39.15.Amazon_food_review_truncated_SVD

July 21, 2018

1 Amazon food review dataset apply truncated SVD

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

2 Objective

1. Take 2000 words by TFIDF importance
2. Calculate cooccurance matrix with neighbourhood of size 5 and count how many times wi occur in context of wj
3. Then do truncated SVD
4. try multiple value of k(find optimal k by amount of variance explained)[use singular value]
5. cluster(kmeans k=50) word vector for top 2000
6. word cluster together should be related

3 Import data and libraries

```
In [1]: from sklearn.manifold import TSNE
        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
        from sklearn.cross_validation import train_test_split,KFold
        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.grid_search import GridSearchCV
        from sklearn.linear_model import LogisticRegression

        con = sqlite3.connect('database.sqlite')

        #get only +ve and -ve review
        raw_data = pd.read_sql_query("""SELECT * FROM Reviews WHERE Score != 3""", con)
```

```
C:\Users\suman\Anaconda3\lib\site-packages\sklearn\cross_validation.py:41: DeprecationWarning:
  "This module will be removed in 0.20.", DeprecationWarning)
C:\Users\suman\Anaconda3\lib\site-packages\sklearn\grid_search.py:42: DeprecationWarning: This
  DeprecationWarning)
```

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 [186]: #take only 50000 data
          print('total data \n',sorted_data['Score'].value_counts())
          #clean_data=sorted_data.sample(frac=1).groupby('Score').head(10000)
          #take stratified sampling i.e. positive and negative reviews are proportionate to ra
          #testing
          _ , clean_data = train_test_split(sorted_data, test_size = 50000, random_state=1,stra
          clean_data['Score'].value_counts()
```

```
total data
 positive    307063
```

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

```
Out[186]: positive    42159
          negative     7841
          Name: Score, dtype: int64
```

```
In [187]: # 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 c
              cleaned = re.sub(r'[?|!|\'|"|#]',r' ',sentence)
              cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
              return  cleaned
          print(sno.stem('tasty'))

          i=0
          str1=' '
          mystop={'of','four','one','would'}
          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 upper
          for sent in clean_data['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) & (cleaned_words.lower() not i
                              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 desc
                              if(clean_data['Score'].values)[i] == 'negative':
                                  all_negative_words.append(s) #list of all words used to desc
                          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
          print(clean_data.shape)
          #Sort data on timestamp
          clean_data=clean_data.sort_values(by=['Time'],ascending=False)
          #clean_data
          clean_data['CleanedText'].sample(2)
          clean_data['CleanedText'].iloc[0]
```

```
tasti
(50000, 11)


C:\Users\suman\Anaconda3\lib\site-packages\ipykernel_launcher.py:52: 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.htm


Out[187]: b'use lot coconut late granola cake cup cake etc particular brand serv purpos well p
```

5 Get top 2000 words by TFIDF score and create co-occurence matrix by window 5

```
In [188]: x=clean_data['CleanedText'].values
          y = clean_data['Score']
          #ignore terms that appears in less than 20 document
          tf_idf_vect = TfidfVectorizer(min_df = 20)
          final_counts = tf_idf_vect.fit_transform(x)
          #use the same vectors to convert test data
          indices = np.argsort(tf_idf_vect.idf_)[::-1]
          features = tf_idf_vect.get_feature_names()
          #testing
          top_n = 2000
          top_features = [features[i] for i in indices[:top_n]]
          print (top_features[0:20])
          print('len of top feature',len(top_features))
```

```python
#remove other words from review
final_string=[]
all_string=[]

i=0
for sent in clean_data['CleanedText'].values:

    filtered_sentence=[]
    for w in sent.decode('utf8').split():
                if(w in top_features):
                    filtered_sentence.append(w.encode('utf8'))

                else:
                    continue
    str1 = b" ".join(filtered_sentence) #final string of cleaned words
    if ((i<5) & (str1!=b'')):
        print('sentence copy',str1)
    if (str1.decode('utf8') !=''):
      i=i+1
      final_string.append(str1)
      all_string.append(str1)

#clean_data['CleanedText']=final_string
#Now final_string is ready to work with
#print(clean_data['CleanedText'].shape)
all_string[0:20]
```

```
['frapp', 'brave', 'cornstarch', 'unsatisfi', 'bourbon', 'omaha', 'lundberg', 'wider', 'crude'
len of top feature 2000
sentence copy b'neighborhood mighti'
sentence copy b'meanwhil economi drag govern cell cell cell govern vote'
sentence copy b'holi yield mist yield math mist yield mist arizona mediocr elig mist'
sentence copy b'cornstarch lump agent'
sentence copy b'crowd'
```

```
Out[188]: [b'neighborhood mighti',
           b'meanwhil economi drag govern cell cell cell govern vote',
           b'holi yield mist yield math mist yield mist arizona mediocr elig mist',
           b'cornstarch lump agent',
           b'crowd',
           b'cheat chlorid',
           b'lap cornstarch merrick',
           b'bank til rees',
           b'electrolyt gatorad unnatur',
           b'kuerig',
           b'largest carmel saturday',
           b'queen',
           b'aluminum aluminum ugh',
           b'smack',
           b'model morsel',
           b'nugget',
           b'lite',
           b'newton',
           b'magazin',
           b'quench thirst']
```

```
In [189]: #Convert to cooccurance mat
          #type(final_string)
          print(len(top_features))
          window=5
          len1=len(top_features)
          #print(len)
          m=np.zeros([len1,len1])
          columns=top_features
          rows=top_features
          df=pd.DataFrame(m,columns=columns,index=rows)
          #print(df)

          def cal_occ(sentence,df):
              sen=sentence.split()
              l=len(sen)-1
              for i,word in enumerate(sen):
                  #loop through every sentence in a window and get neigherest words and keep a
                  for j in range(max(i-window,0),min(i+window+1,l+1)):
                      if word!=sen[j]:
                          #print('printing',word,sen[j])
                          df[word][sen[j]]+=1

          for sentence in final_string:
              #print('call',sentence)
              cal_occ(sentence.decode('utf8'),df)

          print(df.shape)
```

```
2000
(2000, 2000)
```

```
In [190]: from sklearn.preprocessing import StandardScaler
          #Get cooccuring words for a given word
          print('The most cooccuring word with ',df.index[4])
          aa=df.iloc[4]
          bb=aa.sort_values(ascending=False)
          print(type(bb))
```

```
The most cooccuring word with  bourbon
<class 'pandas.core.series.Series'>
```

```
In [191]: #df
```

6 Create countvectorizer using cooccurence matrix

```
In [192]: #count_vect = CountVectorizer(vocabulary=top_features) #in scikit-learn
          #X = count_vect.fit_transform(final_string)

          #print(X.shape)

          #Cooccurance matrix
          #X = (X.T * X) # this is co-occurrence matrix in sparse csr format
          #X.setdiag(0) # sometimes you want to fill same word cooccurence to 0
          #print(X.todense())

          #print(count_vect.vocabulary_)

          #Create truncated SVD
          from sklearn.decomposition import TruncatedSVD

          #Try different component
          l=[50,100,200,250,300,400,500,800,1000]
          for i in l:
            svd = TruncatedSVD(n_components=i, n_iter=7, random_state=0)
            svd.fit(df.values)
            #print(svd.explained_variance_ratio_)
            l1=svd.explained_variance_ratio_
            print('% variance explained with component ',i,svd.explained_variance_ratio_.sum()
            #print('singular values',svd.singular_values_)

          #So looks like with 1000 component 96% variance is explained
```

```
% variance explained with component  50 0.36579687381
% variance explained with component  100 0.493899032028
% variance explained with component  200 0.640628352312
% variance explained with component  250 0.690038705112
% variance explained with component  300 0.730234281914
% variance explained with component  400 0.793356505632
% variance explained with component  500 0.841036750945
% variance explained with component  800 0.930341375921
% variance explained with component  1000 0.962662429164
```

SO by 500 component 84% variance is explained # Use SVD

```
In [205]: #VT = svd.components_
          #TruncatedSVD is basically a wrapper around sklearn.utils.extmath.randomized_svd; yo

          from sklearn.utils.extmath import randomized_svd

          U, Sigma, VT = randomized_svd(df.values,
                                        n_components=500,
                                        n_iter=50,
                                        random_state=0)

          print('U value\n')
          #print(U)
          print('sigma value\n')
          #print(Sigma)
          print('VT value\n')
          #print(VT)
          print(U.shape,Sigma.shape,VT.shape)
          #print('1st word vector representation',df.index[0])

          #take log transform
          #U=np.log(U+1)
```

```
U value

sigma value

VT value

(2000, 500) (500,) (500, 2000)
```

7 Form cluster of 10 using those important words SVD value

8 Get top few words similar to a random word

```
In [214]: from random import randint
          j=randint(0, 2000)
          print('1st word vector representation',df.index[j],' for j',j)#print(U.shape[0])
          #Calculate distance of this word with all words and sort in descending order
          l=[]
          for i in range(U.shape[1]):
            a=np.linalg.norm(U[j]-U[i])
            l.append(a)
          l1=sorted(range(len(l)), key=lambda k: l[k])
          #print(l)
          print('top 10 words similar to ',df.index[j],' are ',df.index[l1[0:10]])
```

```
1st word vector representation massag  for j 99
```

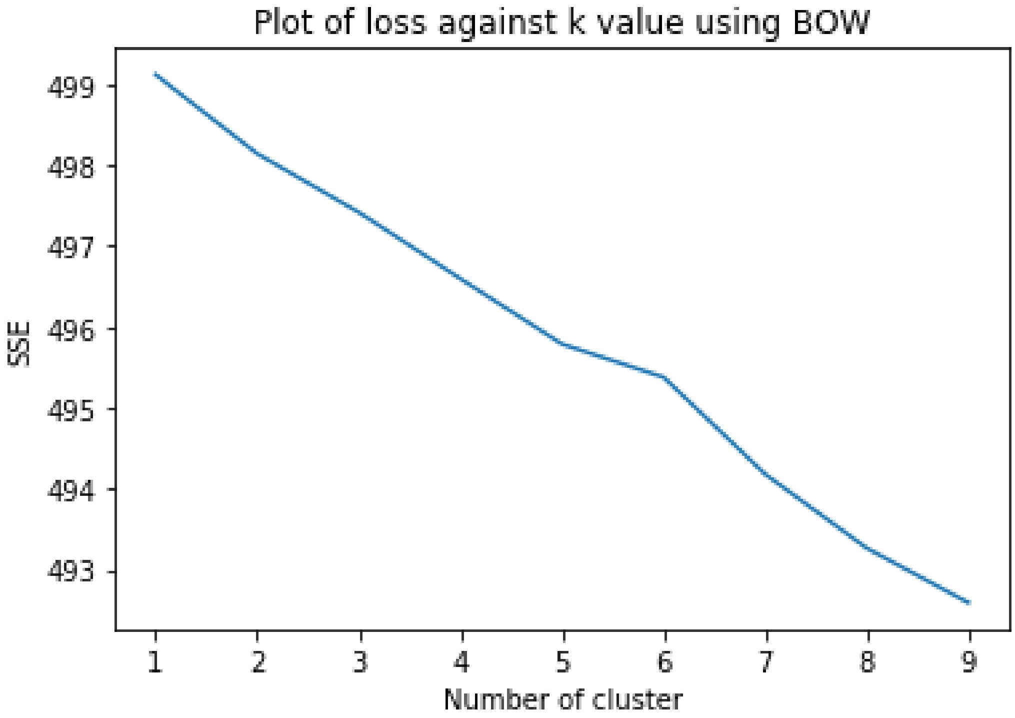
```
top 10 words similar to  massag  are  Index(['massag', 'kuerig', 'choclat', 'runner', 'incid',
       'crouton', 'these', 'frapp'],
      dtype='object')
```

```
In [215]: from sklearn.cluster import KMeans
          # Now U is vec presentation of words
          n_clusters=10
          kmeans=KMeans(n_clusters=10, random_state=0).fit(U)
          kmeans.cluster_centers_

          sse = {}
          for k in range(1, 10):
              kmeans = KMeans(init='k-means++',n_clusters=k, max_iter=100).fit(U)
              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 BOW")
          plt.xlabel("Number of cluster")
          plt.ylabel("SSE")
          plt.show()

          #a=np.where(kmeans.labels_ == 1)[0]
          #b=np.where(kmeans.labels_ == 0)[0]
          #check 5 text for cluster 1

          kmeans = KMeans(init='k-means++',n_clusters=50, max_iter=100).fit(U)
          n_clusters=50
          print(a.shape)
          for i in range(n_clusters):
            a=np.where(kmeans.labels_ == i)[0]
            print('in cluster \n',i)
            print(a[0:10])
            k=0
            for j in a:
                k=k+1
                if (k<10):
                  print(top_features[j][:10])
```



```
()
in cluster
 0
[1836]
flip
in cluster
 1
[  59  342  716 1269 1457 1696 1771]
breastmilk
repel
pediatrici
enfamil
scream
advanc
gerber
in cluster
 2
[ 56  97 262 346 434 465 476 502 509 554]
bridg
avoderm
chlorin
brandi
dextros
lessen
```

```
eukanuba
bypass
saccharin
in cluster
 3
[430]
egbert
in cluster
 4
[1812]
genet
in cluster
 5
[ 877  891 1161 1724]
firmer
helper
barrel
model
in cluster
 6
[ 112  168  500  673  694  791  950 1000 1409 1417]
knead
laboratori
coca
tim
river
artisan
spelt
horseradis
loav
in cluster
 7
[1619]
ultra
in cluster
 8
[1797]
thirst
in cluster
 9
[  78   80  424  632  835 1644 1691]
ghee
semolina
marmalad
vietnames
garnish
tiger
sweat
```

```
in cluster
 10
[1194]
lobster
in cluster
 11
[ 1  6  7  8 11 12 13 15 16 17]
brave
lundberg
wider
crude
blog
understat
blade
carolina
incid
in cluster
 12
[38]
lapsang
in cluster
 13
[246]
shim
in cluster
 14
[ 21  66  82  84 145 149 172 185 201 231]
dijon
pari
stat
frizzi
unbleach
ib
candl
mar
asept
in cluster
 15
[461]
gopher
in cluster
 16
[1533]
jolli
in cluster
 17
[1426]
catnip
```

```
in cluster
 18
[1318]
velveeta
in cluster
 19
[1288]
insulin
in cluster
 20
[1654]
michael
in cluster
 21
[1491]
signatur
in cluster
 22
[ 26  96 140 355 361 384 407 426 445 446]
triglyceri
spark
topper
hotdog
dane
ceram
stabil
inquir
companion
in cluster
 23
[864]
manuka
in cluster
 24
[  40  188  280  314  675  695  861  997 1073 1170]
rubi
scotch
pomeranian
potti
appletini
brine
mocktail
anchovi
weed
in cluster
 25
[710]
sift
```

```
in cluster
 26
[715]
shea
in cluster
 27
[1476]
izz
in cluster
 28
[1734]
fog
in cluster
 29
[884]
tzu
in cluster
 30
[1634]
chamomil
in cluster
 31
[1566]
dandruff
in cluster
 32
[ 4  5 14 19 20 24 30 36 41 45]
bourbon
omaha
strengthen
hound
detox
disabl
refridger
revolt
repuls
in cluster
 33
[1002]
queen
in cluster
 34
[ 202  258  306  438  503  592  849 1015 1021 1044]
mechan
shard
antler
los
bulldog
```

```
whiskey
compound
buri
foot
in cluster
 35
[811]
skinless
in cluster
 36
[1234]
therapi
in cluster
 37
[931]
chlorid
in cluster
 38
[1790]
skillet
in cluster
 39
[979]
nib
in cluster
 40
[ 0  2  3  9 10 23 27 29 32 33]
frapp
cornstarch
unsatisfi
slot
understood
dioxid
trident
whirl
breaker
in cluster
 41
[805]
rica
in cluster
 42
[305]
gunpowd
in cluster
 43
[1961]
felin
```

```
in cluster
 44
[1539]
wire
in cluster
 45
[482]
dha
in cluster
 46
[181]
needl
in cluster
 47
[1745]
crown
in cluster
 48
[1435]
similac
in cluster
 49
[1565]
wolfgang
```

9 Observation

To find the similar word its not giving proper words, maybe non engligh words and text cleanning is required much. But most of the cases top similar word is the word itself which proofs its calculating the distance Even U vector after log transform also not producing better result as below

```
In [216]: #try log transform to find similar words
          U=np.log(U+1)
```

```
In [227]: j=randint(0, 2000)
          print('1st word vector representation',df.index[j],' for j',j)#print(U.shape[0])
          #Calculate distance of this word with all words and sort in descending order
          #take log transform
          l=[]
          for i in range(U.shape[1]):
            a=np.linalg.norm(U[j]-U[i])
            l.append(a)
          l1=sorted(range(len(l)), key=lambda k: l[k])
          #print(l)
          print('top 10 words similar to ',df.index[j],' are ',df.index[l1[0:10]])
```

```
1st word vector representation confess  for j 352
top 10 words similar to  confess  are  Index(['confess', 'kuerig', 'these', 'yuk', 'gosh', 'co
       'frapp', 'toasti', 'choclat'],
      dtype='object')
```

Ignore the above 2 plots those plots are plotted below again