36.14.Amazon_food_review_kmeans_hierarchical_DBSCAN_v1.0

July 2, 2018

1 Amazon food review dataset apply clustering polarity review

Data set from https://www.kaggle.com/snap/amazon-fine-food-reviews

2 Objective

Use xi and apply kmeans(using kmenas++) for various value of k using BOW,TFIDF etc. find best k

For each centroid read few items that could be similar review like food, mobile
Implement hierarchical try with different cluster for different text presentation(BOW,TFIDF)
Try dbscan with W2V use dim of vec 100, minpts=2*d, use all data
Use elbow meathod or similar to find best eps
Try other eps and see how sensitive it is

3 Import data and libraries

```
In [1]: 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
        con = sqlite3.connect('database.sqlite')
        #get only +ve and -ve review
        raw_data = pd.read_sql_query("""SELECT * FROM Reviews WHERE Score != 3""", con)
```

4 Data preprocessing

```
In [2]: filtered_data=raw_data
        # Score>3 a positive rating, and score<3 a negative rating.
        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
        #filtered_data.sample(5)
        filtered_data['Score'].value_counts()
        #Sorting data according to ProductId in ascending order
        sorted_data=filtered_data.sort_values('ProductId', axis=0, ascending=True, inplace=Fals
        #Deduplication of entries for same profilename,userid, time, text and take first eleme
        sorted_data=sorted_data.drop_duplicates(subset={"UserId","ProfileName","Time","Text"},
```

```
In [3]: #take only 2500 + 2500 data
        from sklearn.cross_validation import train_test_split,KFold
        _ , clean_data = train_test_split(sorted_data, test_size = 5000, stratify = sorted_data
        clean_data['Score'].value_counts()
```

```
C:\Users\suman\Anaconda3\lib\site-packages\sklearn\cross_validation.py:41: DeprecationWarning:
  "This module will be removed in 0.20.", DeprecationWarning)
```

```
Out[3]: positive    4216
        negative     784
        Name: Score, dtype: int64
```

```
In [4]: # Clean html tag and punctuation
        import re
        import string
        from nltk.corpus import stopwords
        from nltk.stem import PorterStemmer
        from nltk.stem.wordnet import WordNetLemmatizer

        stop = set(stopwords.words('english')) #set of stopwords
        sno = nltk.stem.SnowballStemmer('english') #initialising the snowball stemmer
        #substitute html tag and punctuation
        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 cha
            cleaned = re.sub(r'[?|!|\'|"|#]',r'',sentence)
            cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
            return  cleaned
        #print(sno.stem('tasty'))
```

```
In [5]: i=0
        str1=' '
        final_string=[]
        all_positive_words=[] # store words from +ve reviews here
        all_negative_words=[] # store words from -ve reviews here.
        s=''
        #Create new catagory as Cleanedtext after removing htmltag and punctuation and upperca
        for sent in clean_data['Text'].values:
            filtered_sentence=[]
            #print(sent);
            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)
                            if (clean_data['Score'].values)[i] == 'positive':
                                all_positive_words.append(s) #list of all words used to descri
                            if(clean_data['Score'].values)[i] == 'negative':
                                all_negative_words.append(s) #list of all words used to descri
                        else:
                            continue
                    else:
                        continue
            str1 = b" ".join(filtered_sentence) #final string of cleaned words

            final_string.append(str1)
            i+=1
```

```
In [6]: clean_data['CleanedText']=final_string
        clean_data.shape
        #Sort data on timestamp
        clean_data=clean_data.sort_values(by=['Time'],ascending=False)
        clean_data.reset_index(inplace=True)
        clean_data.sample(2)
```

```
C:\Users\suman\Anaconda3\lib\site-packages\ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  """Entry point for launching an IPython kernel.
```

```
Out[6]:        index      Id   ProductId          UserId    ProfileName  \
        4547    7253    7924  B00166D8TW  A3MILDAIBVX6WM          JShoe
        2530  375849  406408  B0006G4YK0  A2DUSUQPBGL9F8  Happy Shopper

              HelpfulnessNumerator  HelpfulnessDenominator     Score        Time  \
        4547                     0                       0  positive  1218153600
        2530                     0                       0  negative  1311292800

                          Summary                                               Text  \
        4547  Eggcellent Product!  This egg protein is great!<br />First off, it ...
        2530                 nope  I really really wanted these to work for my ad...

                                                    CleanedText
        4547  b'egg protein great first sweeten stevia natur...
        2530  b'realli realli want work adopt pom ador senio...
```

5 Use kmeans

6 BOW

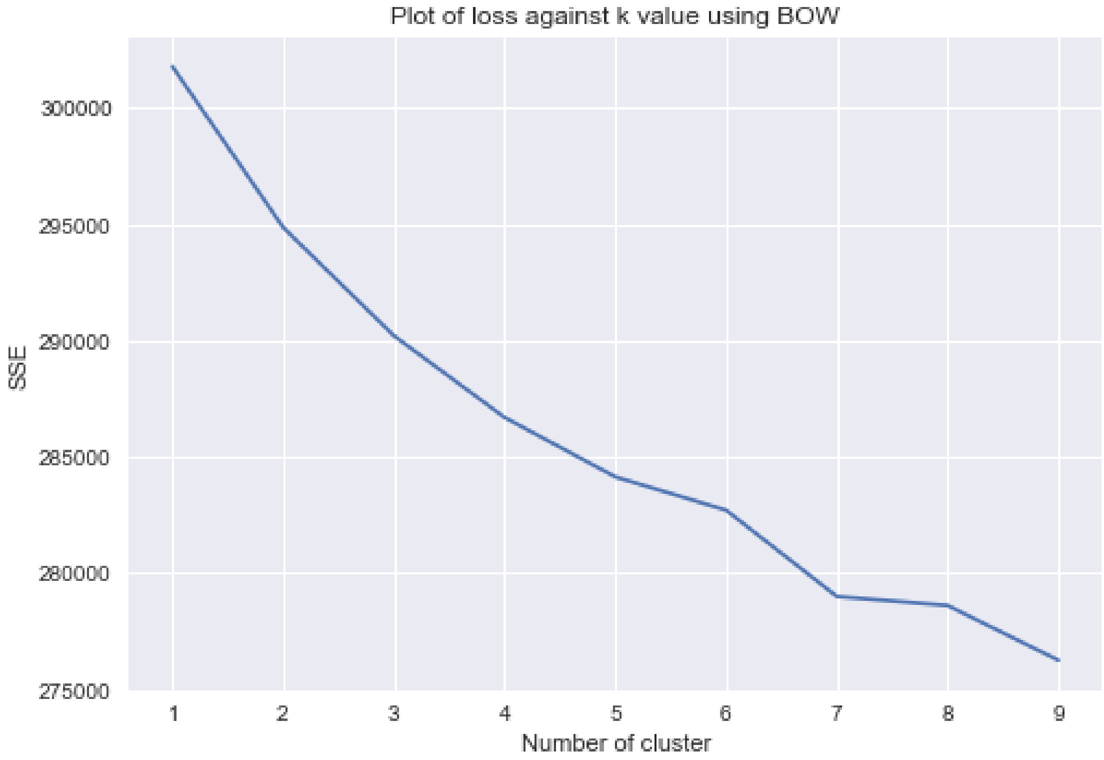
```
In [7]: #now convert CleanedText to TDM
        count_vect = CountVectorizer() #in scikit-learn
        final_counts = count_vect.fit_transform(clean_data['CleanedText'].values)
        print(final_counts.get_shape())
        print(type(final_counts))
        #print(final_counts[[1]])
        #print(final_counts[0,:])# this is stored like dict format only non zero values. spars
        #x = pd.DataFrame(final_counts.toarray())#this is stored like dataframe format all 0 a
        # sparse matrix in csr format works faster compare to dense format
        #print(x.shape,x.loc[0])

        from sklearn.cross_validation import train_test_split
        from sklearn.neighbors import KNeighborsClassifier
        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

        from sklearn.cluster import KMeans
        from sklearn.grid_search import GridSearchCV

        x=final_counts
        x_bow=x
        kmeans=KMeans(n_clusters=2, random_state=0).fit(x)
        kmeans.cluster_centers_
```

```
sse = {}
for k in range(1, 10):
    kmeans = KMeans(init='k-means++',n_clusters=k, max_iter=100).fit(x)
    #x["clusters"] = kmeans.labels_
    sse[k] = kmeans.inertia_ # Inertia: Sum of distances of samples to their closest c
plt.figure()
plt.plot(list(sse.keys()), list(sse.values()))
plt.title("Plot of loss against k value using BOW")
plt.xlabel("Number of cluster")
plt.ylabel("SSE")
plt.show()


# Use k=2 and build cluster
kmeans = KMeans(init='k-means++',n_clusters=2, max_iter=100).fit(x)
print(kmeans.labels_)
# find some data from clusters

#cluster_map = pd.DataFrame()
#cluster_map['data_index'] = x.index
#cluster_map['cluster'] = kmeans.labels_
#cluster_map[cluster_map.cluster == 1]

#print("Top terms per cluster:")
#order_centroids = kmeans.cluster_centers_.argsort()[:, ::-1]
#terms = count_vect.get_feature_names()
#for i in range(2):
#    print ("Cluster ",i)
#    for ind in order_centroids[i, :10]:
#        print (' %s' % terms[ind])


#Find few sentences from different cluster
# Find sentences with 0 and 1 cluster
#print(kmeans.labels_)
#find cluster 1 index
a=np.where(kmeans.labels_ == 1)[0]
b=np.where(kmeans.labels_ == 0)[0]
#check 5 text for cluster 1
print(clean_data['CleanedText'][a[0]])
print(clean_data['CleanedText'][a[1]])
print(clean_data['CleanedText'][a[2]])
print(clean_data['CleanedText'][a[3]])
print(clean_data['CleanedText'][a[4]])
#check 5 text for cluster 1
print(clean_data['CleanedText'][b[0]])
print(clean_data['CleanedText'][b[1]])
```

```
        print(clean_data['CleanedText'][b[2]])
        print(clean_data['CleanedText'][b[3]])
        print(clean_data['CleanedText'][b[4]])
```

```
(5000, 9715)
<class 'scipy.sparse.csr.csr_matrix'>
```

```
C:\Users\suman\Anaconda3\lib\site-packages\sklearn\grid_search.py:42: DeprecationWarning: This
  DeprecationWarning)
```



```
[1 1 1 ..., 1 1 1]
b'dog love healthi treat great train crumbl tri break piec'
b'tobin jame excel wine one especi husband enjoy tobin jame merlot difficult find good wine rea
b'ive eat strict paleo eat diet near one year includ ghee huge tast benefit ghee virtual lacto
b'use year give long last energi boost sudden let good tast put travel'
b'chill oragemint classic refresh dri scratchi pallet premium price met except tast exceed sat
b'whether use gourmet sauc pack natur flavor alway make assum msg meal darn good fill tast feel
b'ive never much soda drinker alway lookout altern beverag like juic tea late ive swept craze
b'son gentleas sinc month old due son abl toler similac advanc horribl gassi fussi diagnos mil
b'coffe tast like fresh coffe tast brew stale coffe bean disappoint expect good cup coffe come
b'headlin pretti much sum bigalow green tea basic run mill cheap low qualiti bag green tea har
```

7 Cluster summersing

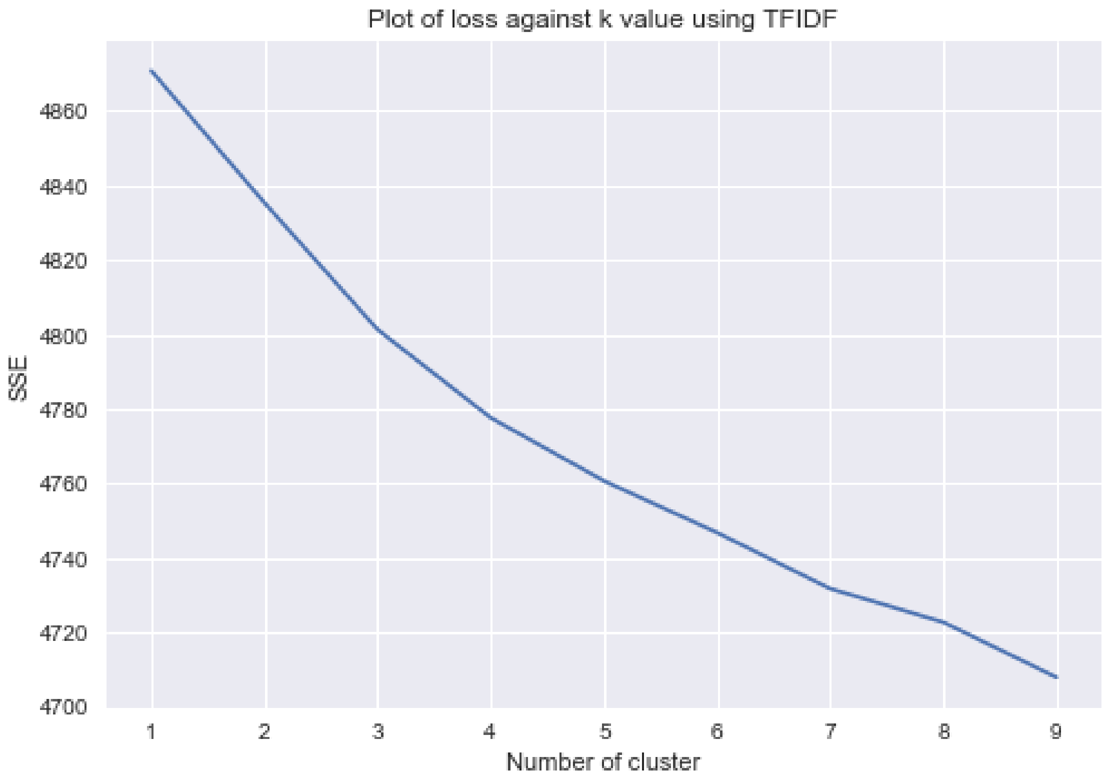
As we have formed 2 cluster and 5 sample from each cluster. Though its not clear but it seems 1) cluster 1 talks about detail review of food type and short review 2) cluster 2 talks about short review of drink type and long review

```
In [8]: #print(dir())
        #print(globals())
        #print(locals())
```

8 TFIDF

```
In [9]: tf_idf_vect = TfidfVectorizer()
        final_counts = tf_idf_vect.fit_transform(clean_data['CleanedText'].values)
        x=final_counts
        x_tfidf=x
        kmeans=KMeans(n_clusters=2, random_state=0).fit(x)
        kmeans.cluster_centers_
        sse = {}
        for k in range(1, 10):
            kmeans = KMeans(init='k-means++',n_clusters=k, max_iter=100).fit(x)
            #x["clusters"] = kmeans.labels_
            sse[k] = kmeans.inertia_ # Inertia: Sum of distances of samples to their closest c
        plt.figure()
        plt.plot(list(sse.keys()), list(sse.values()))
        plt.title("Plot of loss against k value using TFIDF")
        plt.xlabel("Number of cluster")
        plt.ylabel("SSE")
        plt.show()

        # Use k=2 and build cluster
        kmeans = KMeans(init='k-means++',n_clusters=2, max_iter=100).fit(x)
        print(kmeans.labels_)
        # find some data from clusters

        #cluster_map = pd.DataFrame()
        #cluster_map['data_index'] = x.index
        #cluster_map['cluster'] = kmeans.labels_
        #cluster_map[cluster_map.cluster == 1]

        #print("Top terms per cluster:")
        #order_centroids = kmeans.cluster_centers_.argsort()[:, ::-1]
        #terms = count_vect.get_feature_names()
        #for i in range(2):
        #    print ("Cluster ",i)
        #    for ind in order_centroids[i, :10]:
        #        print (' %s' % terms[ind])
```

```
#Find few sentences from different cluster
# Find sentences with 0 and 1 cluster
#print(kmeans.labels_)
#find cluster 1 index
a=np.where(kmeans.labels_ == 1)[0]
b=np.where(kmeans.labels_ == 0)[0]
#check 5 text for cluster 1
print(clean_data['CleanedText'][a][0:5])
#check 5 text for cluster 1
print(clean_data['CleanedText'][b][0:5])
```



```
[1 1 1 ..., 1 1 1]
0    b'dog love healthi treat great train crumbl tr...
1    b'tobin jame excel wine one especi husband enj...
2    b'ive eat strict paleo eat diet near one year ...
3    b'use year give long last energi boost sudden ...
4    b'chill oragemint classic refresh dri scratchi...
Name: CleanedText, dtype: object
5     b'great rich coffe prefer pilon decaf interest...
8     b'love coffe coffe connoisseur enjoy good cup ...
39    b'coffe tast like fresh coffe tast brew stale ...
```

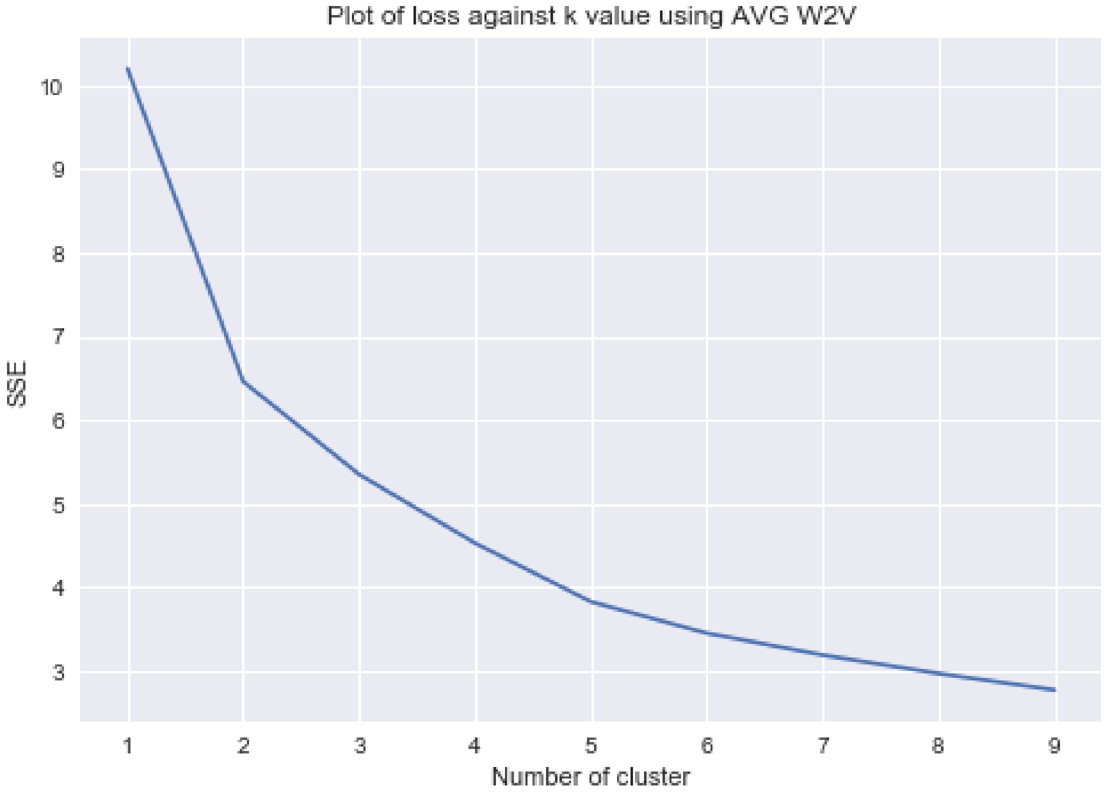
```
41    b'tri price thought differ style cup less expe...
45    b'thrill find tulli french roast decaf back st...
Name: CleanedText, dtype: object
```

9 AVG W2V

In [10]:

```
#ignore warning
import warnings
warnings.filterwarnings('ignore')
from gensim.models import Word2Vec
from gensim.models import KeyedVectors
import pickle
model = KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin.gz', bi
import gensim
i=0
#create a list of list to be used in W2V
list_of_sent=[]
for sent in clean_data['CleanedText'].values:
    filtered_sentence=[]
    #sent=cleanhtml(sent)
    for w in sent.split():
        #for cleaned_words in cleanpunc(w).split():
         for cleaned_words in w.split():
            if(cleaned_words.isalpha()):
                filtered_sentence.append(cleaned_words.lower().decode('utf8'))
            else:
                continue
    list_of_sent.append(filtered_sentence)
#convert each sentence's words to a vector of 50 dimension. Dont construct vec if wor
#and 4 core processor
w2v_model=gensim.models.Word2Vec(list_of_sent,min_count=5,size=50, workers=4)
# average Word2Vec
# for each sentence make average of vectors by (vectors of each words)/(total no of w
# compute average word2vec for each review.
sent_vectors = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent: # 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
        try:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors.append(sent_vec)
x = sent_vectors
x_avgw2v=x
from sklearn.preprocessing import normalize
x = normalize(x, norm='l2', axis=0)

kmeans=KMeans(n_clusters=2, random_state=0).fit(x)
kmeans.cluster_centers_
sse = {}
for k in range(1, 10):
    kmeans = KMeans(init='k-means++',n_clusters=k, max_iter=100).fit(x)
    #x["clusters"] = kmeans.labels_
    sse[k] = kmeans.inertia_ # Inertia: Sum of distances of samples to their closest
plt.figure()
plt.plot(list(sse.keys()), list(sse.values()))
plt.title("Plot of loss against k value using AVG W2V")
plt.xlabel("Number of cluster")
plt.ylabel("SSE")
plt.show()

# Use k=2 and build cluster
kmeans = KMeans(init='k-means++',n_clusters=2, max_iter=100).fit(x)
print(kmeans.labels_)
# find some data from clusters

#cluster_map = pd.DataFrame()
#cluster_map['data_index'] = x.index
#cluster_map['cluster'] = kmeans.labels_
#cluster_map[cluster_map.cluster == 1]

#print("Top terms per cluster:")
#order_centroids = kmeans.cluster_centers_.argsort()[:, ::-1]
#terms = count_vect.get_feature_names()
#for i in range(2):
#  print ("Cluster ",i)
#  for ind in order_centroids[i, :10]:
#    print (' %s' % terms[ind])


#Find few sentences from different cluster
# Find sentences with 0 and 1 cluster
#print(kmeans.labels_)
#find cluster 1 index
a=np.where(kmeans.labels_ == 1)[0]
b=np.where(kmeans.labels_ == 0)[0]
#check 5 text for cluster 1
print(clean_data['CleanedText'][a][0:5])
#check 5 text for cluster 1
```

```
        print(clean_data['CleanedText'][b][0:5])
```



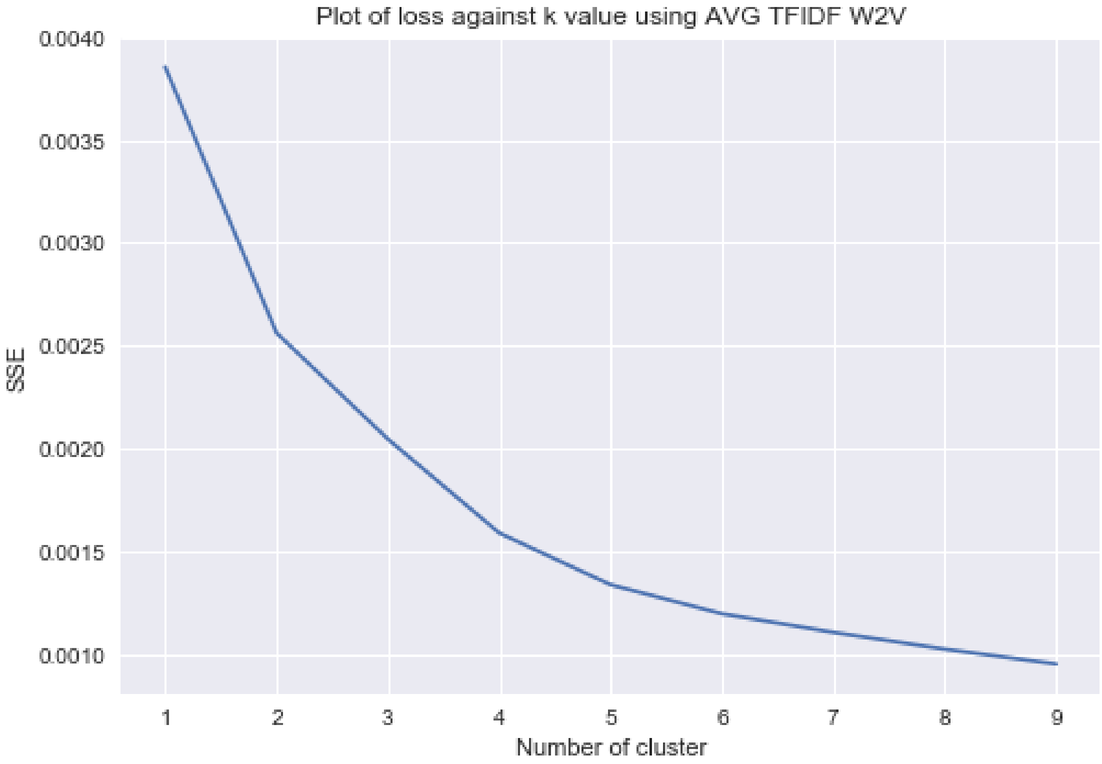
```
[0 0 1 ..., 0 1 0]
2    b'ive eat strict paleo eat diet near one year ...
4    b'chill oragemint classic refresh dri scratchi...
5    b'great rich coffe prefer pilon decaf interest...
6    b'greasi plain simpl reliev itchi scalp negat ...
8    b'love coffe coffe connoisseur enjoy good cup ...
Name: CleanedText, dtype: object
0    b'dog love healthi treat great train crumbl tr...
1    b'tobin jame excel wine one especi husband enj...
3    b'use year give long last energi boost sudden ...
7    b'whether use gourmet sauc pack natur flavor a...
9    b'bought licoric pipe dad love black old fashi...
Name: CleanedText, dtype: object
```

10 AVG TFIDF W2V

```
In [11]: #ignore warning
         import warnings
```

```
warnings.filterwarnings('ignore')

#from gensim.models import Word2Vec
#from gensim.models import KeyedVectors
#import pickle
model = KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin.gz', bin
#import gensim

i=0
#create a list of list to be used in W2V
list_of_sent=[]
for sent in clean_data['CleanedText'].values:
    filtered_sentence=[]
    #sent=cleanhtml(sent)
    for w in sent.split():
        #for cleaned_words in cleanpunc(w).split():
         for cleaned_words in w.split():
            if(cleaned_words.isalpha()):
                filtered_sentence.append(cleaned_words.lower().decode('utf8'))
            else:
                continue
    list_of_sent.append(filtered_sentence)
#convert each sentence's words to a vector of 50 dimension. Dont construct vec if wor
#and 4 core processor
w2v_model=gensim.models.Word2Vec(list_of_sent,min_count=5,size=50, workers=4)

tf_idf_vect = TfidfVectorizer()
final_tf_idf=tf_idf_vect.fit_transform(clean_data['CleanedText'].values)
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_sent_vectors = []; # the tfidf-w2v for each sentence/review is stored in this l
row=0;
#calculate avg tfidf score for each sentences
for sent in list_of_sent: # 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
        try:
            vec = w2v_model.wv[word]#calculate w2v for each word
            # obtain the tf_idfidf of a word in a sentence/review
            tf_idf = final_tf_idf[row, tfidf_feat.index(word)]#get tfidf score of each
            sent_vec += (vec * tf_idf) # multiply vec with tfidf of each word and cum
            weight_sum += tf_idf # also add tfidf sums in each sentence
        except:
            pass
    sent_vec /= weight_sum
    tfidf_sent_vectors.append(sent_vec)
    row += 1
#tfidf_sent_vectors.


x=tfidf_sent_vectors
x_avgw2vtfidf=x
from sklearn.preprocessing import normalize
x = normalize(x, norm='l1', axis=0)

kmeans=KMeans(n_clusters=2, random_state=0).fit(x)
kmeans.cluster_centers_
sse = {}
for k in range(1, 10):
    kmeans = KMeans(init='k-means++',n_clusters=k, max_iter=100).fit(x)
    #x["clusters"] = kmeans.labels_
    sse[k] = kmeans.inertia_ # Inertia: Sum of distances of samples to their closest
plt.figure()
plt.plot(list(sse.keys()), list(sse.values()))
plt.title("Plot of loss against k value using AVG TFIDF W2V")
plt.xlabel("Number of cluster")
plt.ylabel("SSE")
plt.show()


# Use k=2 and build cluster
kmeans = KMeans(init='k-means++',n_clusters=2, max_iter=100).fit(x)
print(kmeans.labels_)
# find some data from clusters

#cluster_map = pd.DataFrame()
#cluster_map['data_index'] = x.index
#cluster_map['cluster'] = kmeans.labels_
#cluster_map[cluster_map.cluster == 1]

#print("Top terms per cluster:")
#order_centroids = kmeans.cluster_centers_.argsort()[:, ::-1]
#terms = count_vect.get_feature_names()
#for i in range(2):
#    print ("Cluster ",i)
#    for ind in order_centroids[i, :10]:
#        print (' %s' % terms[ind])


#Find few sentences from different cluster
# Find sentences with 0 and 1 cluster
#print(kmeans.labels_)
#find cluster 1 index
a=np.where(kmeans.labels_ == 1)[0]
```

```
b=np.where(kmeans.labels_ == 0)[0]
#check 5 text for cluster 1
print(clean_data['CleanedText'][a][0:5])
#check 5 text for cluster 1
print(clean_data['CleanedText'][b][0:5])
```



```
[0 0 0 ..., 0 1 1]
4     b'chill oragemint classic refresh dri scratchi...
5     b'great rich coffe prefer pilon decaf interest...
8     b'love coffe coffe connoisseur enjoy good cup ...
11    b'ive never much soda drinker alway lookout al...
12    b'delight receiv new drink ive fan long time h...
Name: CleanedText, dtype: object
0    b'dog love healthi treat great train crumbl tr...
1    b'tobin jame excel wine one especi husband enj...
2    b'ive eat strict paleo eat diet near one year ...
3    b'use year give long last energi boost sudden ...
6    b'greasi plain simpl reliev itchi scalp negat ...
Name: CleanedText, dtype: object
```

11 Try hierarchical cluster

12 BOW

```
In [12]: # copud from https://raw.githubusercontent.com/jqmviegas/jqm_cvi/master/jqmcvi/base.p
         #ignore warning
         import warnings
         warnings.filterwarnings('ignore')
         from sklearn.preprocessing import normalize
         from sklearn.cluster import AgglomerativeClustering
         x=x_bow
         #for index, metric in enumerate([1,2,3]):
         #    model = AgglomerativeClustering(n_clusters=metric,linkage="average")
         #    model.fit(x)
         #    plt.figure()
         #    plt.axes([0, 0, 1, 1])
         #    for l, c in zip(np.arange(model.n_clusters), 'rgbk'):
         #        plt.plot(x[model.labels_ == l].T, c=c, alpha=.5)
         #    plt.axis('tight')
         ##    plt.axis('off')
         #    plt.suptitle("AgglomerativeClustering(cluster=%s)" % metric, size=20)
         #plt.show()

         cluster=AgglomerativeClustering(n_clusters=2).fit(x.toarray())
         a=np.where(cluster.labels_ == 1)[0]
         b=np.where(cluster.labels_ == 0)[0]
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][a[0]])
         print(clean_data['CleanedText'][a[1]])
         print(clean_data['CleanedText'][a[2]])
         print(clean_data['CleanedText'][a[3]])
         print(clean_data['CleanedText'][a[4]])
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][b[0]])
         print(clean_data['CleanedText'][b[1]])
         print(clean_data['CleanedText'][b[2]])
         print(clean_data['CleanedText'][b[3]])
         print(clean_data['CleanedText'][b[4]])
```

```
b'dog love healthi treat great train crumbl tri break piec'
b'tobin jame excel wine one especi husband enjoy tobin jame merlot difficult find good wine rea
b'ive eat strict paleo eat diet near one year includ ghee huge tast benefit ghee virtual lacto
b'use year give long last energi boost sudden let good tast put travel'
b'chill oragemint classic refresh dri scratchi pallet premium price met except tast exceed sati
b'coffe tast like fresh coffe tast brew stale coffe bean disappoint expect good cup coffe come
b'freez dri ice cream great tast exact like expens kind astronaut packag fraction price receiv
b'realli enjoy tea drink howev need coffe ive look someth keep away addict big flavor coffe fru
b'love morn coffe bought dolc gusto machin sale fraction retail cost tri curb cost latt everi
```

```
b'coffe storag drawer holder keurig pod wonder purchas extrem impress place one flavor row kno
```

13 SUmmarizing each cluster

first cluster talks about food type review and second one coffee type review(long review)

14 TFIDF

```
In [13]: from sklearn.cluster import AgglomerativeClustering
         x=x_tfidf
         #for index, metric in enumerate([1,2,3]):
         #    model = AgglomerativeClustering(n_clusters=metric,linkage="average")
         #    model.fit(x)
         #    plt.figure()
         #    plt.axes([0, 0, 1, 1])
         #    for l, c in zip(np.arange(model.n_clusters), 'rgbk'):
         #        plt.plot(x[model.labels_ == l].T, c=c, alpha=.5)
         #    plt.axis('tight')
         ##    plt.axis('off')
         #    plt.suptitle("AgglomerativeClustering(cluster=%s)" % metric, size=20)
         #plt.show()

         cluster=AgglomerativeClustering(n_clusters=2).fit(x.toarray())
         a=np.where(cluster.labels_ == 1)[0]
         b=np.where(cluster.labels_ == 0)[0]
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][a][0:6])
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][b][0:6])
```

```
59     b'headlin pretti much sum bigalow green tea ba...
68     b'far yummi tea purchas great cold damp night ...
75     b'rule big fan herbal tea ill give anyth tri l...
109    b'anoth delici tea lipton blackberri tast defi...
113    b'coupl year enjoy tea last snack day light su...
142    b'realli enjoy tea drink howev need coffe ive ...
Name: CleanedText, dtype: object
0    b'dog love healthi treat great train crumbl tr...
1    b'tobin jame excel wine one especi husband enj...
2    b'ive eat strict paleo eat diet near one year ...
3    b'use year give long last energi boost sudden ...
4    b'chill oragemint classic refresh dri scratchi...
5    b'great rich coffe prefer pilon decaf interest...
Name: CleanedText, dtype: object
```

15 plot accuracy with k value

16 W2V ADG

```
In [14]: #for index, metric in enumerate([1,2,3]):
         #    model = AgglomerativeClustering(n_clusters=metric,linkage="average")
         #    model.fit(x)
         #    plt.figure()
         #    plt.axes([0, 0, 1, 1])
         #    for l, c in zip(np.arange(model.n_clusters), 'rgbk'):
         #        plt.plot(x[model.labels_ == l].T, c=c, alpha=.5)
         #    plt.axis('tight')
         ##    plt.axis('off')
         #    plt.suptitle("AgglomerativeClustering(cluster=%s)" % metric, size=20)
         #plt.show()
         x=x_avgw2v
         cluster=AgglomerativeClustering(n_clusters=2).fit(x)
         a=np.where(cluster.labels_ == 1)[0]
         b=np.where(cluster.labels_ == 0)[0]
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][a][0:6])
         #check 5 text for cluster 1
         print(clean_data['CleanedText'][b][0:6])
```

```
0     b'dog love healthi treat great train crumbl tr...
7     b'whether use gourmet sauc pack natur flavor a...
9     b'bought licoric pipe dad love black old fashi...
13    b'famili love eat crisp bread tast great plain...
14    b'haribo candi usual good excit receiv centipe...
15    b'say addict buy cannot maintain disciplin nee...
Name: CleanedText, dtype: object
1    b'tobin jame excel wine one especi husband enj...
2    b'ive eat strict paleo eat diet near one year ...
3    b'use year give long last energi boost sudden ...
4    b'chill oragemint classic refresh dri scratchi...
5    b'great rich coffe prefer pilon decaf interest...
6    b'greasi plain simpl reliev itchi scalp negat ...
Name: CleanedText, dtype: object
```

17 W2V AVG TFIDF

```
In [15]: #ignore warning
         import warnings
         warnings.filterwarnings('ignore')
         from sklearn.preprocessing import normalize
         import time
```

```
x=x_avgw2vtfidf
#cluster=AgglomerativeClustering(n_clusters=2).fit(x)


#for index, metric in enumerate([1,2,3]):
#    model = AgglomerativeClustering(n_clusters=metric,linkage="average")
#    model.fit(x)
#    plt.figure()
#    plt.axes([0, 0, 1, 1])
#    for l, c in zip(np.arange(model.n_clusters), 'rgbk'):
#        plt.plot(x[model.labels_ == l].T, c=c, alpha=.5)
#    plt.axis('tight')
##    plt.axis('off')
#    plt.suptitle("AgglomerativeClustering(cluster=%s)" % metric, size=20)
#plt.show()

cluster=AgglomerativeClustering(n_clusters=2).fit(x)
a=np.where(cluster.labels_ == 1)[0]
b=np.where(cluster.labels_ == 0)[0]
#check 5 text for cluster 1
print(clean_data['CleanedText'][a][0:6])
#check 5 text for cluster 1
print(clean_data['CleanedText'][b][0:6])
```

```
0     b'dog love healthi treat great train crumbl tr...
7     b'whether use gourmet sauc pack natur flavor a...
14    b'haribo candi usual good excit receiv centipe...
15    b'say addict buy cannot maintain disciplin nee...
17    b'pleas dont fool buy item cannot return box b...
18    b'hard find local groceri amazon deal can come...
Name: CleanedText, dtype: object
1    b'tobin jame excel wine one especi husband enj...
2    b'ive eat strict paleo eat diet near one year ...
3    b'use year give long last energi boost sudden ...
4    b'chill oragemint classic refresh dri scratchi...
5    b'great rich coffe prefer pilon decaf interest...
6    b'greasi plain simpl reliev itchi scalp negat ...
Name: CleanedText, dtype: object
```

18 DBSCAN

19 try dbscan use W2V use dim of vec 100, minpts=2*d use all data use elbow method to find eps #try other eps and see how sensitive it is # W2V

```
In [16]: _ , clean_data = train_test_split(sorted_data, test_size = 10000, stratify = sorted_da
         i=0
         str1=' '
         final_string=[]
         all_positive_words=[] # store words from +ve reviews here
         all_negative_words=[] # store words from -ve reviews here.
         s=''
         #Create new catagory as Cleanedtext after removing htmltag and punctuation and upperc
         for sent in clean_data['Text'].values:
             filtered_sentence=[]
             #print(sent);
             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)
                             if (clean_data['Score'].values)[i] == 'positive':
                                 all_positive_words.append(s) #list of all words used to descr
                             if(clean_data['Score'].values)[i] == 'negative':
                                 all_negative_words.append(s) #list of all words used to descr
                         else:
                             continue
                     else:
                         continue
             str1 = b" ".join(filtered_sentence) #final string of cleaned words

             final_string.append(str1)
             i+=1


         clean_data['CleanedText']=final_string
         clean_data.shape
         #Sort data on timestamp
         clean_data=clean_data.sort_values(by=['Time'],ascending=False)
         clean_data.reset_index(inplace=True)
         clean_data.sample(2)

         model = KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin.gz', bi
         import gensim
```

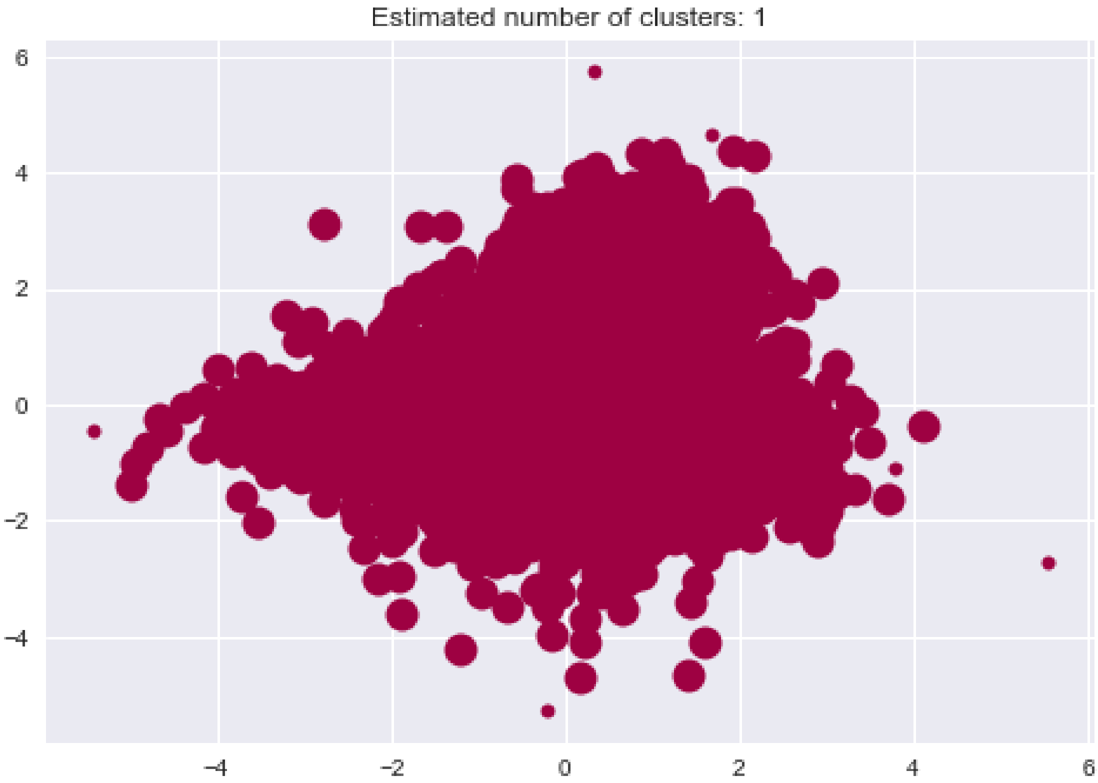
```
i=0
#create a list of list to be used in W2V
list_of_sent=[]
for sent in clean_data['CleanedText'].values:
    filtered_sentence=[]
    #sent=cleanhtml(sent)
    for w in sent.split():
        #for cleaned_words in cleanpunc(w).split():
         for cleaned_words in w.split():
            if(cleaned_words.isalpha()):
                filtered_sentence.append(cleaned_words.lower().decode('utf8'))
            else:
                continue
    list_of_sent.append(filtered_sentence)
#convert each sentence's words to a vector of 50 dimension. Dont construct vec if wor
#and 4 core processor
# excluding words occuring less than 50 because the cluster is not clear to distingui
w2v_model=gensim.models.Word2Vec(list_of_sent,min_count=50,size=100, workers=4)
sent_vectors = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent: # for each review/sentence
    sent_vec = np.zeros(100) # 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
        try:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors.append(sent_vec)
x = sent_vectors
x_avgw2v=x
```

20 Use AVG W2V

```
In [21]: from sklearn.cluster import DBSCAN
         from sklearn.preprocessing import StandardScaler
         x=x_avgw2v
         x = StandardScaler().fit_transform(x)
         #print(x)

         #for i in range(6,30):
         #for i in range(50,55):
         #   j=i/3
         #   db = DBSCAN(eps=j, min_samples=500).fit(x)
         #   labels = db.labels_
         #   print(j,set(labels))

         db = DBSCAN(eps=16.6, min_samples=200).fit(x)
         labels=db.labels_
         num_clusters = len(set(labels))
         print("num_cluster including noise",num_clusters,set(labels))
         y = clean_data['Score']
         labels_true=y.values
         core_samples_mask = np.zeros_like(db.labels_, dtype=bool)
         core_samples_mask[db.core_sample_indices_] = True
         labels = db.labels_
         # Number of clusters in labels, ignoring noise if present.
         n_clusters_ = len(set(labels)) - (1 if -1 in labels else 0)
         #print("no of cluster ignoring noise",n_clusters_)
         #print('Estimated number of clusters: %d' % n_clusters_)
         #print("Homogeneity: %0.3f" % metrics.homogeneity_score(labels_true, labels))
         #print("Completeness: %0.3f" % metrics.completeness_score(labels_true, labels))
         #print("V-measure: %0.3f" % metrics.v_measure_score(labels_true, labels))
         #print("Adjusted Rand Index: %0.3f" % metrics.adjusted_rand_score(labels_true, labels
         #print("Adjusted Mutual Information: %0.3f"     % metrics.adjusted_mutual_info_score(
         #print("Silhouette Coefficient: %0.3f"      % metrics.silhouette_score(x, labels))

         print(labels_true)

         import matplotlib.pyplot as plt
         # Black removed and is used for noise instead.
         unique_labels = set(labels)
         colors = [plt.cm.Spectral(each)
                   for each in np.linspace(0, 1, len(unique_labels))]
         for k, col in zip(unique_labels, colors):
             if k == -1:
                 # Black used for noise.
                 col = [0, 0, 0, 1]

             class_member_mask = (labels == k)

             xy = x[class_member_mask & core_samples_mask]
             plt.plot(xy[:, 0], xy[:, 1], 'o', markerfacecolor=tuple(col),
                      markeredgecolor='k', markersize=14)

             xy = x[class_member_mask & ~core_samples_mask]
             plt.plot(xy[:, 0], xy[:, 1], 'o', markerfacecolor=tuple(col),
                      markeredgecolor='k', markersize=6)

         plt.title('Estimated number of clusters: %d' % n_clusters_)
         plt.show()
```

```
num_cluster including noise 1 {0}
```

```
['positive' 'positive' 'positive' ..., 'positive' 'positive' 'positive']
```



In [19]:
```
#import matplotlib.pyplot as pl

#for i in range(1,20):
#   j=i/10
#   dbscan = DBSCAN(eps=j, min_samples=100).fit(x)
#   labels = db.labels_
#   print(j,set(labels))

#from sklearn.decomposition import PCA
#pca = PCA(n_components=2).fit(x)
#pca_2d = pca.transform(x)
#for i in range(0, pca_2d.shape[0]):
#   if (dbscan.labels_[i] == 0):
#     c1 = pl.scatter(pca_2d[i,0],pca_2d[i,1],c='r',marker='+')
#   elif (dbscan.labels_[i] == 1):
#     c2 = pl.scatter(pca_2d[i,0],pca_2d[i,1],c='g',marker='o')
#   elif (dbscan.labels_[i] == -1):
#     c3 = pl.scatter(pca_2d[i,0],pca_2d[i,1],c='b',marker='*')
#   pl.legend([c1, c2, c3], ['Cluster 1', 'Cluster 2','Noise'])
```

```
        #  pl.title('DBSCAN finds 2 clusters and noise')
        #  pl.show()
        #print(db.labels_)
```

```
[0 0 0 ..., 0 0 0]
```

21 SUmmarizing each cluster

As we are not getting 2 cluster with DBSCAN there is no point in summerizing data

22 Conclusion

W2V takes time to implement. For kmeans better model is like below W2VAVGTFIDF>W2VAVG>TFIDF>BOW The different clustering texts are quite similar In DBSCAN its difficult to choose eps to get 2 cluster, most of the cases getting 0 cluster, I am getting only one cluster and outliers in best case.

23 Steps followed

Only !=3 reviews are taken Mark >3 as positive and <3 as negative. Sort data as per product id in ascending order Deduplication of entries for same profilename,userid, time, text and take first element Get stratified sampling of 5k data Clean html and punctuation Convert to uppercase and word<3 are rejected data sorted on time Split the data in train and test to 70:30 BOW TFIDF AVGW2V and AVG TFIDF W2V was used in whole data For kmeans clustering different value of k clustering error was plotted. AgglomerativeClustering for 2 cluster is formed DBSCAN eps=16.6, min_samples=200 For top 5 review of each cluster tried to summarize clustering type