In [110]:
```
import pandas as pd
import numpy as np
```

Task 1 Bag of Words and simple Features

Linear model with non-review based features and L2 regularisation

In [111]:
```
df = pd.read_csv('data/train.csv')
```

In [112]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 89970 entries, 0 to 89969
Data columns (total 14 columns):
Id                       89970 non-null int64
country                  89927 non-null object
description              89970 non-null object
designation              64086 non-null object
points                   89970 non-null int64
price                    83828 non-null float64
province                 89927 non-null object
region_1                 75108 non-null object
region_2                 34869 non-null object
taster_name              71843 non-null object
taster_twitter_handle    68373 non-null object
title                    89970 non-null object
variety                  89970 non-null object
winery                   89970 non-null object
dtypes: float64(1), int64(2), object(11)
memory usage: 9.6+ MB
```

In [5]:
```
df.head()
```

Out[5]:

	Id	country	description	designation	points	price	province	region_1	region_2	taster_name	taster_twitter_handle	tit
0	69712	France	A buoyant wine, this has delicious acidity and...	La Riviera	89	17.0	Provence	Côtes de Provence	NaN	Roger Voss	@vossroger	Domain de Sanglie 2015 I Rivie Rosé (
1	1171	Germany	Despite weighing in at 12% alcohol, this seems...	Niersteiner Bergkirche Kabinett	86	20.0	Rheinhessen	NaN	NaN	Joe Czerwinski	@JoeCz	Lou Guntru 200 Nierstein Bergkircl Kabi
2	129181	US	Sweet, simple and fruity, this light-bodied wi...	Estate	84	23.0	California	Sierra Foothills	Sierra Foothills	Jim Gordon	@gordone_cellars	Naggi 201 Esta Musc Cane (Sier Foo
3	116814	US	Tastes like a sweet and sour sauce mixed into ...	NaN	84	19.0	California	California	California Other	NaN	NaN	One Hop 200 Sauvigno Blan (Californ
4	116519	Spain	As a one-liter package you get one-third more ...	NaN	86	9.0	Central Spain	Vino de la Tierra de Castilla	NaN	Michael Schachner	@wineschach	Bodega Egure 200 Temprani (Vino de Ti

In [113]:
```
def dummy(df,col):
    drop = np.unique(df[col])[-1]
    dummy = pd.get_dummies(df[col])
    new_col = []
    for i in dummy.columns:
        new_col.append(col+'_'+str(i))
    dummy.columns = new_col
    df = pd.concat([df, dummy], axis=1)
    df.drop([col, new_col[-1]], inplace=True, axis=1)
    return df
```

In [114]:
```
df.columns
```

Out[114]:
```
Index(['Id', 'country', 'description', 'designation', 'points', 'price',
       'province', 'region_1', 'region_2', 'taster_name',
       'taster_twitter_handle', 'title', 'variety', 'winery'],
      dtype='object')
```

In [115]:
```
df['country'].fillna(df['country'].mode()[0], inplace=True)
df['designation'].fillna(df['designation'].mode()[0], inplace=True)
df['province'].fillna(df['province'].mode()[0], inplace=True)
df['region_1'].fillna(df['region_1'].mode()[0], inplace=True)
df['region_2'].fillna(df['region_2'].mode()[0], inplace=True)
df['taster_name'].fillna(df['taster_name'].mode()[0], inplace=True)
df['taster_twitter_handle'].fillna(df['taster_twitter_handle'].mode()[0], inplace=True)
```

In [116]:
```
df['price'].fillna(df['price'].median(), inplace=True)
```

In [117]:
```
cols = [ 'country', 'taster_name', 'variety']
```

In [118]:
```
empty = []
for col in cols:
    try:
        df = dummy(df,col)
    except:
        empty.append(col)
```

In [119]:
```
empty
```

Out[119]:
```
[]
```

In [120]:
```
y = df['points'].values
```

In [121]:
```
df.drop(['Id',
'description',
'designation',
'points',
'province',
'region_1',
'region_2',
'taster_twitter_handle',
'title',
'winery'],axis=1,inplace=True)
```

In [184]:
```
from sklearn.preprocessing import MinMaxScaler

scaler = MinMaxScaler()

df_scaled = scaler.fit_transform(df)

df_scaled1 = pd.DataFrame(df_scaled, columns = df.columns)
```

In [185]:
```
df_sub = df.iloc[:,(df_scaled1.var() > 0.02).values]
```

In [ ]:
```
(df_scaled1.var() > 0.02).values
```

In [186]:
```
df_sub['price'] = df['price']
```

```
/anaconda3/lib/python3.7/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#index
ing-view-versus-copy
  """Entry point for launching an IPython kernel.
```

In [126]:
```
X = df_sub.values
```

In [127]:
```
from sklearn.linear_model import Ridge

clf = Ridge(alpha = 0.01, normalize = False)
clf.fit(X, y)
```

Out[127]:
```
Ridge(alpha=0.01, copy_X=True, fit_intercept=True, max_iter=None,
      normalize=False, random_state=None, solver='auto', tol=0.001)
```

In [128]:
```
clf.score(X,y)
```

Out[128]:
```
0.23772346398423183
```

In [129]:
```
alphas = 10**np.linspace(10,-2,100)*0.5
alphas
```

Out[129]:
```
array([5.00000000e+09, 3.78231664e+09, 2.86118383e+09, 2.16438064e+09,
       1.63727458e+09, 1.23853818e+09, 9.36908711e+08, 7.08737081e+08,
       5.36133611e+08, 4.05565415e+08, 3.06795364e+08, 2.32079442e+08,
       1.75559587e+08, 1.32804389e+08, 1.00461650e+08, 7.59955541e+07,
       5.74878498e+07, 4.34874501e+07, 3.28966612e+07, 2.48851178e+07,
       1.88246790e+07, 1.42401793e+07, 1.07721735e+07, 8.14875417e+06,
       6.16423370e+06, 4.66301673e+06, 3.52740116e+06, 2.66834962e+06,
       2.01850863e+06, 1.52692775e+06, 1.15506485e+06, 8.73764200e+05,
       6.60970574e+05, 5.00000000e+05, 3.78231664e+05, 2.86118383e+05,
       2.16438064e+05, 1.63727458e+05, 1.23853818e+05, 9.36908711e+04,
       7.08737081e+04, 5.36133611e+04, 4.05565415e+04, 3.06795364e+04,
       2.32079442e+04, 1.75559587e+04, 1.32804389e+04, 1.00461650e+04,
       7.59955541e+03, 5.74878498e+03, 4.34874501e+03, 3.28966612e+03,
       2.48851178e+03, 1.88246790e+03, 1.42401793e+03, 1.07721735e+03,
       8.14875417e+02, 6.16423370e+02, 4.66301673e+02, 3.52740116e+02,
       2.66834962e+02, 2.01850863e+02, 1.52692775e+02, 1.15506485e+02,
       8.73764200e+01, 6.60970574e+01, 5.00000000e+01, 3.78231664e+01,
       2.86118383e+01, 2.16438064e+01, 1.63727458e+01, 1.23853818e+01,
       9.36908711e+00, 7.08737081e+00, 5.36133611e+00, 4.05565415e+00,
       3.06795364e+00, 2.32079442e+00, 1.75559587e+00, 1.32804389e+00,
       1.00461650e+00, 7.59955541e-01, 5.74878498e-01, 4.34874501e-01,
       3.28966612e-01, 2.48851178e-01, 1.88246790e-01, 1.42401793e-01,
       1.07721735e-01, 8.14875417e-02, 6.16423370e-02, 4.66301673e-02,
       3.52740116e-02, 2.66834962e-02, 2.01850863e-02, 1.52692775e-02,
       1.15506485e-02, 8.73764200e-03, 6.60970574e-03, 5.00000000e-03])
```

In [130]:
```
ridge = Ridge(normalize = True)
coefs = []

for a in alphas:
    ridge.set_params(alpha = a)
    ridge.fit(X, y)
    coefs.append(ridge.coef_)

np.shape(coefs)
```

Out[130]:
```
(100, 31)
```

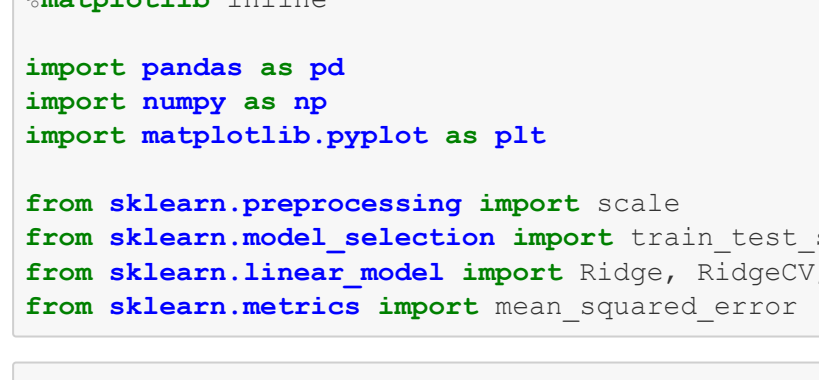
In [131]:
```
%matplotlib inline

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

from sklearn.preprocessing import scale
from sklearn.model_selection import train_test_split
from sklearn.linear_model import Ridge, RidgeCV, Lasso, LassoCV
from sklearn.metrics import mean_squared_error
```

In [132]:
```
ax = plt.gca()
ax.plot(alphas, coefs)
ax.set_xscale('log')
plt.axis('tight')
plt.xlabel('alpha')
plt.ylabel('weights')
```

Out[132]:
```
Text(0, 0.5, 'weights')
```



In [176]:
```
X_train, X_test , y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=1)
```

In [177]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```

Out[177]:
```
0.020185086292982747
```

In [178]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
```

Out[178]:
```
6.9170635285557935
```

In [179]:
```
ridge.score(X_test, y_test)
```

Out[179]:
```
0.24470745847603645
```

In [198]:
```
public = pd.read_csv('data/public.csv')
```

In [213]:
```
private = pd.read_csv('data/private.csv')
```

Predicting the non-review based model on private dataset

In [169]:
```
private['country'].fillna(private['country'].mode()[0], inplace=True)
private['designation'].fillna(private['designation'].mode()[0], inplace=True)
private['province'].fillna(private['province'].mode()[0], inplace=True)
private['region_1'].fillna(private['region_1'].mode()[0], inplace=True)
private['region_2'].fillna(private['region_2'].mode()[0], inplace=True)
private['taster_name'].fillna(private['taster_name'].mode()[0], inplace=True)
private['taster_twitter_handle'].fillna(private['taster_twitter_handle'].mode()[0], inplace=True)

private['price'].fillna(private['price'].median(), inplace=True)

cols = [ 'country', 'taster_name', 'variety']

empty = []
for col in cols:
    try:
        private = dummy(private,col)
    except:
        empty.append(col)

empty
```

Out[169]:
```
[]
```

In [171]:
```
y_private = private['points'].values
```

In [ ]:
```
df_sub_private = private[df_sub.columns]

X_private = df_sub_private.values
```

In [192]:
```
mean_squared_error(y_private, ridge.predict(X_private))

ridge.score(X_private, y_private)
```

Out[192]:
```
0.24936179420755233
```

Predicting the non-review based model on public dataset

In [200]:
```
public['country'].fillna(public['country'].mode()[0], inplace=True)
public['designation'].fillna(public['designation'].mode()[0], inplace=True)
public['province'].fillna(public['province'].mode()[0], inplace=True)
public['region_1'].fillna(public['region_1'].mode()[0], inplace=True)
public['region_2'].fillna(public['region_2'].mode()[0], inplace=True)
public['variety'].fillna(public['variety'].mode()[0], inplace=True)
public['taster_name'].fillna(public['taster_name'].mode()[0], inplace=True)
public['taster_twitter_handle'].fillna(public['taster_twitter_handle'].mode()[0], inplace=True)

public['price'].fillna(public['price'].median(), inplace=True)

cols = ['country', 'taster_name', 'variety']

empty = []
for col in cols:
    try:
        public = dummy(public,col)
    except:
        empty.append(col)

empty
```

Out[200]:
```
[]
```

In [201]:
```
y_public = public['points'].values


df_sub_public = public[df_sub.columns]

df_sub_public.info()

X_public = df_sub_public.values


mean_squared_error(y_public, ridge.predict(X_public))

ridge.score(X_public, y_public)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20001 entries, 0 to 20000
Data columns (total 31 columns):
country_Argentina                  20001 non-null uint8
country_Austria                    20001 non-null uint8
country_Chile                      20001 non-null uint8
country_France                     20001 non-null uint8
country_Italy                      20001 non-null uint8
country_Portugal                   20001 non-null uint8
country_Spain                      20001 non-null uint8
country_US                         20001 non-null uint8
taster_name_Anna Lee C. Iijima     20001 non-null uint8
taster_name_Anne Krebiehl MW       20001 non-null uint8
taster_name_Jim Gordon             20001 non-null uint8
taster_name_Joe Czerwinski         20001 non-null uint8
taster_name_Kerin O'Keefe          20001 non-null uint8
taster_name_Matt Kettmann          20001 non-null uint8
taster_name_Michael Schachner      20001 non-null uint8
taster_name_Paul Gregutt           20001 non-null uint8
taster_name_Roger Voss             20001 non-null uint8
taster_name_Sean P. Sullivan       20001 non-null uint8
variety_Bordeaux-style Red Blend   20001 non-null uint8
variety_Cabernet Sauvignon         20001 non-null uint8
variety_Chardonnay                 20001 non-null uint8
variety_Merlot                     20001 non-null uint8
variety_Nebbiolo                   20001 non-null uint8
variety_Pinot Noir                 20001 non-null uint8
variety_Red Blend                  20001 non-null uint8
variety_Riesling                   20001 non-null uint8
variety_Rosé                       20001 non-null uint8
variety_Sangiovese                 20001 non-null uint8
variety_Sauvignon Blanc            20001 non-null uint8
variety_Syrah                      20001 non-null uint8
price                              20001 non-null float64
dtypes: float64(1), uint8(30)
memory usage: 742.3 KB
```

Out[201]:
```
0.2500127079784289
```

linear model using review based features and Count vectoriser and L2 regularisation

In [33]:
```
import re # for regular expressions
import pandas as pd
pd.set_option("display.max_colwidth", 200)
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import string
import nltk # for text manipulation
import warnings
warnings.filterwarnings("ignore", category=DeprecationWarning)

%matplotlib inline
```

In [34]:
```
combi = pd.read_csv('data/train.csv')
```

In [35]:
```
def remove_pattern(input_txt, pattern):
    r = re.findall(pattern, input_txt)
    for i in r:
        input_txt = re.sub(i, '', input_txt)

    return input_txt
```

In [ ]:
```
combi['description'] = np.vectorize(remove_pattern)(combi['description'], "@[\w]*")
```

In [ ]:
```
combi['description'] = combi['description'].str.replace("[^a-zA-Z#]", " ")
```

In [ ]:
```
combi['description'] = combi['description'].str.replace('#','')
```

In [38]:
```
combi['description'] = combi['description'].apply(lambda x: ' '.join([w for w in x.split() if len(w)>2
]))
```

In [40]:
```
tokenized_tweet = combi['description'].apply(lambda x: x.split()) # tokenizing
```

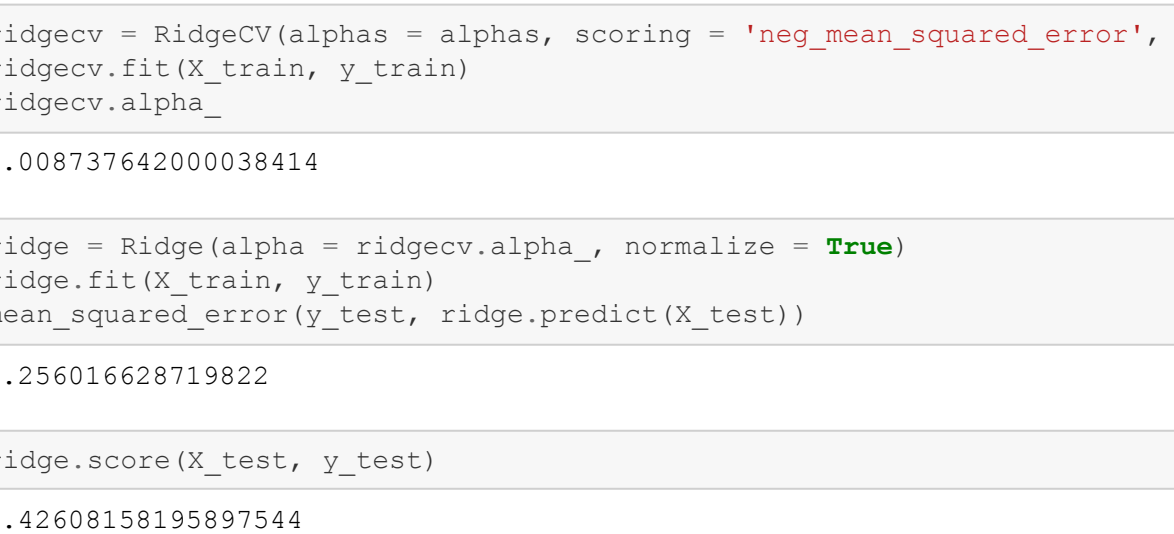
In [ ]:
```
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
tokenized_tweet.apply(lambda x: [lemmatizer.lemmatize(i) for i in x]) # stemming
```

In [168]:
```
for i in range(len(tokenized_tweet)):
    tokenized_tweet[i] = ' '.join(tokenized_tweet[i])

combi['description'] = tokenized_tweet
```

In [43]:
```
all_words = ' '.join([text for text in combi['description']])
from wordcloud import WordCloud
wordcloud = WordCloud(width=800, height=500, random_state=21, max_font_size=110).generate(all_words)

plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.show()
```



In [44]:
```
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer
import gensim
```

In [217]:
```
bow_vectorizer = CountVectorizer(max_df=0.90, min_df=2, max_features=200, stop_words='english')
bow = bow_vectorizer.fit_transform(combi['description'])
bow.shape
```

Out[217]:
```
(89970, 200)
```

In [203]:
```
bow = np.array(bow.todense())
```

In [204]:
```
X_train, X_test , y_train, y_test = train_test_split(bow, y, test_size=0.2, random_state=1)
```

In [205]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```

Out[205]:
```
0.008737642000038414
```

In [206]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
```

Out[206]:
```
5.256016628719822
```

In [207]:
```
ridge.score(X_test, y_test)
```

Out[207]:
```
0.42608158195897544
```

Checking accuracy of linear model using review based features, Count vectoriser and L2 regularisation on public dataset

In [218]:
```
import re # for regular expressions
import pandas as pd
pd.set_option("display.max_colwidth", 200)
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import string
import nltk # for text manipulation
import warnings
warnings.filterwarnings("ignore", category=DeprecationWarning)

%matplotlib inline


def remove_pattern(input_txt, pattern):
    r = re.findall(pattern, input_txt)
    for i in r:
        input_txt = re.sub(i, '', input_txt)

    return input_txt

public['description'] = np.vectorize(remove_pattern)(public['description'], "@[\w]*")

public['description'] = public['description'].str.replace("[^a-zA-Z#]", " ")

public['description'] = public['description'].str.replace('#','')

public['description'] = public['description'].apply(lambda x: ' '.join([w for w in x.split() if len(w)
>2]))

tokenized_tweet = public['description'].apply(lambda x: x.split()) # tokenizing

tokenized_tweet.head()

from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
tokenized_tweet.apply(lambda x: [lemmatizer.lemmatize(i) for i in x]) # stemming
#lemmatized_output = ' '.join([lemmatizer.lemmatize(token) for token in tokens])

for i in range(len(tokenized_tweet)):
    tokenized_tweet[i] = ' '.join(tokenized_tweet[i])

public['description'] = tokenized_tweet

all_words = ' '.join([text for text in public['description']])


bow_public = bow_vectorizer.transform(public['description'])
bow.shape


bow_public = np.array(bow_public.todense())

y = public['points']


mean_squared_error(y, ridge.predict(bow_public))

ridge.score(bow_public, y)
```

Out[218]:
```
0.41728530345424897
```

Checking accuracy of linear model using review based features, Count vectoriser and L2 regularisation on private dataset

In [219]:
```
def remove_pattern(input_txt, pattern):
    r = re.findall(pattern, input_txt)
    for i in r:
        input_txt = re.sub(i, '', input_txt)

    return input_txt

private['description'] = np.vectorize(remove_pattern)(private['description'], "@[\w]*")

private['description'] = private['description'].str.replace("[^a-zA-Z#]", " ")

private['description'] = private['description'].str.replace('#','')

private['description'] = private['description'].apply(lambda x: ' '.join([w for w in x.split() if len(
w)>2]))

tokenized_tweet = private['description'].apply(lambda x: x.split()) # tokenizing

tokenized_tweet.head()

from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
tokenized_tweet.apply(lambda x: [lemmatizer.lemmatize(i) for i in x]) # stemming
#lemmatized_output = ' '.join([lemmatizer.lemmatize(token) for token in tokens])

for i in range(len(tokenized_tweet)):
    tokenized_tweet[i] = ' '.join(tokenized_tweet[i])

private['description'] = tokenized_tweet

all_words = ' '.join([text for text in private['description']])



bow_private = bow_vectorizer.transform(private['description'])



bow_private = np.array(bow_private.todense())

y = private['points']


mean_squared_error(y, ridge.predict(bow_private))

ridge.score(bow_private, y)
```

Out[219]:
```
0.42575316972328936
```

Combining non review and review based tfidf features

In [68]:
```
tfidf = np.array(tfidf.todense())
X.shape, tfidf.shape, type(tfidf), type(X)
```

Out[68]:
```
((89970, 31), (89970, 200), numpy.ndarray, numpy.ndarray)
```

In [69]:
```
X_tfidf = np.hstack((X,tfidf))

X_train, X_test , y_train, y_test = train_test_split(X_tfidf, y, test_size=0.2, random_state=1)

ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_

ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))

ridge.score(X_test, y_test)
```

Out[69]:
```
0.5395942473832831
```

Task 3: Custom Word Vectors

Custom word to vec embeddings using skip-gram model

In [70]:
```
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer
import gensim
```

In [229]:
```
tokenized_tweet = combi['description'].apply(lambda x: x.split()) # tokenizing

model_w2v = gensim.models.Word2Vec(
            tokenized_tweet,
            size=50, # desired no. of features/independent variables
            window=5, # context window size
            min_count=2,
            sg = 1, # 1 for skip-gram model
            hs = 0,
            negative = 10, # for negative sampling
            workers= 2, # no.of cores
            seed = 34)
```

In [230]:
```
model_w2v.train(tokenized_tweet, total_examples= len(combi['description']), epochs=20)
```

Out[230]:
```
(49396884, 61990780)
```

model_w2v.shape

In [231]:
```
def word_vector(tokens, size):
    vec = np.zeros(size).reshape((1, size))
    count = 0.
    for word in tokens:
        try:
            vec += model_w2v[word].reshape((1, size))
            count += 1.
        except KeyError: # handling the case where the token is not in vocabulary

            continue
    if count != 0:
        vec /= count
    return vec
```

In [232]:
```
wordvec_arrays = np.zeros((len(tokenized_tweet), 50))

for i in range(len(tokenized_tweet)):
    wordvec_arrays[i,:] = word_vector(tokenized_tweet[i], 50)

wordvec_df = pd.DataFrame(wordvec_arrays)
wordvec_df.shape
```

Out[232]:
```
(89970, 50)
```

In [236]:
```
X_train, X_test , y_train, y_test = train_test_split(wordvec_df, combi['points'], test_size=0.2, rando
m_state=1)
```

In [237]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```

Out[237]:
```
0.005
```

In [238]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
```

Out[238]:
```
4.208923794471053
```

In [239]:
```
ridge.score(X_test, y_test)
```

Out[239]:
```
0.5404164300815004
```

Checking accuracy of custom word to vec embeddings using skip-gram model on private dataset

In [241]:
```
tokenized_tweet_private = private['description'].apply(lambda x: x.split()) # tokenizing

wordvec_arrays_private = np.zeros((len(tokenized_tweet_private), 50))

for i in range(len(tokenized_tweet_private)):
    wordvec_arrays_private[i,:] = word_vector(tokenized_tweet_private[i], 50)

wordvec_df_private = pd.DataFrame(wordvec_arrays_private)
wordvec_df_private.shape

mean_squared_error(private['points'], ridge.predict(wordvec_df_private))

ridge.score(wordvec_df_private, private['points'])
```

Out[241]:
```
0.5018984673156571
```

Checking accuracy of custom word to vec embeddings using skip-gram model on public dataset

In [242]:
```
tokenized_tweet_public = public['description'].apply(lambda x: x.split()) # tokenizing

wordvec_arrays_public = np.zeros((len(tokenized_tweet_public), 50))

for i in range(len(tokenized_tweet_public)):
    wordvec_arrays_public[i,:] = word_vector(tokenized_tweet_public[i], 50)

wordvec_df_public = pd.DataFrame(wordvec_arrays_public)
wordvec_df_public.shape

mean_squared_error(public['points'], ridge.predict(wordvec_df_public))

ridge.score(wordvec_df_public, public['points'])
```

Out[242]:
```
0.4933246314798058
```

Combine custom skip gram word2vec and bow features

In [82]:
```
X_bow_sg_w2v = np.hstack((wordvec_df,bow))
```

In [83]:
```
X_bow_sg_w2v
```

Out[83]:
```
array([[-0.00262551, -0.23499813,  0.2317796 , ...,  0.        ,
         0.        ,  0.        ],
       [-0.27572221, -0.10347272,  0.18937457, ...,  0.        ,
         0.        ,  0.        ],
       [-0.03521588, -0.15286143,  0.28467456, ...,  0.        ,
         0.        ,  0.        ],
       ...,
       [-0.17225228, -0.19234901,  0.18830725, ...,  0.        ,
         0.        ,  0.        ],
       [-0.16508608, -0.23316762,  0.32500752, ...,  0.        ,
         0.        ,  0.        ],
       [-0.32364449, -0.09797542,  0.10864892, ...,  0.        ,
         0.        ,  0.        ]])
```

In [84]:
```
X_train, X_test , y_train, y_test = train_test_split(X_bow_sg_w2v, y, test_size=0.2, random_state=1)
```

In [85]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```

Out[85]:
```
0.005
```

In [86]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
```

Out[86]:
```
3.545981161827917
```

In [87]:
```
ridge.score(X_test, y_test)
```

Out[87]:
```
0.6128048972144841
```

Task 2 Pre-trained Word Vectors

Using pre-trained word2vec embeddings created by Google

In [253]:
```
model = gensim.models.KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin', binary=T
rue)
```

In [254]:
```
def word_vector_pretrained(tokens, size):
    vec = np.zeros(size).reshape((1, size))
    count = 0.
    for word in tokens:
        try:
            vec += model[word].reshape((1, size))
            count += 1.
        except KeyError: # handling the case where the token is not in vocabulary

            continue
    if count != 0:
        vec /= count
    return vec
```

In [255]:
```
wordvec_arrays = np.zeros((len(tokenized_tweet), 300))

for i in range(len(tokenized_tweet)):
    wordvec_arrays[i,:] = word_vector_pretrained(tokenized_tweet[i], 300)

wordvec_df = pd.DataFrame(wordvec_arrays)
wordvec_df.shape
```
Out[255]: (89970, 300)

In [257]:
```
X_train, X_test , y_train, y_test = train_test_split(wordvec_df, combi['points'], test_size=0.2, rando
m_state=1)
```

In [258]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```
Out[258]: 0.008737642000038414

In [259]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
```
Out[259]: 5.239015673425837

In [261]:
```
ridge.score(X_test, y_test)
```
Out[261]: 0.4279379614297319

Using pre-trained word2vec embeddings on private dataset

In [262]:
```
tokenized_tweet_private = private['description'].apply(lambda x: x.split()) # tokenizing

wordvec_arrays_private = np.zeros((len(tokenized_tweet_private), 300))

for i in range(len(tokenized_tweet_private)):
    wordvec_arrays_private[i,:] = word_vector_pretrained(tokenized_tweet_private[i], 300)

wordvec_df_private = pd.DataFrame(wordvec_arrays_private)
wordvec_df_private.shape

mean_squared_error(private['points'], ridge.predict(wordvec_df_private))

ridge.score(wordvec_df_private, private['points'])
```
Out[262]: 0.4846125449904594

Using pre-trained word2vec embeddings on public dataset

In [264]:
```
tokenized_tweet_public = public['description'].apply(lambda x: x.split()) # tokenizing

wordvec_arrays_public = np.zeros((len(tokenized_tweet_public), 300))

for i in range(len(tokenized_tweet_public)):
    wordvec_arrays_public[i,:] = word_vector_pretrained(tokenized_tweet_public[i], 300)

wordvec_df_public = pd.DataFrame(wordvec_arrays_public)
wordvec_df_public.shape

mean_squared_error(public['points'], ridge.predict(wordvec_df_public))

ridge.score(wordvec_df_public, public['points'])
```
Out[264]: 0.4765056668795022

Combine pretrained word embedding with bag of words features

In [103]:
```
wordvec_bow = np.hstack((wordvec_df,bow))
```

In [107]:
```
X_train, X_test , y_train, y_test = train_test_split(wordvec_bow, y, test_size=0.2, random_state=1)
```

In [108]:
```
ridgecv = RidgeCV(alphas = alphas, scoring = 'neg_mean_squared_error', normalize = True)
ridgecv.fit(X_train, y_train)
ridgecv.alpha_
```
Out[108]: 0.01155064850041579

In [109]:
```
ridge = Ridge(alpha = ridgecv.alpha_, normalize = True)
ridge.fit(X_train, y_train)
mean_squared_error(y_test, ridge.predict(X_test))
ridge.score(X_test, y_test)
```
Out[109]: 0.5598097292977211