In [1]:

```
import pandas as pd
import numpy as np
import nltk
import re
from nltk.tokenize import word_tokenize, sent_tokenize
from nltk.corpus import stopwords
import json as js
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.model_selection import train_test_split
from sklearn.model_selection import GridSearchCV
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
from keras.preprocessing.text import Tokenizer
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer
from nltk.stem import SnowballStemmer
from sklearn.metrics import mean_squared_error
from keras.models import load_model
from sklearn.preprocessing import OneHotEncoder
from itertools import compress
from sklearn.linear_model import LogisticRegression
from sklearn.externals import joblib
import heapq
from sklearn.linear_model import LinearRegression
pd.set_option('display.max_columns', None) # see the full cols
```

```
/anaconda3/lib/python3.6/site-packages/h5py/__init__.py:36: Future
Warning: Conversion of the second argument of issubdtype from `flo
at` to `np.floating` is deprecated. In future, it will be treated
as `np.float64 == np.dtype(float).type`.
  from ._conv import register_converters as _register_converters
Using TensorFlow backend.
```

1.Data Proc

(0).Import data

In [2]:

```
def sentenceClean(x):
    result = x.lower()
    result = re.sub('pretty|very|always|food|chinese', ' ', result)
    result = re.sub('not so', 'not', result)
    result = re.sub('high\squality', 'great', result)
    result = re.sub('low\squality', 'bad', result)
    result = re.sub('n\'t\s', ' not', result)
    result = re.sub('\sstars|\sstar', 'stars', result)
    result = re.sub('0stars', 'zerostars', result)
    result = re.sub('1stars', 'onestars', result)
    result = re.sub('2stars', 'twostars', result)
    result = re.sub('3stars', 'threestars', result)
    result = re.sub('4stars', 'fourstars', result)
    result = re.sub('5stars', 'fivestars', result)
    result = re.sub('not\s', ' not', result)
    result = re.sub('never\s', ' not', result)
    return result
```

In [4]:

```
def sentenceClean2(x):
    result = x.lower()
    result = re.sub('as (\w+?) as', '\\1', result)
    result = re.sub('not only (\w+?), but also', '\\1 and ', result)
    result = re.sub('\'s|\'m|\'re|\'d|\'ll|\'ve', ' ', result)
    result = re.sub('fast food', 'fastfood', result)
    result = re.sub('pretty|very|always|food|chinese', ' ', result)
    result = re.sub('high\squality', 'great', result)
    result = re.sub('low\squality', 'bad', result)
    result = re.sub('[\.,\(\)\+:!\?#]', ' ', result)
    result = re.sub('n\'t\s', ' not', result)
    result = re.sub('\sstars|\sstar', 'stars', result)
    result = re.sub('0stars', 'zerostars', result)
    result = re.sub('1stars', 'onestars', result)
    result = re.sub('2stars', 'twostars', result)
    result = re.sub('3stars', 'threestars', result)
    result = re.sub('4stars', 'fourstars', result)
    result = re.sub('5stars', 'fivestars', result)
    result = re.sub('\\d|\$', '', result)
    result = re.sub('not\s', ' not', result)
    result = re.sub('never\s', ' not', result)
    result = re.sub('-',' ', result)  #
    result = ' '.join([w for w in word_tokenize(result) if w in list(adjs_fina
l['adj'])]) #
    return result
```

In [5]:

```
def sentenceClean3(x):
    result = xlower()
    result = re.sub('as (\w+?) as', '\\1', result)
    result = re.sub('not only (\w+?), but also', '\\1 and ', result)
    result = re.sub('but\s', ' duanju ', result)
    result = re.sub('otherwise\s', ' duanju ', result)
    result = re.sub('[\.,!\?]', ' duanju ', result)
    result = re.sub('high\squality', 'great', result)
    result = re.sub('low\squality', 'bad', result)
    result = re.sub('fast food', 'fastfood', result)
    result = re.sub('n\'t\s', ' not', result)
    result = re.sub('\sstars|\sstar', 'stars', result)
    result = re.sub('0stars', 'zerostars', result)
    result = re.sub('1stars', 'onestars', result)
    result = re.sub('2stars', 'twostars', result)
    result = re.sub('3stars', 'threestars', result)
    result = re.sub('4stars', 'fourstars', result)
    result = re.sub('5stars', 'fivestars', result)
    result = re.sub('not\s', ' not', result)
    result = re.sub('never\s', ' never', result)
    result = re.sub(r'\n', ' ', result) ###################
    return result
```

In [6]:

```
def sentenceClean4(x):
    result = x.lower()
    result = re.sub('as (\w+?) as', '\\1', result)
    result = re.sub('not only (\w+?), but also', '\\1 and ', result)
    result = re.sub('\'s|\'m|\'re|\'d|\'ll|\'ve', ' ', result)
    result = re.sub('fast food', 'fastfood', result)
    result = re.sub('pretty|very|always|food|chinese', ' ', result)
    result = re.sub('high\squality', 'great', result)
    result = re.sub('low\squality', 'bad', result)
    result = re.sub('[\.,\(\)\+:!\?#]', ' ', result)
    result = re.sub('n\'t\s', ' not', result)
    result = re.sub('\sstars|\sstar', 'stars', result)
    result = re.sub('0stars', 'zerostars', result)
    result = re.sub('1stars', 'onestars', result)
    result = re.sub('2stars', 'twostars', result)
    result = re.sub('3stars', 'threestars', result)
    result = re.sub('4stars', 'fourstars', result)
    result = re.sub('5stars', 'fivestars', result)
    result = re.sub('\\d|\$', '', result)
    result = re.sub('not\s', ' not', result)
    result = re.sub('never\s', ' not', result)
    result = re.sub('-',' ', result)
    result = ' '.join([w for w in word_tokenize(result) if w in adjs]) #
    return result
```

In [4]:

```
text_all  = pd.read_csv('../../../../Module2/Yelp_prediction/chinese_review.csv')
```

In [5]:

```
text = pd.read_csv('../../../../Module2/Yelp_prediction/chi_review_only.csv')
```

(a).Extract QQ Express

In [6]:

```
c = text_all['business_id'] == 190967
```

In [7]:

```
qq_all = text_all[c]
```

In [8]:

```
qq_raw = pd.DataFrame(qq_all['text'],columns=['text'])
```

In [9]:

```
qq_raw.index = range(qq_raw.shape[0])
```

In [17]:

```
qq_text = pd.DataFrame(qq_raw['text'].apply(sentenceClean3),columns=['text'])
```

(b).Extract Chineses restaurant in Madison

In [18]:

```
mad_chi = pd.read_csv('mad_chi_text.csv')
```

In [19]:

```
mad_chi['text'] = mad_chi['text'].apply(sentenceClean3)
```

In [20]:

```
y = pd.value_counts(mad_chi['business_id'])
```

In [21]:

```
y_reserved = list(compress(list(y.index),list(y.values>50))) #num of reviews>50
```

In [22]:

```
con = []
for i in range(mad_chi.shape[0]):
    if mad_chi['business_id'].iloc[i] in y_reserved:
        con.append(True)
    else:
        con.append(False)
```

In [23]:

```
mad_chi_final = mad_chi[con]
```

(c).Extract stars

In [24]:

```
text_stars = pd.DataFrame(text_all.stars)
```

(1).Extract adjs

In [25]:

```
uselesslst = list(set(stopwords.words('english')).difference(set(['no','nor','
not'])))
```

In [26]:

```
text_first =  pd.DataFrame(text['text'].apply(sentenceClean))
```

In [27]:

```
adjList = ['JJ','JJR','JJS','RB','RBR','RBS','VBN']
```

In [28]:

```
def detect_adj(x):
    tst = []
    orig = nltk.pos_tag(word_tokenize(x))
    for i in range(len(orig)):
        if orig[i][1] in adjList:
            tst.append(orig[i][0])
    return tst
```

In [29]:

```
allText = '. '.join(text_first.text)
```

In [30]:

```
alladjs = detect_adj(allText)
```

In [31]:

```
alladjs_f =  [var for var in alladjs if var not in uselesslst]
```

In [32]:

```
alladjs_s = []
for i in range(len(alladjs_f)):
    alladjs_s.append(re.sub('[^a-z]', '',alladjs_f[i]))   # remove the items w
hich are not character in adjs
```

In [33]:

```
ind = []
for i in range(len(alladjs_s)):
    if alladjs_s[i] == '':
        ind.append(i)
```

In [34]:

```
a_f = pd.DataFrame(alladjs_f,columns=['words'])
```

In [35]:

```
a_f.drop(ind,inplace=True)
```

In [36]:

```
adj_only = np.unique(a_f)
```

In [37]:

```
c = pd.value_counts(a_f['words'])
```

In [38]:

```
adjs_f = pd.DataFrame(columns=['adj', 'nums'])
```

In [39]:

```
adjs_f['adj'] = c.index
adjs_f['nums'] = c.values
```

In [40]:

```
lst = list(adjs_f.index[adjs_f['nums'] > 500]) #only choose adjs which appear
more than 100 times
```

In [41]:

```
adjs_s = adjs_f.iloc[lst]
```

In [42]:

```
adjs_final = pd.DataFrame(adjs_s['adj'])
```

In [43]:

```
adjs_final.head()
```

Out[43]:

	adj
0	good
1	great
2	really
3	also
4	back

(2).Reviews to adjs

In [44]:

```
text_second = text['text'].apply(sentenceClean2)
```

In [45]:

```
pd_second = pd.DataFrame(text_second)
```

In [46]:

```
c1 = pd_second['text']!=''
```

In [47]:

```
ind1 = list(c1.values)
```

In [48]:

```
allind = list(range(pd_second.shape[0]))
```

In [49]:

```
inde = list(compress(allind, ind1))
```

In [50]:

```
pd_t = pd_second.iloc[inde]
```

In [51]:

```
pd_t.index = range(pd_t.shape[0])
```

In [52]:

```
pd_t_text = list(pd_t['text'])
```

In [53]:

```
vectorizer = CountVectorizer()
```

In [54]:

```
X = vectorizer.fit_transform(pd_t_text)
```

In [55]:

```
nam = vectorizer.get_feature_names()
```

In [56]:

```
ma = X.toarray()
```

In [57]:

```
df1 = pd.DataFrame(ma, columns=nam, index=range(pd_t.shape[0]))
```

In [58]:

```
text_stars_f = text_stars.iloc[inde]
```

In [59]:

```
text_stars_f.index = range(text_stars_f.shape[0])
```

In [60]:

```
text_stars_f = pd.DataFrame(text_stars_f,columns=['stars'])
```

In [61]:

```
text_stars_binary = pd.DataFrame(np.where(text_stars_f>=4,1,0))
```

In [62]:

```
text_stars_binary.index = range(text_stars_f.shape[0])
```

In [63]:

```
text_stars_binary.columns = ['stars']
```

(3).Try Tfidf

In [64]:

```
tfidf_dat = pd_t
```

In [65]:

```
tfidf_dat_f =tfidf_dat[tfidf_dat['text'].notnull()]
```

In [66]:

```
ti = TfidfVectorizer()
```

In [67]:

```
tfidf_value = ti.fit_transform(tfidf_dat_f['text'])
```

In [68]:

```
feature_names = ti.get_feature_names()
```

In [69]:

```
df_tfidf = pd.DataFrame(tfidf_value.toarray(), columns = feature_names)
```

(4).Punctuate treatment

In [66]:

```
text_third = text['text'].apply(sentenceClean3)
```

2.Scores for adjs

(1).Ordinary

In [67]:

```
X = df1
```

In [74]:

```
y = text_stars_binary
```

In [69]:

```
clf = LogisticRegression(random_state=123, solver='sag')
```

In [70]:

```
clf.fit(X,y)
```

```
/anaconda3/lib/python3.6/site-packages/sklearn/utils/validation.py
:761: DataConversionWarning: A column-vector y was passed when a 1
d array was expected. Please change the shape of y to (n_samples,
), for example using ravel().
  y = column_or_1d(y, warn=True)
/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/sag.py
:334: ConvergenceWarning: The max_iter was reached which means the
coef_ did not converge
  "the coef_ did not converge", ConvergenceWarning)
```

Out[70]:

```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_inter
cept=True,
          intercept_scaling=1, max_iter=100, multi_class='warn',
          n_jobs=None, penalty='l2', random_state=123, solver='sag
',
          tol=0.0001, verbose=0, warm_start=False)
```

In [71]:

```
coe = clf.coef_
```

In [72]:

```
c = abs(coe)>0.2
```

In [73]:

```
coe_all = coe[c]
```

In [74]:

```
allwords = list(X.columns)
```

In [75]:

```
useful_words = list(compress(allwords, list(c[0])))
```

In [76]:

```
coe_usefulwords = list(coe_all)
```

In [77]:

```
dic = dict(zip(useful_words,coe_usefulwords))
```

In [78]:

```
df = pd.DataFrame(columns=['words','score'],index=range(len(useful_words)))
```

In [79]:

```
df['words'] = useful_words
df['score'] = coe_usefulwords
```

In [80]:

```
df.iloc[df.score.values.argsort()[:10]]
```

Out[80]:

	words	score
376	worst	-2.183735
176	mediocre	-1.967689
143	horrible	-1.885465
235	notworth	-1.857786
106	flavorless	-1.842342
344	terrible	-1.787523
214	notimpressed	-1.732537
23	awful	-1.666477
73	disappointing	-1.599558
151	inedible	-1.598462

In [81]:

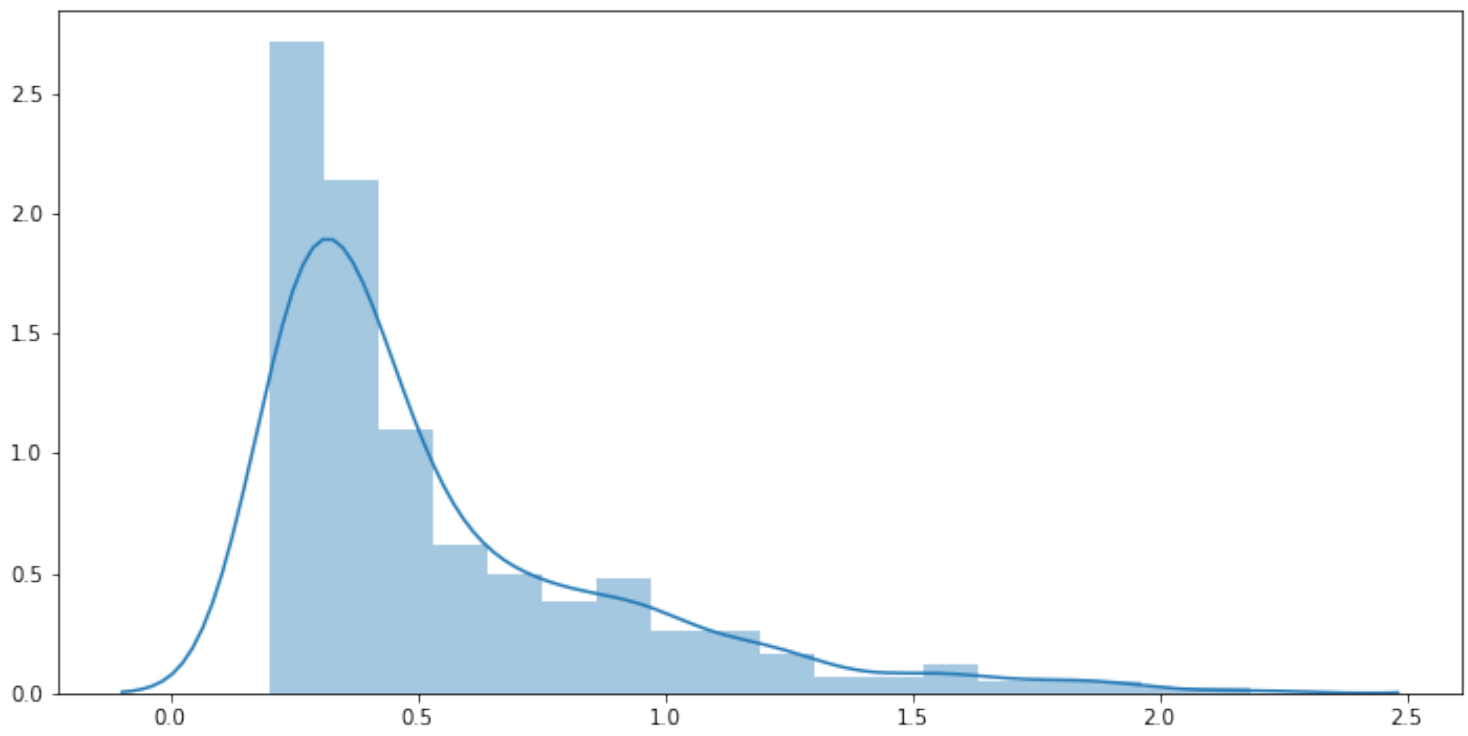
```
df.iloc[df.score.values.argsort()[::-1][:10]]
```

Out[81]:

	words	score
261	phenomenal	1.462403
199	notdisappointed	1.338303
96	fantastic	1.237228
22	awesome	1.184935
90	excellent	1.183631
311	skeptical	1.177116
8	amazing	1.121655
67	delicious	1.097352
149	incredible	1.092331
269	pleased	1.020797

In [149]:

```
f, ax= plt.subplots(figsize = (12,6))
sns.distplot(np.abs(coe_usefulwords))
plt.show()
```



(2).Tfidf

In [75]:

```
tfidf = df_tfidf
```

In [76]:

```
clf_t = LogisticRegression(random_state=123, solver='sag')
```

In [77]:

```
clf_t.fit(tfidf,y)
```

```
/anaconda3/lib/python3.6/site-packages/sklearn/utils/validation.py
:761: DataConversionWarning: A column-vector y was passed when a 1
d array was expected. Please change the shape of y to (n_samples,
), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[77]:

```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_inter
cept=True,
          intercept_scaling=1, max_iter=100, multi_class='warn',
          n_jobs=None, penalty='l2', random_state=123, solver='sag
',
          tol=0.0001, verbose=0, warm_start=False)
```

In [78]:

```
coe_tfidf = clf_t.coef_
```

In [79]:

```
c = abs(coe_tfidf)>1
```

In [80]:

```
coe_tfidf_all = coe_tfidf[c]
```

In [81]:

```
allwords = list(tfidf.columns)
```

In [82]:

```
useful_words = list(compress(allwords, list(c[0])))
```

In [83]:

```
coe_usefulwords = list(coe_tfidf_all)
```

In [84]:

```
dic = dict(zip(useful_words,coe_usefulwords))
```

In [85]:

```
df = pd.DataFrame(columns=['words','score'],index=range(coe_tfidf_all.shape[0]
))
df['words'] = useful_words
df['score'] = coe_usefulwords
```

In [86]:

```
df.iloc[df.score.values.argsort()[:10]]
```

Out[86]:

	words	score
312	worst	-8.196511
143	mediocre	-6.982294
194	notworth	-6.375627
120	horrible	-6.197028
33	bland	-5.967597
285	terrible	-5.926594
60	disappointing	-5.840991
87	flavorless	-5.276968
200	ok	-5.272287
209	overpriced	-4.840953

In [87]:

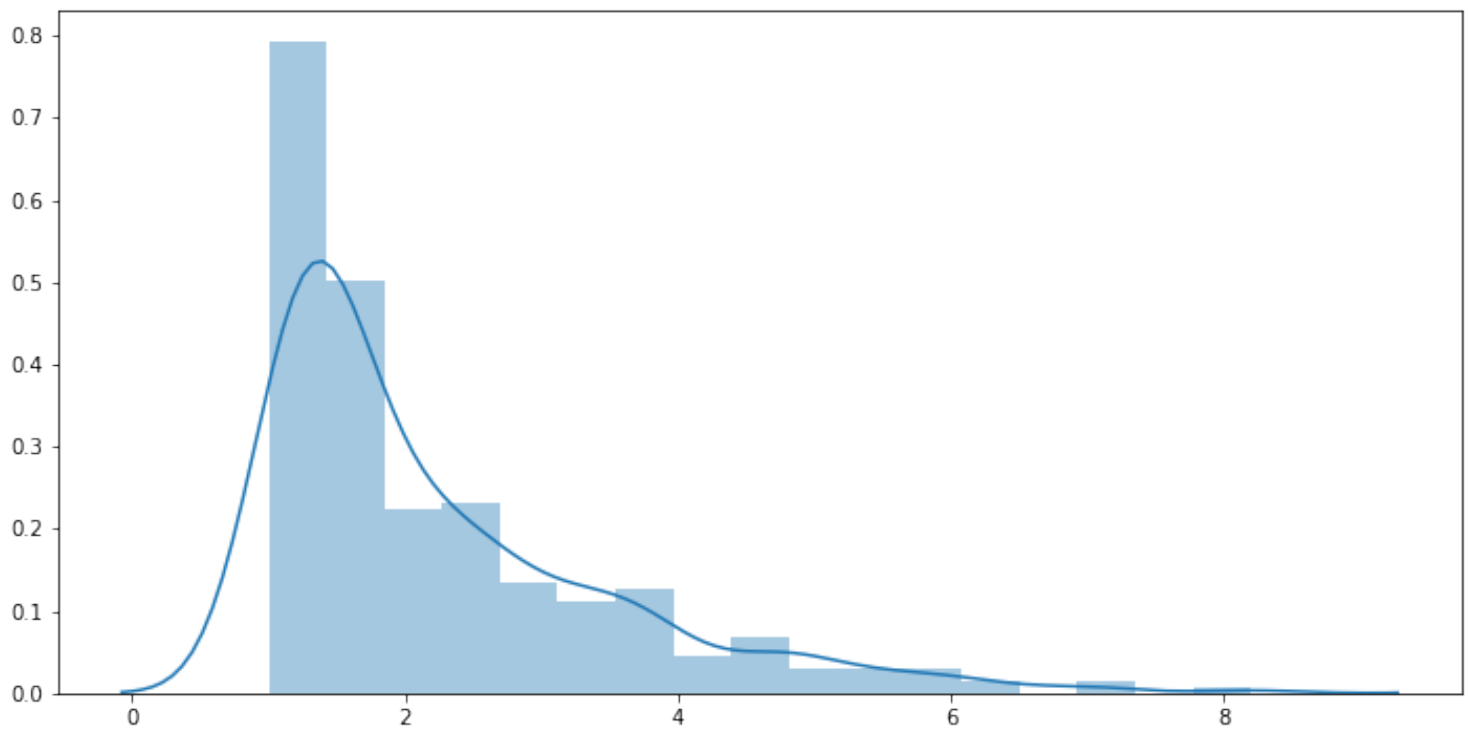
```
df.iloc[df.score.values.argsort()[::-1][:10]]
```

Out[87]:

	words	score
54	delicious	7.043990
8	amazing	5.709487
104	great	5.482821
73	excellent	5.442165
29	best	5.182681
20	awesome	4.964996
78	fantastic	4.798915
81	favorite	4.768694
213	perfect	4.064217
217	phenomenal	4.029358

In [88]:

```
f, ax= plt.subplots(figsize = (12,6))
sns.distplot(np.abs(coe_usefulwords))
plt.show()
```



3.Ranking

(0).Aggregate Functions

In [83]:

```
def food(x):  #
    pattern = re.compile(r'duanju.+?food.+?duanju')  #
    result = pattern.findall(x)
    if result != []:
        string_f = ''.join(result)
        split_f = string_f.split()
        rev_f = ' '.join(split_f[::-1])
        result_s = pattern.findall(rev_f)
        string_s = ''.join(result_s)
        split_s = string_s.split()
        split_s.pop(0)
        split_s.pop()
        rev_s = ' '.join(split_s[::-1])
    else:
        pattern = re.compile(r'.+?food.+?duanju')    #
        result = pattern.findall(x)
        if result != []:
            split_t = ''.join(result).split()
            split_t.pop()
            rev_s = ' '.join(split_t)
        else:
            rev_s = 'GG'
    return rev_s
```

In [84]:

```
def zhixing_f(x):
    blst = [] #first part
    for i in range(x.shape[0]):                          #
        blst.append("food" in x['text'].iloc[i])   #
    lst = list(range(x.shape[0]))    #
    lst_food = list(compress(lst,blst))  #
    qq_food = x.iloc[lst_food] #
    lst_f = []  #second
    for var in qq_food['text']:   #
        lst_f.append(food(var))  ##
    df_f = pd.DataFrame(lst_f,columns=['text']) ##
    df_f_adjs = df_f['text'].apply(sentenceClean4) ##
    food_score = []  #third
    a = 0
    for i in range(df_f_adjs.shape[0]): #
        if df_f_adjs[i] == '':  #
            a = 0
            food_score.append(a)   #
        else:
            a = 0
            for j in range(len(df_f_adjs[i].split())): #
                a += dic[df_f_adjs[i].split()[j]] #
            food_score.append(a)   #
    food_score = pd.DataFrame(food_score,columns=['scores'])  ##
    avg_food_score = np.mean(food_score['scores'])  #
    food_score_all.append(avg_food_score)
```

In [85]:

```
def price(x):  #
    pattern = re.compile(r'duanju.+?price.+?duanju')  #
    result = pattern.findall(x)
    if result != []:
        string_f = ''.join(result)
        split_f = string_f.split()
        rev_f = ' '.join(split_f[::-1])
        result_s = pattern.findall(rev_f)
        string_s = ''.join(result_s)
        split_s = string_s.split()
        split_s.pop(0)
        split_s.pop()
        rev_s = ' '.join(split_s[::-1])
    else:
        pattern = re.compile(r'.+?price.+?duanju')    #
        result = pattern.findall(x)
        if result != []:
            split_t = ''.join(result).split()
            split_t.pop()
            rev_s = ' '.join(split_t)
        else:
            rev_s = 'GG'
    return rev_s
```

In [86]:

```
def zhixing_p(x):
    blst = [] #first part
    for i in range(x.shape[0]):                          #
        blst.append("price" in x['text'].iloc[i])   ##################
    lst = list(range(x.shape[0]))    #
    lst_food = list(compress(lst,blst))  #
    qq_food = x.iloc[lst_food] #
    lst_f = []  #second
    for var in qq_food['text']:   #
        lst_f.append(price(var))  ######################
    df_f = pd.DataFrame(lst_f,columns=['text']) ##
    df_f_adjs = df_f['text'].apply(sentenceClean4) ##
    food_score = []  #third
    a = 0
    for i in range(df_f_adjs.shape[0]): #
        if df_f_adjs[i] == '':  #
            a = 0
            food_score.append(a)   #
        else:
            a = 0
            for j in range(len(df_f_adjs[i].split())): #
                a += dic[df_f_adjs[i].split()[j]] #
            food_score.append(a)   #
    food_score = pd.DataFrame(food_score,columns=['scores'])  ##
    avg_food_score = np.mean(food_score['scores'])  #
    price_score_all.append(avg_food_score)     ################
```

In [87]:

```
def service(x):  #
    pattern = re.compile(r'duanju.+?service.+?duanju')  #
    result = pattern.findall(x)
    if result != []:
        string_f = ''.join(result)
        split_f = string_f.split()
        rev_f = ' '.join(split_f[::-1])
        result_s = pattern.findall(rev_f)
        string_s = ''.join(result_s)
        split_s = string_s.split()
        split_s.pop(0)
        split_s.pop()
        rev_s = ' '.join(split_s[::-1])
    else:
        pattern = re.compile(r'.+?service.+?duanju')    #
        result = pattern.findall(x)
        if result != []:
            split_t = ''.join(result).split()
            split_t.pop()
            rev_s = ' '.join(split_t)
        else:
            rev_s = 'GG'
    return rev_s
```

In [88]:

```
def zhixing_s(x):
    blst = [] #first part
    for i in range(x.shape[0]):                         #
        blst.append("service" in x['text'].iloc[i])   ##################
    lst = list(range(x.shape[0]))    #
    lst_food = list(compress(lst,blst))  #
    qq_food = x.iloc[lst_food] #
    lst_f = []  #second
    for var in qq_food['text']:   #
        lst_f.append(service(var))  ######################
    df_f = pd.DataFrame(lst_f,columns=['text']) ##
    df_f_adjs = df_f['text'].apply(sentenceClean4) ##
    food_score = []  #third
    a = 0
    for i in range(df_f_adjs.shape[0]): #
        if df_f_adjs[i] == '':  #
            a = 0
            food_score.append(a)   #
        else:
            a = 0
            for j in range(len(df_f_adjs[i].split())): #
                a += dic[df_f_adjs[i].split()[j]] #
            food_score.append(a)   #
    food_score = pd.DataFrame(food_score,columns=['scores'])  ##
    avg_food_score = np.mean(food_score['scores'])  #
    service_score_all.append(avg_food_score)     ###############
```

In [89]:

```
food_score_all = []
```

In [90]:

```
price_score_all = []
```

In [91]:

```
service_score_all = []
```

(1).Application on chinese resaurant in Madison

In [92]:

```
words_score = df
```

In [93]:

```
dic = dict(zip(words_score['words'],words_score['score']))
```

In [94]:

```
adjs = list(words_score['words'])
```

In [102]:

```
dic_id_name = dict(zip(mad_chi_final['business_id'],mad_chi_final['names']))
```

In [103]:

```
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(zhixing_f)
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(zhixing_p)
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(zhixing_s)
```

Out[103]:

□

In [104]:

```
food_score_all = food_score_all[1:]
price_score_all = price_score_all[1:]
service_score_all = service_score_all[1:]
```

In [105]:

```
avg_stars = mad_chi_final['stars'].groupby(mad_chi_final['business_id']).apply
(np.mean)
```

In [106]:

```
ranking = pd.DataFrame(index=range(24),columns=['Name','Food','Price','Service
','Avg-stars'])
ranking['Name'] = dic_id_name.values()
ranking['Food']  = food_score_all
ranking['Price'] = price_score_all
ranking['Service'] =  service_score_all
ranking['Avg-stars'] = avg_stars.values
```

In [107]:

```
ranking
```

Out[107]:

	Name	Food	Price	Service	Avg-stars
0	DumplingHaus	0.022103	-0.324424	0.096001	3.767442
1	Hong Kong Cafe	-0.936759	-0.757243	0.139010	2.985915
2	Bahn Thai Restaurant	-0.063567	0.327551	-0.340548	3.532468
3	Flaming Wok	-0.103574	0.468692	-0.052243	3.153846
4	Noodles & Company	-0.417332	-0.376087	-0.008943	2.894737
5	Orient House	0.131335	0.137891	-0.179039	3.488550
6	World Buffet	-0.799988	-0.238134	-0.047105	2.892308
7	Double 10	-0.068549	-0.411850	0.438345	3.955224
8	Asian Sweet Bakery	0.097313	0.536490	0.311303	4.340206
9	Taiwan Little Eats	0.355481	-0.278307	0.076682	4.078125
10	Soga Shabu Shabu	-0.805146	-0.478058	-1.104705	3.028986
11	Umami Ramen & Dumpling Bar	0.204935	-0.612160	0.389832	3.694823
12	VIP	-0.088354	0.172812	-0.361860	3.640000
13	Jade Garden	-0.153307	0.176930	-0.114873	2.965517
14	Ichiban Sichuan	0.187644	-0.245518	0.001380	3.623037
15	Double 10 Mini Hot Pot	0.460187	-0.008415	0.587850	4.516340
16	Fugu	-0.086585	0.009532	-0.431869	3.280702
17	Magic Wok	0.237591	-0.014450	0.333336	4.025974
18	HuHot Mongolian Grill	-0.271193	-0.305702	-0.367609	3.188406
19	Nani Restaurant	-0.131199	-0.176667	-0.249753	3.543353
20	Tavernakaya	0.089810	-0.941379	0.314586	3.635838
21	Hong Kong Station	-0.140604	0.567320	-0.517170	3.358491
22	Natt Spil	-0.281686	0.130962	-1.055618	3.877005
23	QQ Express	-0.468645	0.399200	-0.093739	3.288136

(2).Improvement: Credibility

In [108]:

```
tnum_reviews = mad_chi_final['business_id'].groupby(mad_chi_final['business_id
']).count()
```

In [109]:

```
tnum = list(tnum_reviews.values)
```

In [110]:

```
num_food = []
num_price = []
num_service = []
```

In [111]:

```
def food_only(x):
    blst = []
    for i in range(x.shape[0]):
        blst.append("food" in x['text'].iloc[i])
    num_food.append(sum(blst))
```

In [112]:

```
def price_only(x):
    blst = []
    for i in range(x.shape[0]):
        blst.append("price" in x['text'].iloc[i])
    num_price.append(sum(blst))
```

In [113]:

```
def service_only(x):
    blst = []
    for i in range(x.shape[0]):
        blst.append("service" in x['text'].iloc[i])
    num_service.append(sum(blst))
```

In [114]:

```
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(food_only)
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(price_only)
pd.DataFrame(mad_chi_final['text']).groupby(mad_chi_final['business_id']).appl
y(service_only)
```

Out[114]:

□

In [115]:

```
num_food = num_food[1:]
num_price = num_price[1:]
num_service = num_service[1:]
```

In [116]:

```
food_ratio = []
price_ratio = []
service_ratio = []
```

In [117]:

```
for i in range(len(tnum)):
    food_ratio.append(num_food[i]/tnum[i])
    price_ratio.append(num_price[i]/tnum[i])
    service_ratio.append(num_service[i]/tnum[i])
```

In [118]:

```
food_new = []
price_new = []
service_new = []
```

In [119]:

```
for i in range(len(tnum)):
    food_new.append(ranking['Food'].iloc[i]*food_ratio[i])
    price_new.append(ranking['Price'].iloc[i]*price_ratio[i])
    service_new.append(ranking['Service'].iloc[i]*service_ratio[i])
```

In [120]:

```
ranking['Food'] = food_new
ranking['Price'] = price_new
ranking['Service'] = service_new
```

In [121]:

```
ranking
```

Out[121]:

	Name	Food	Price	Service	Avg-stars
0	DumplingHaus	0.011994	-0.095567	0.019349	3.767442
1	Hong Kong Cafe	-0.540945	-0.117319	0.041116	2.985915
2	Bahn Thai Restaurant	-0.040452	0.021270	-0.119413	3.532468
3	Flaming Wok	-0.075689	0.084124	-0.009377	3.153846
4	Noodles & Company	-0.214157	-0.024743	-0.001530	2.894737
5	Orient House	0.090230	0.032631	-0.042368	3.488550
6	World Buffet	-0.615376	-0.040300	-0.008696	2.892308
7	Double 10	-0.042971	-0.073764	0.058882	3.955224
8	Asian Sweet Bakery	0.041132	0.188048	0.025674	4.340206
9	Taiwan Little Eats	0.233284	-0.060880	0.008387	4.078125
10	Soga Shabu Shabu	-0.525095	-0.096997	-0.432276	3.028986
11	Umami Ramen & Dumpling Bar	0.084320	-0.083400	0.121092	3.694823
12	VIP	-0.049037	0.045795	-0.166455	3.640000
13	Jade Garden	-0.108372	0.021354	-0.009903	2.965517
14	Ichiban Sichuan	0.142453	-0.044990	0.000354	3.623037
15	Double 10 Mini Hot Pot	0.261675	-0.002475	0.153686	4.516340
16	Fugu	-0.061774	0.001561	-0.133854	3.280702
17	Magic Wok	0.151195	-0.001877	0.043290	4.025974
18	HuHot Mongolian Grill	-0.194552	-0.042089	-0.122536	3.188406
19	Nani Restaurant	-0.071287	-0.026551	-0.101056	3.543353
20	Tavernakaya	0.052432	-0.223101	0.123652	3.635838
21	Hong Kong Station	-0.087546	0.085633	-0.234190	3.358491
22	Natt Spil	-0.149128	0.013306	-0.231446	3.877005
23	QQ Express	-0.373328	0.101492	-0.020654	3.288136

(3).Final ranking

In [122]:

```
cor_coe = []
```

In [123]:

```
reg = LinearRegression()
```

In [124]:

```
X = pd.DataFrame(ranking['Food']) #'Food','Price','Service'
y = ranking['Avg-stars']
reg.fit(X,y)
cor_coe.append(reg.score(X, y))
```

In [125]:

```
X = pd.DataFrame(ranking['Price']) #'Food','Price','Service'
y = ranking['Avg-stars']
reg.fit(X,y)
cor_coe.append(reg.score(X, y))
```

In [126]:

```
X = pd.DataFrame(ranking['Service']) #'Food','Price','Service'
y = ranking['Avg-stars']
reg.fit(X,y)
cor_coe.append(reg.score(X, y))
```

In [127]:

```
final_score = pd.DataFrame(ranking['Food']*cor_coe[0]+ranking['Price']*cor_coe
[1]+ranking['Service']*cor_coe[2],columns=['Final_Score'])
```

In [128]:

```
ranking_f = pd.concat([ranking,final_score],axis=1)
```

In [129]:

```
c = np.argsort(ranking_f['Food'])[::-1] #'Food','Price','Service','Final_Score
'
c_f = list(range(ranking.shape[0]))
a = 1
for i in range(len(c_f)):
    c_f[list(c.values)[i]] = a
    a += 1
ranking_f['Food'] = c_f #'Food','Price','Service','Final_Score'
```

In [130]:

```
c = np.argsort(ranking_f['Price'])[::-1] #'Food','Price','Service','Final_Scor
e'
c_f = list(range(ranking.shape[0]))
a = 1
for i in range(len(c_f)):
    c_f[list(c.values)[i]] = a
    a += 1
ranking_f['Price'] = c_f #'Food','Price','Service','Final_Score'
```

In [131]:

```
c = np.argsort(ranking_f['Service'])[::-1] #'Food','Price','Service','Final_Sc
ore'
c_f = list(range(ranking.shape[0]))
a = 1
for i in range(len(c_f)):
    c_f[list(c.values)[i]] = a
    a += 1
ranking_f['Service'] = c_f #'Food','Price','Service','Final_Score'
```

In [132]:

```
c = np.argsort(ranking_f['Final_Score'])[::-1] #'Food','Price','Service','Fina
l_Score'
c_f = list(range(ranking.shape[0]))
a = 1
for i in range(len(c_f)):
    c_f[list(c.values)[i]] = a
    a += 1
ranking_f['Final_Score'] = c_f #'Food','Price','Service','Final_Score'
```

In [133]:

```
ranking_f = ranking_f.sort_values(by = ['Final_Score'])
```

In [134]:

```
ranking_f
```

Out[134]:

	Name	Food	Price	Service	Avg-stars	Final_Score
15	Double 10 Mini Hot Pot	1	12	1	4.516340	1
9	Taiwan Little Eats	2	18	9	4.078125	2
17	Magic Wok	3	11	5	4.025974	3
14	Ichiban Sichuan	4	17	10	3.623037	4
11	Umami Ramen & Dumpling Bar	6	20	3	3.694823	5
5	Orient House	5	6	16	3.488550	6
20	Tavernakaya	7	24	2	3.635838	7
8	Asian Sweet Bakery	8	1	7	4.340206	8
0	DumplingHaus	9	21	8	3.767442	9
7	Double 10	11	19	4	3.955224	10
2	Bahn Thai Restaurant	10	8	18	3.532468	11
3	Flaming Wok	15	4	13	3.153846	12
12	VIP	12	5	21	3.640000	13
16	Fugu	13	10	20	3.280702	14
19	Nani Restaurant	14	14	17	3.543353	15
13	Jade Garden	17	7	14	2.965517	16
21	Hong Kong Station	16	3	23	3.358491	17
22	Natt Spil	18	9	22	3.877005	18
4	Noodles & Company	20	13	11	2.894737	19
18	HuHot Mongolian Grill	19	16	19	3.188406	20
23	QQ Express	21	2	15	3.288136	21
1	Hong Kong Cafe	23	23	6	2.985915	22
6	World Buffet	24	15	12	2.892308	23
10	Soga Shabu Shabu	22	22	24	3.028986	24

4.Advice on QQ Express(Demo)

In [143]:

```
blst = []
for i in range(qq_text.shape[0]):
    blst.append("price" in qq_text['text'].iloc[i])
lst = list(range(qq_text.shape[0]))
lst_price = list(compress(lst,blst))
qq_price = qq_text.iloc[lst_price]
lst_p = []
for var in qq_price['text']:
    lst_p.append(price(var))
df_p = pd.DataFrame(lst_p,columns=['text'])
df_p_adjs = df_p['text'].apply(sentenceClean4)
qq_price_adjs = pd.value_counts(' '.join(list(np.unique(df_p_adjs))).split())
print(qq_price_adjs )
print("\nSince the ranking of price of QQ Express is No.2, we do not need to i
mprove it.")
```

```
reasonably    2
priced        2
excellent     1
definitely    1
glad          1
ordered       1
better        1
reasonable    1
great         1
good          1
notthat       1
fast          1
fantastic     1
worth         1
dtype: int64

Since the ranking of price of QQ Express is No.2, we do not need t
o improve it.
```

In [144]:

```
blst = []
for i in range(qq_text.shape[0]):
    blst.append("service" in qq_text['text'].iloc[i]) #
lst = list(range(qq_text.shape[0]))
lst_service = list(compress(lst,blst))
qq_service = qq_text.iloc[lst_service]
lst_s = []
for var in qq_service['text']:
    lst_s.append(service(var)) #
df_s = pd.DataFrame(lst_s,columns=['text'])
df_s_adjs = df_s['text'].apply(sentenceClean4)
qq_service_adjs = pd.value_counts(' '.join(list(np.unique(df_s_adjs))).split()
)
print(qq_service_adjs)
print("\nThe ranking of service of QQ Express seems not too bad, if we want to
improve it, try to be more polite.")
```

```
fast         5
single       2
average      1
no           1
notexpect    1
friendly     1
notbusy      1
however      1
terrible     1
great        1
good         1
highly       1
greeted      1
rude         1
notreally    1
dtype: int64

The ranking of service of QQ Express seems not too bad, if we want
to improve it, try to be more polite.
```

In [145]:

```
blst = []
for i in range(qq_text.shape[0]):
    blst.append("food" in qq_text['text'].iloc[i]) #
lst = list(range(qq_text.shape[0]))
lst_food = list(compress(lst,blst))
qq_food = qq_text.iloc[lst_food]
lst_f = []
for var in qq_food['text']:
    lst_f.append(food(var)) #
df_f = pd.DataFrame(lst_f,columns=['text'])
df_f_adjs = df_f['text'].apply(sentenceClean4)
qq_food_adjs = pd.value_counts(' '.join(list(np.unique(df_f_adjs))).split())
print(qq_food_adjs[qq_food_adjs.values>=4])
print("\nThe ranking of food of QQ Express is too bad, I think the most likely
reason is their food is too greasy, thus, they should change their food to be
more fresh. ")
```

```
good         10
greasy        9
fast          8
authentic     5
okay          5
great         5
ordered       4
used          4
better        4
best          4
no            4
dtype: int64

The ranking of food of QQ Express is too bad, I think the most lik
ely reason is their food is too greasy, thus, they should change t
heir food to be more fresh.
```