vec model using your own text corpus
i=0
list_of_sent=[]
for sent in F:
    list_of_sent.append(sent.split())
```

```
In [14]: print(F)
         print("**********************************************************************")
         print(list_of_sent[0])

['witti littl book make son laugh loud recit car drive along alway sing refrain hes learn whale
 'grew read sendak book watch realli rosi movi incorpor love son love howev miss hard cover vers
 'fun way children learn month year learn poem throughout school year like handmot invent poem'
 ...
 'never cat lover oldest one follow home year old weight less lbs first met sensent system food
 'prompt deliveri product use everi day didnt drag bag home store thank'
 'pom predispos collaps trachea luxat patella spell correct use along sever supplement herb dog
**********************************************************************
['witti', 'littl', 'book', 'make', 'son', 'laugh', 'loud', 'recit', 'car', 'drive', 'along', 'al


In [15]: # min_count = 5 considers only words that occured atleast 5 times
         w2v_model=Word2Vec(list_of_sent,min_count=5,size=50, workers=4)

In [16]: w2v_words = list(w2v_model.wv.vocab)
         print("number of words that occured minimum 5 times ",len(w2v_words))
         print("sample words ", w2v_words[0:50])

number of words that occured minimum 5 times  2292
sample words  ['littl', 'book', 'make', 'son', 'laugh', 'loud', 'car', 'drive', 'along', 'alway'


In [17]: warnings.filterwarnings("ignore")
         w2v_model.wv.most_similar('tasti')

Out[17]: [('top', 0.9992796778678894),
          ('mean', 0.9992645382881165),
          ('christma', 0.9992632865905762),
          ('fresh', 0.9992468357086182),
          ('fair', 0.9992359280586243),
          ('remov', 0.9992358088493347),
          ('bubbl', 0.9992269277572632),
          ('prefer', 0.9992203116416931),
          ('come', 0.9992167949676514),
          ('wheat', 0.999215304851532)]

In [18]: len(w2v_model.wv['color'])

Out[18]: 50

In [22]: # average Word2Vec
         # compute average word2vec for each review.
         sent_vectors = []; # the avg-w2v for each sentence/review is stored in this list
         for sent in tqdm(list_of_sent[:2000]): # 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:
                    vec = w2v_model.wv[word]
                    sent_vec += vec
                    cnt_words += 1
            if cnt_words != 0:
                sent_vec /= cnt_words
            sent_vectors.append(sent_vec)
        print(len(sent_vectors))
        print(len(sent_vectors[0]))
```

```
100%|[U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U+2588][U
```

```
2000
50
```

In [23]:
```
# Data-preprocessing: Standardizing the data

from sklearn.preprocessing import StandardScaler
standardized_data = StandardScaler().fit_transform(sent_vectors)
print(standardized_data.shape)
warnings.filterwarnings("ignore")
```

```
(2000, 50)
```

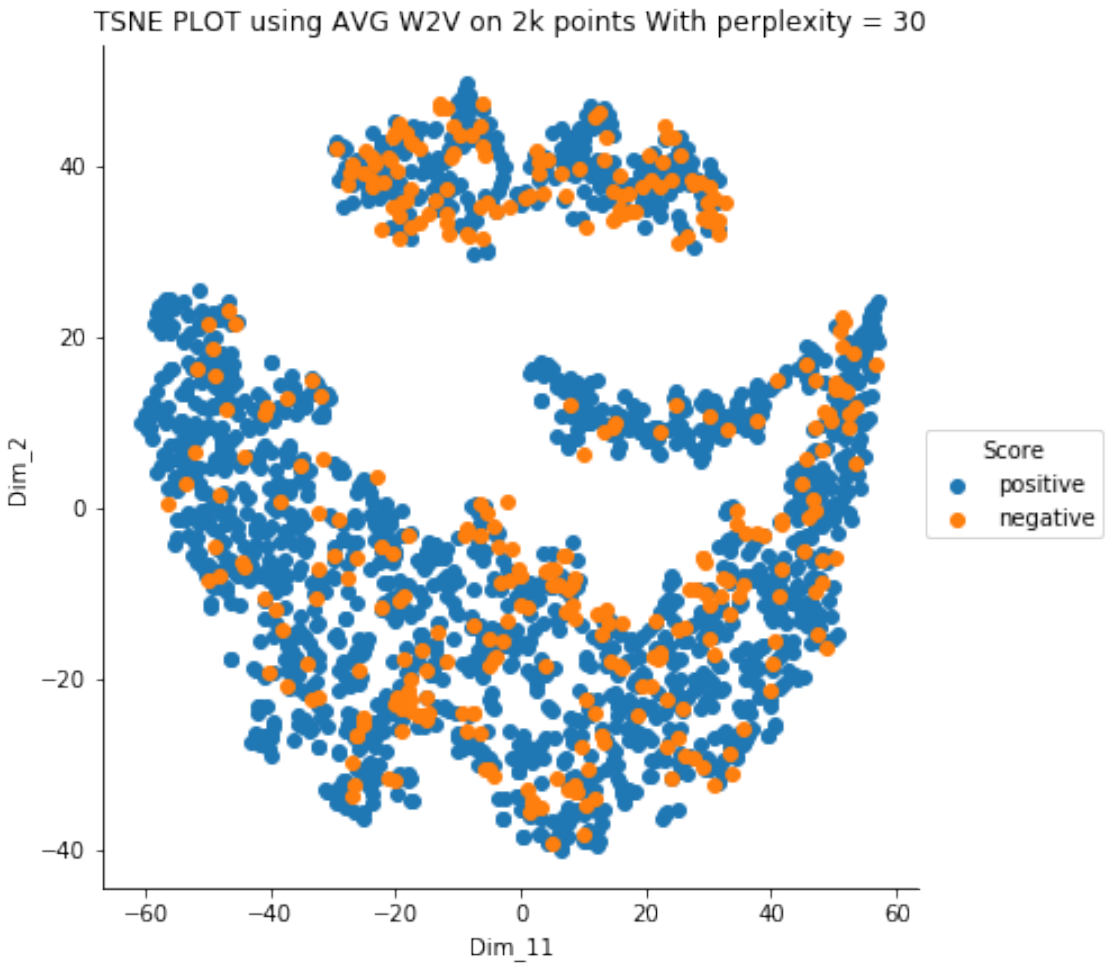
9 T-SNE

In [24]:
```
from sklearn.manifold import TSNE
```

```
model = TSNE(n_components=2, random_state=0, perplexity=30)
tsne_data = model.fit_transform(standardized_data)

# creating a new data fram which help us in ploting the result data
tsne_data = np.vstack((tsne_data.T, b)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim_11", "Dim_2", "Score"))

# Ploting the result of tsne
sns.FacetGrid(tsne_df, hue="Score", size=6).map(plt.scatter, 'Dim_11', 'Dim_2').add_leg
plt.title('TSNE PLOT using AVG W2V on 2k points With perplexity = 30')
plt.show()
```



10 BOW

```
In [25]: #BoW
         count_vect = CountVectorizer() #in scikit-learn
         final_counts = count_vect.fit_transform(F)
         print("the type of count vectorizer ",type(final_counts))
         print("the shape of out text BOW vectorizer ",final_counts.get_shape())
         print("the number of unique words ", final_counts.get_shape()[1])
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (2000, 6858)
the number of unique words  6858
```

```
In [26]: A=final_counts.toarray()
         A
```

```
Out[26]: array([[0, 0, 0, ..., 0, 0, 0],
                [0, 0, 0, ..., 0, 0, 0],
                [0, 0, 0, ..., 0, 0, 0],
                ...,
                [0, 0, 0, ..., 0, 0, 0],
                [0, 0, 0, ..., 0, 0, 0],
                [0, 0, 0, ..., 0, 0, 0]], dtype=int64)
```

11 STANDARDIZING THE DATA

```
In [27]: # Data-preprocessing: Standardizing the data

         from sklearn.preprocessing import StandardScaler
         standardized_data = StandardScaler().fit_transform(A)
         print(standardized_data.shape)
         warnings.filterwarnings("ignore")
```

```
(2000, 6858)
```

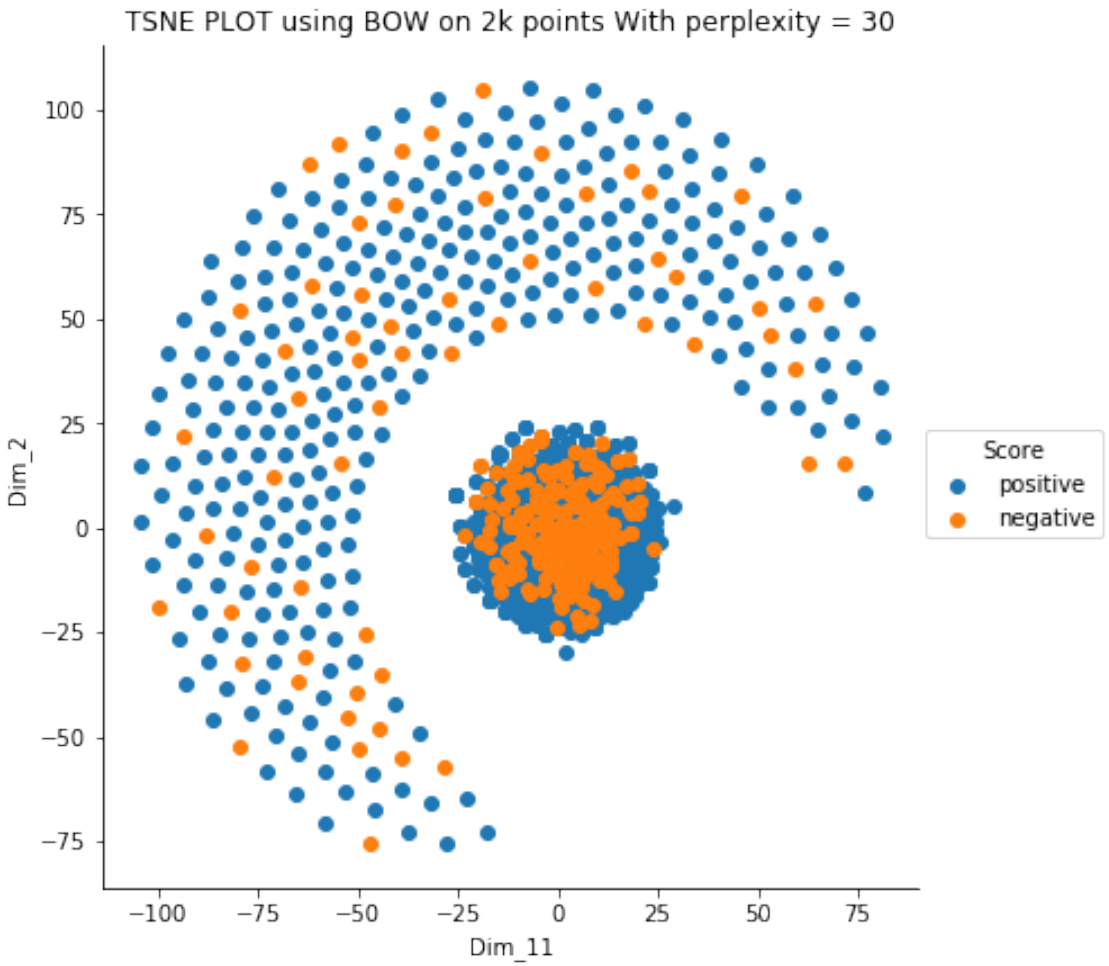
12 TSNE USING BAG OF WORDS

```
In [29]: from sklearn.manifold import TSNE
```

```
         model = TSNE(n_components=2, random_state=0, perplexity=30)
         tsne_data = model.fit_transform(standardized_data)

         # creating a new data fram which help us in ploting the result data
         tsne_data = np.vstack((tsne_data.T, b)).T
         tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim_11", "Dim_2", "Score"))

         # Ploting the result of tsne
         sns.FacetGrid(tsne_df, hue="Score", size=6).map(plt.scatter, 'Dim_11', 'Dim_2').add_leg
         plt.title('TSNE PLOT using BOW on 2k points With perplexity = 30')
         plt.show()
```



13 TF_IDF

```
In [30]: tf_idf_vect = TfidfVectorizer(ngram_range=(1,2))
         final_tf_idf = tf_idf_vect.fit_transform(F)
         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.g
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text TFIDF vectorizer  (2000, 76693)
the number of unique words including both unigrams and bigrams  76693
```

```
In [31]: features = tf_idf_vect.get_feature_names()
         print("some sample features(unique words in the corpus)",features[700:710])
```

```
some sample features(unique words in the corpus) ['adjac mole', 'adjac new', 'adjust', 'adjust e
```

In [32]:
```
# source: https://buhrmann.github.io/tfidf-analysis.html
def top_tfidf_feats(row, features, top_n=25):
    ''' Get top n tfidf values in row and return them with their corresponding feature
    topn_ids = np.argsort(row)[::-1][:top_n]
    top_feats = [(features[i], row[i]) for i in topn_ids]
    df = pd.DataFrame(top_feats)
    df.columns = ['feature', 'tfidf']
    return df

top_tfidf = top_tfidf_feats(final_tf_idf[1,:].toarray()[0],features,25)
```

In [33]:
```
top_tfidf
```

Out[33]:

	feature	tfidf
0	version paperback	0.167682
1	incorpor love	0.167682
2	two hand	0.167682
3	keep page	0.167682
4	kind flimsi	0.167682
5	page open	0.167682
6	book watch	0.167682
7	hard cover	0.167682
8	paperback seem	0.167682
9	flimsi take	0.167682
10	read sendak	0.167682
11	rosi movi	0.167682
12	miss hard	0.167682
13	love son	0.167682
14	howev miss	0.167682
15	cover version	0.167682
16	grew read	0.167682
17	movi incorpor	0.167682
18	seem kind	0.167682
19	sendak book	0.159085
20	rosi	0.159085
21	paperback	0.159085
22	watch realli	0.159085
23	realli rosi	0.159085
24	hand keep	0.159085

In [34]:
```
A1=final_tf_idf.toarray()
```

14 STANDERDIZED DATA

In [35]:
```
# Data-preprocessing: Standardizing the data

from sklearn.preprocessing import StandardScaler
standardized_data = StandardScaler().fit_transform(A1)
```

```
print(standardized_data.shape)
warnings.filterwarnings("ignore")
```

```
(2000, 76693)
```

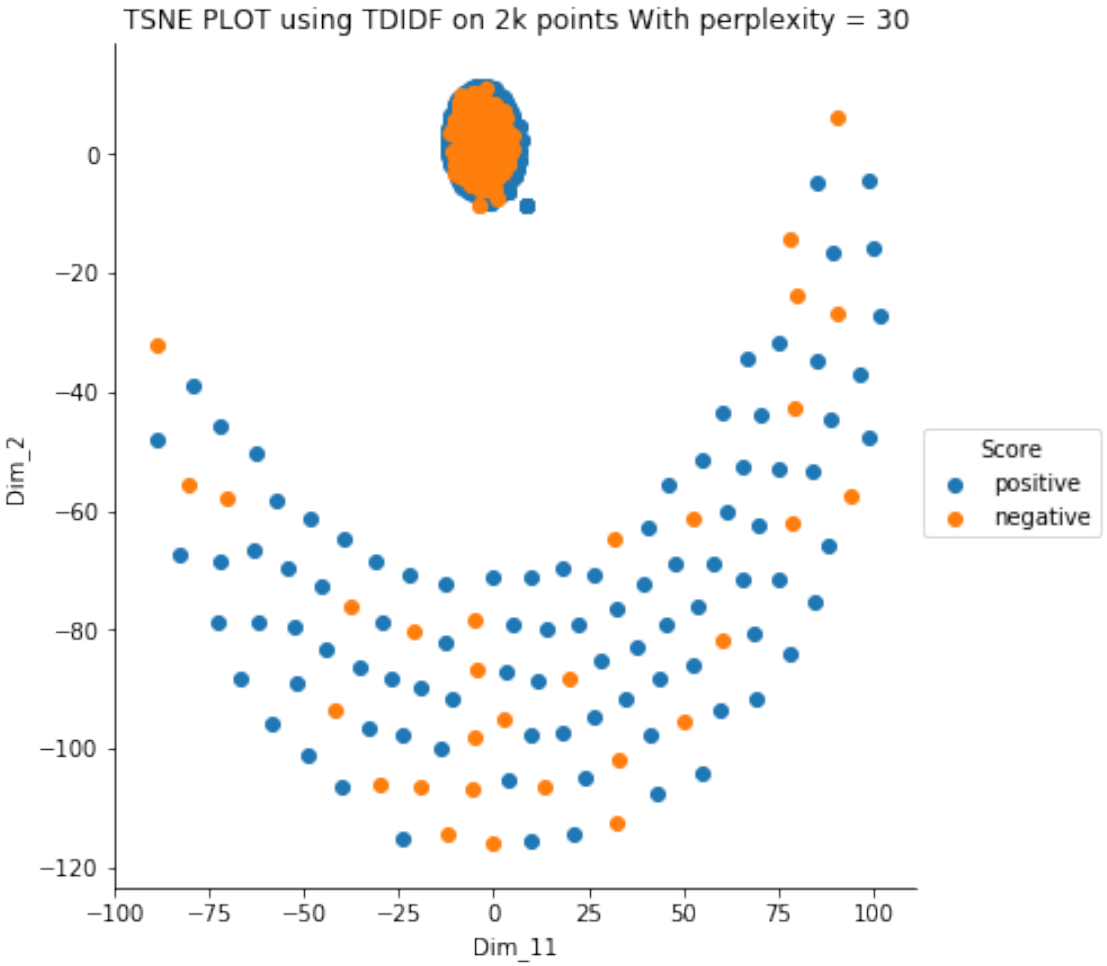
15 TSNE USING TF_IDF

```
In [38]: from sklearn.manifold import TSNE
```

```
model = TSNE(n_components=2, random_state=0, perplexity=30)
tsne_data = model.fit_transform(standardized_data)

# creating a new data fram which help us in ploting the result data
tsne_data = np.vstack((tsne_data.T, b)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim_11", "Dim_2", "Score"))

# Ploting the result of tsne
sns.FacetGrid(tsne_df, hue="Score", size=6).map(plt.scatter, 'Dim_11', 'Dim_2').add_leg
plt.title('TSNE PLOT using TDIDF on 2k points With perplexity = 30')
plt.show()
```



16 TFIDF-W2V

```
In [40]: # S = ["abc def pqr", "def def def abc", "pqr pqr def"]
         model = TfidfVectorizer()
         tf_idf_matrix = model.fit_transform(F)
         # we are converting a dictionary with word as a key, and the idf as a value
         dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))

In [41]:  #TF-IDF weighted Word2Vec
         tfidf_feat = model.get_feature_names() # tfidf words/col-names
         # final_tf_idf is the sparse matrix with row= sentence, col=word and cell_val = tfidf

         tfidf_sent_vectors = []; # the tfidf-w2v for each sentence/review is stored in this lis
         row=0;
         for sent in tqdm(list_of_sent[:2000]): # 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:
                    vec = w2v_model.wv[word]
                    # tf_idf = tf_idf_matrix[row, tfidf_feat.index(word)]
                    # to reduce the computation we are
                    # dictionary[word] = idf value of word in whole courpus
                    # sent.count(word) = tf valeus of word in this review
                    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%| [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U+2588] [U
```

17 STANDERDIZING THE DATA

In [42]:
```
# Data-preprocessing: Standardizing the data

from sklearn.preprocessing import StandardScaler
standardized_data = StandardScaler().fit_transform(tfidf_sent_vectors)
print(standardized_data.shape)
warnings.filterwarnings("ignore")
```

```
(2000, 50)
```

18 TSNE USING TF_IDF_W2V

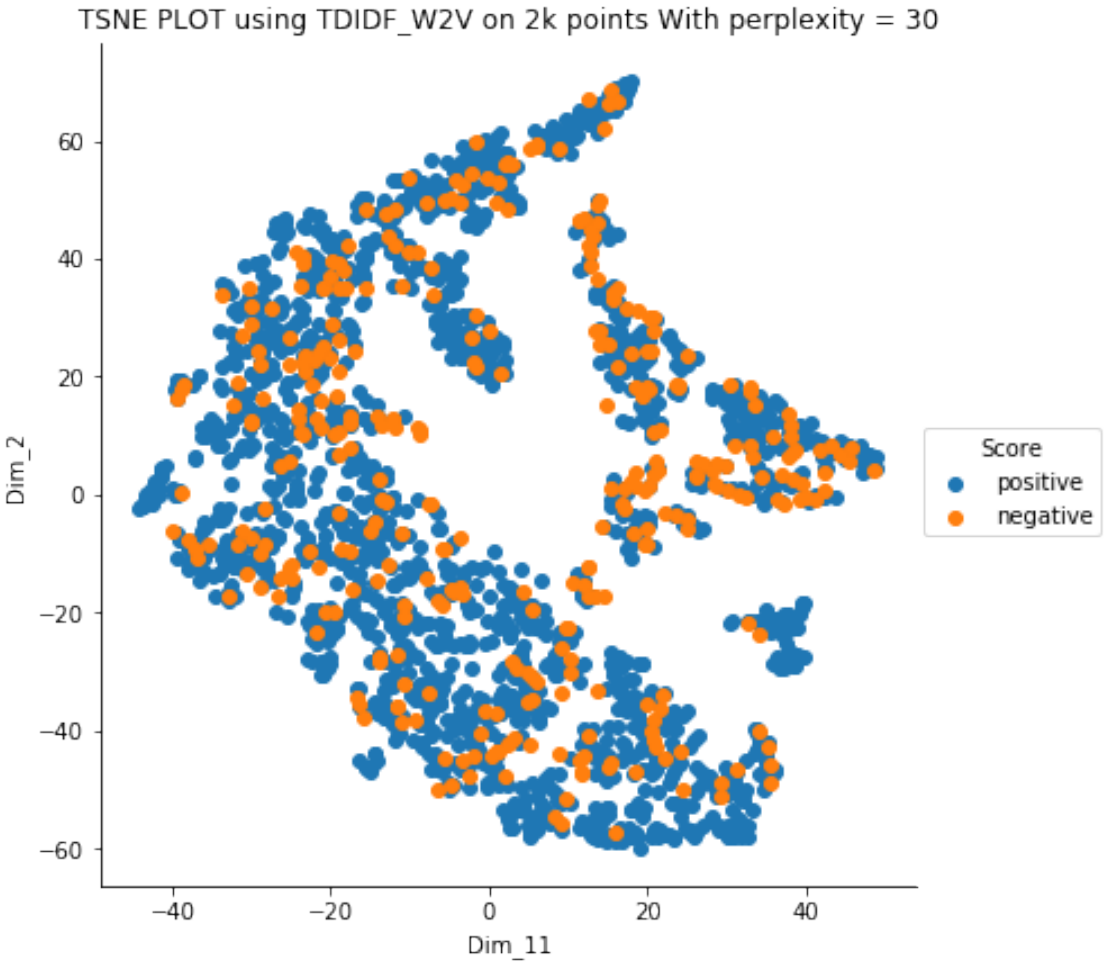
In [43]:
```
from sklearn.manifold import TSNE



model = TSNE(n_components=2, random_state=0, perplexity=30)
tsne_data = model.fit_transform(standardized_data)

# creating a new data fram which help us in ploting the result data
tsne_data = np.vstack((tsne_data.T, b)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("Dim_11", "Dim_2", "Score"))

# Ploting the result of tsne
sns.FacetGrid(tsne_df, hue="Score", size=6).map(plt.scatter, 'Dim_11', 'Dim_2').add_leg
plt.title('TSNE PLOT using TDIDF_W2V on 2k points With perplexity = 30')
plt.show()
```


TSNE PLOT using TDIDF_W2V on 2k points With perplexity = 30
Dim_2
Dim_11
60
40
20
0
−20
−40
−60
−40
−20
0
20
40
Score
positive
negative