NLP Final Project

Topic

Create an NLP based model to understand the polarity of review and estimate a rating based on the review provided to a movie. Post we train a model to identify the polarity of review we will try to create a regression or classification model to map the review to a rating from range of 1-10.

Loading and formating of input data (Step 0)

In [1]:

```
# import os
# import shutil
# import glob

# # creating new folders for sorting the ratings
# for i in range(1,11):
#     try:
#         os.mkdir(f'./Cleaned_dataset/ratings_' + str(i))
#     except:
#         files = glob.glob('./Cleaned_dataset/ratings_' + str(i)+'/*')
#         os.remove(files)

# # filtering and copying negative reviews
# neg_path = './Project Dataset/aclImdb/train/neg/'
# neg_files = os.listdir(neg_path)
# flip = False
# for file_name in neg_files:
#     try:
#         # copying review to their respective rating folder
#         rating = file_name.split('_')[1].split('.')[0]
#         if rating == '4':
#             if(not flip):
#                 shutil.copy2(neg_path + file_name,'./Cleaned_dataset/ratings_4/'+ fil
e_name)
#                 flip = True
#             else:
#                 shutil.copy2(neg_path + file_name,'./Cleaned_dataset/ratings_5/'+ fil
e_name)
#                 flip = False
#         else:
#             shutil.copy2(neg_path + file_name,'./Cleaned_dataset/ratings_' + rating
 +'/' + file_name)
#     except:
#         print(neg_path + file_name)

# # filtering and copying positive reviews
# pos_path = './Project Dataset/aclImdb/train/pos/'
# pos_files = os.listdir(pos_path)
# flip = False
# for file_name in pos_files:
#     try:
#         # copying review to their respective rating folder
#         rating = file_name.split('_')[1].split('.')[0]
#         if rating == '7':
#             if(not flip):
#                 shutil.copy2(pos_path + file_name,'./Cleaned_dataset/ratings_7/' + fi
le_name)
#                 flip = True
#             else:
#                 shutil.copy2(pos_path + file_name,'./Cleaned_dataset/ratings_6/' + fi
le_name)
#                 flip = False
#         else:
#             shutil.copy2(pos_path + file_name,'./Cleaned_dataset/ratings_' + rating +
'/' + file_name)
#     except:
#         print(pos_path + file_name)
```

Load data in to data frames (Step 0)

In [9]:

```
# %%time
# import pandas as pd
# import os

# data_set = pd.DataFrame(columns=['Rating','Review'])
# ratings_folder_path = os.listdir('./Cleaned_dataset/')
# if 'tokenized_words.csv' in ratings_folder_path:
#     ratings_folder_path.remove('tokenized_words.csv')
# if 'vectorized_words.csv' in ratings_folder_path:
#     ratings_folder_path.remove('vectorized_words.csv')

# for folder in ratings_folder_path:
#     rating = folder.split('_')
#     review_files = os.listdir('./Cleaned_dataset/' + folder + '/')
#     for review in review_files:
#         try:
#             fp = open('./Cleaned_dataset/' + folder + '/' + review,'r')
#             review_data = fp.read()
#             rating_number = rating[1]
#             data_set = data_set.append(pd.Series([rating_number,review_data], index=d
ata_set.columns),ignore_index=True)
#             fp.close()
#         except:
#             # try except to deal with error in file reading due to codec issues
#             pass

# print(data_set.head(10))
```

```
  Rating                                             Review
0      1  Sorry everyone,,, I know this is supposed to b...
1      1  When I was little my parents took me along to ...
2      1  This film is mediocre at best. Angie Harmon is...
3      1  This film is one giant pant load. Paul Schrade...
4      1  This movie must be in line for the most boring...
5      1  A worn-out plot of a man who takes the rap for...
6      1  Shame on Yash Raj films and Aditya Chopra who ...
7      1  If this is a 2008 product from one of the bigg...
8      1  The action in this movie beats Sunny bhai in G...
9      1  I had no idea what the film is about before I ...
Wall time: 1min 5s
```

Pre-processing data_set (Step 0)

Removing punctuations, Stop words and Lemmatizing

In [ ]:

```
# %%time
# import nltk
# # download wordnet if required
# # nltk.download('wordnet')
# # download stopwords if required
# # nltk.download('stopwords')
# # loading English stop words
# stop_words = nltk.corpus.stopwords.words('english')
# import string
# import re

# # Basic cleaning
# def cleanAndTokenize(review):
#     # removing punctuations
#     non_punc_words = "".join([character for character in review if character not in s
tring.punctuation])

#     non_punc_words = non_punc_words.strip()

#     # tokenizing reviews
#     list_of_token = re.split('\W+',non_punc_words)

#     # removing stop words
#     tokens = [word for word in list_of_token if word not in stop_words]

#     return tokens

# # converting words to lower case.
# data_set['Review'] = data_set['Review'].apply(lambda review : cleanAndTokenize(str(re
view).lower()))

# # using nltk's wordnet lemmatizer
# word_net_lemma = nltk.WordNetLemmatizer()

# def lemmatize_data(token_list):
#     tokens = [word_net_lemma.lemmatize(word) for word in token_list]
#     return tokens

# data_set['Review'] = data_set['Review'].apply(lambda review : lemmatize_data(review))

# # un-comment to write data to file
# # data_set.to_csv('./Cleaned_dataset/tokenized_words.csv',index = False, header=True)
```

Vectorizing reviews using TF-IDF. (Step 0)

In [1]:

```
# %%time
# import pandas as pd
# import pickle
# from sklearn.feature_extraction.text import TfidfVectorizer
# import string
# import re
# import nltk
# # using nltk's wordnet lemmatizer
# word_net_lemma = nltk.WordNetLemmatizer()

# data_set = pd.read_csv('./Cleaned_dataset/tokenized_words.csv')

# print(data_set.head())

# def clean_review(review):
#     non_punc_words = "".join([character for character in review if character not in s
tring.punctuation])
#     list_of_token = re.split('\W+',non_punc_words)
#     tokens = [word_net_lemma.lemmatize(word) for word in list_of_token]
#     return tokens

# tfidf_vectorize = TfidfVectorizer(analyzer=clean_review)
# vectorized_review = tfidf_vectorize.fit_transform(data_set['Review'])

# pickle.dump(tfidf_vectorize,open('./pickle_tfidf/tfidf.pickle','wb'))
# vectorized_review_df = pd.DataFrame(vectorized_review.toarray())
# vectorized_review_df.columns = tfidf_vectorize.get_feature_names()
# print(vectorized_review_df.head())

# pickle.dump(vectorized_review,open('./pickle_tfidf/vectorized_review.pickle','wb'))

# # un-comment to write data to file
# # data_set.to_csv('./Cleaned_dataset/vectorized_words.csv',index = False, header=Tru
e)
```

```
   Rating                                             Review
0       1  ['sorry', 'everyone', 'know', 'supposed', 'art...
1       1  ['little', 'parent', 'took', 'along', 'theater...
2       1  ['film', 'mediocre', 'best', 'angie', 'harmon'...
3       1  ['film', 'one', 'giant', 'pant', 'load', 'paul...
4       1  ['movie', 'must', 'line', 'boring', 'movie', '...
     0   00  000  0000000000001  00001  00015  000s  001  003830  006  ...
\
0  0.0  0.0  0.0            0.0    0.0    0.0   0.0  0.0     0.0  0.0  ...
1  0.0  0.0  0.0            0.0    0.0    0.0   0.0  0.0     0.0  0.0  ...
2  0.0  0.0  0.0            0.0    0.0    0.0   0.0  0.0     0.0  0.0  ...
3  0.0  0.0  0.0            0.0    0.0    0.0   0.0  0.0     0.0  0.0  ...
4  0.0  0.0  0.0            0.0    0.0    0.0   0.0  0.0     0.0  0.0  ...

    âº   â½   â¾  âžiâžek    ã  ã¼ber  ãœvegtigris  ãšxtase    ï  œat
0  0.0  0.0  0.0      0.0  0.0    0.0          0.0      0.0  0.0  0.0
1  0.0  0.0  0.0      0.0  0.0    0.0          0.0      0.0  0.0  0.0
2  0.0  0.0  0.0      0.0  0.0    0.0          0.0      0.0  0.0  0.0
3  0.0  0.0  0.0      0.0  0.0    0.0          0.0      0.0  0.0  0.0
4  0.0  0.0  0.0      0.0  0.0    0.0          0.0      0.0  0.0  0.0

[5 rows x 67517 columns]
Wall time: 4min 39s
```

Load the TFIDF object (Step 1)

In [1]:

```
%%time
import pickle
import pandas as pd
from sklearn.metrics.pairwise import euclidean_distances
import re
import numpy as np
import string
import re
import nltk
# using nltk's wordnet lemmatizer
word_net_lemma = nltk.WordNetLemmatizer()

# this method is repeated because it doesn't get pickled with the tfidf object
def clean_review(review):
    non_punc_words = "".join([character for character in review if character not in str
ing.punctuation])
    list_of_token = re.split('\W+',non_punc_words)
    tokens = [word_net_lemma.lemmatize(word) for word in list_of_token]
    return tokens

class_data = pd.read_csv('./Cleaned_dataset/tokenized_words.csv',usecols = ['Rating'])

tfidf_object = pickle.load(open('./pickle_tfidf/tfidf.pickle','rb'))
vectorized_review_obj = pickle.load(open('./pickle_tfidf/vectorized_review.pickle','rb'
))
```

```
Wall time: 1min 33s
```

Predict a rating for review (Step 2)

In [59]:

```
# Run this cell to enter a new review, post entering the review hit enter to stop takin
g input.
review_input = input()
```

```
I've seen this story before but my kids haven't. Boy with troubled past jo
ins military, faces his past, falls in love and becomes a man. The mentor
this time is played perfectly by Kevin Costner; An ordinary man with commo
n everyday problems who lives an extraordinary conviction, to save lives.
After losing his team he takes a teaching position training the next gener
ation of heroes. The young troubled recruit is played by Kutcher. While hi
s scenes with the local love interest are a tad stiff and don't generate e
nough heat to melt butter, he compliments Costner well. I never really und
erstood Sela Ward as the neglected wife and felt she should of wanted Cost
ner to quit out of concern for his safety as opposed to her selfish needs.
But her presence on screen is a pleasure. The two unaccredited stars of th
is movie are the Coast Guard and the Sea. Both powerful forces which shoul
d not be taken for granted in real life or this movie. The movie has some
slow spots and could have used the wasted 15 minutes to strengthen the cha
racter relationships. But it still works. The rescue scenes are intense an
d well filmed and edited to provide maximum impact. This movie earns the a
udience applause. And the applause of my two sons.
```

In [60]:

```
%%time
new_in = tfidf_object.transform([review_input])
distances = euclidean_distances(vectorized_review_obj,new_in)
dict_class_label = {1:0,2:0,3:0,4:0,5:0,6:0,7:0,8:0,9:0,10:0}

distance_set = np.unique(distances)
distance_set = sorted(distance_set)
# selected after experimenting
min_dist = distance_set[0:41]
for k in min_dist:
    list1 = np.where(distances == k)[0]
    class_label,label_count = np.unique(class_data.loc[list1,:].values,return_counts =
True)
    for index,value in zip(class_label.tolist(),label_count.tolist()):
        dict_class_label[index] += value
print('max count predicted rating: ',max(dict_class_label, key=lambda key: dict_class_l
abel[key]))

distances = euclidean_distances(vectorized_review_obj,new_in)
dict_class_label = {1:0,2:0,3:0,4:0,5:0,6:0,7:0,8:0,9:0,10:0}

distance_set = np.unique(distances)
distance_set = sorted(distance_set)
# selected after experimenting
min_dist = distance_set[0:3]
for k in min_dist:
    list1 = np.where(distances == k)[0]
    class_label,label_count = np.unique(class_data.loc[list1,:].values,return_counts =
True)
    for index,value in zip(class_label.tolist(),label_count.tolist()):
        dict_class_label[index] += value
list_of_rating = [val for val in dict_class_label if dict_class_label[val] > 0]
print('mean predicted rating: ',int(sum(list_of_rating)/len(list_of_rating)))
```

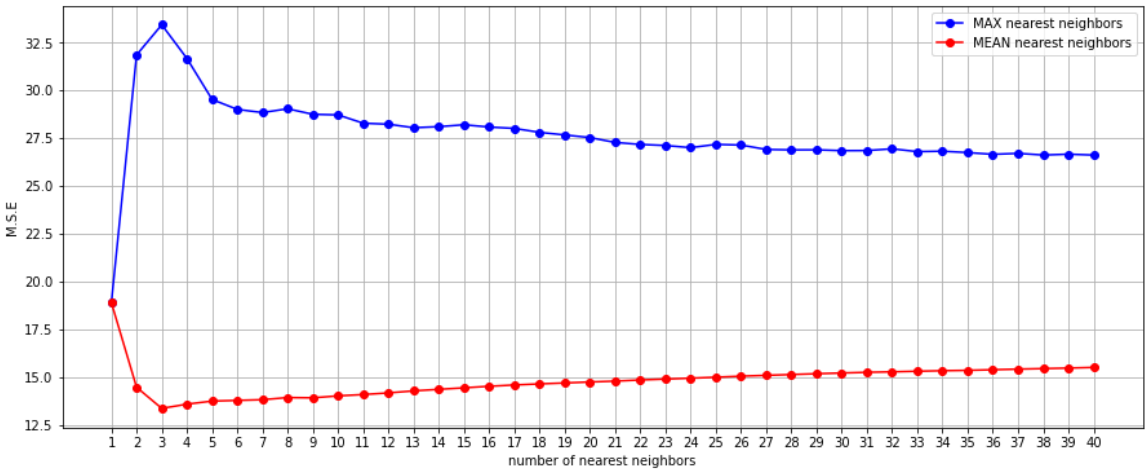
```
max count predicted rating:  10
mean predicted rating:  7
Wall time: 72.8 ms
```

Performance testing

In [13]:

```
%%time
import os
import matplotlib.pyplot as plt

neg_path = './Project Dataset/aclImdb/test/neg/'
neg_files = os.listdir(neg_path)

pos_path = './Project Dataset/aclImdb/test/pos/'
pos_files = os.listdir(pos_path)

max_nn = 41
plot_max = []
plot_mean = []

for nearest_negihbor in range(1,max_nn):
    max_predicted_rating_arr = []
    mean_predicted_rating_arr = []
    actual_rating_arr = []

    for file_name in pos_files:
        try:
            fp = open('./Project Dataset/aclImdb/test/pos/'+file_name,'r')
            actual_rating = int(file_name.split('_')[1].split('.')[0])
            test_review = fp.read()
            new_in = tfidf_object.transform([test_review])
            distances = euclidean_distances(vectorized_review_obj,new_in)
            dict_class_label = {1:0,2:0,3:0,4:0,5:0,6:0,7:0,8:0,9:0,10:0}

            distance_set = np.unique(distances)
            distance_set = sorted(distance_set)
            min_dist = distance_set[0:nearest_negihbor]
            for k in min_dist:
                list1 = np.where(distances == k)[0]
                class_label,label_count = np.unique(class_data.loc[list1,:].values,retu
rn_counts = True)
                for index,value in zip(class_label.tolist(),label_count.tolist()):
                    dict_class_label[index] += value
            actual_rating_arr.append(actual_rating)
            max_predicted_rating_arr.append(max(dict_class_label, key=lambda key: dict_
class_label[key]))

            list_of_rating = [val for val in dict_class_label if dict_class_label[val]
> 0]
            mean_predicted_rating_arr.append(int(sum(list_of_rating)/len(list_of_rating
)))

            del fp
        except Exception:
            pass

    MSE = pd.DataFrame(columns = ['max_predicted_rating_arr','mean_predicted_rating_ar
r','actual_rating_arr'])
    MSE['actual_rating_arr'] = actual_rating_arr
    MSE['max_predicted_rating_arr'] = max_predicted_rating_arr
    MSE['mean_predicted_rating_arr'] = mean_predicted_rating_arr
    mean_squared_error_max = np.square(np.subtract(MSE['actual_rating_arr'],MSE['max_pr
edicted_rating_arr'])).mean()
    mean_squared_error_mean = np.square(np.subtract(MSE['actual_rating_arr'],MSE['mean_
predicted_rating_arr'])).mean()
```

```
    plot_max.append(mean_squared_error_max)
    plot_mean.append(mean_squared_error_mean)

# Plot the mean v/s max values
plt.figure(figsize=(15,6))
plt.plot(list(range(1, max_nn)),plot_max,'b-o', label = 'MAX nearest neighbors')
plt.plot(list(range(1, max_nn)),plot_mean,'r-o', label = 'MEAN nearest neighbors')
plt.legend(loc='upper right')
plt.xlabel('number of nearest neighbors')
plt.ylabel('M.S.E')
plt.xticks(list(range(1, max_nn)))
plt.grid()
plt.show()
```




```
Wall time: 5h 26min 47s
```

Cosine and count vectorization testing.

In [24]:

```
# Run this cell to enter a new review, post entering the review hit enter to stop takin
g input.
input_review = input()
```

```
bad movie
```

In [26]:

```
%%time
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics.pairwise import cosine_distances
import numpy as np

vectorizer_obj = CountVectorizer()#analyzer='word', ngram_range=(2, 2))
count_vector_obj = vectorizer_obj.fit_transform(data_set['Review'])

class_data = pd.DataFrame(data_set['Rating'],dtype='int')


input_count_obj = vectorizer_obj.transform([input_review])

cosine_distance_list = cosine_distances(count_vector_obj,input_count_obj)

dict_class_label = {1:0,2:0,3:0,4:0,5:0,6:0,7:0,8:0,9:0,10:0}

distance_set = np.unique(cosine_distance_list)
distance_set = sorted(distance_set)
min_dist = distance_set[0:1]
for k in min_dist:
    list1 = np.where(cosine_distance_list == k)[0]
    class_label,label_count = np.unique(class_data.loc[list1,:].values,return_counts =
True)
    for index,value in zip(class_label.tolist(),label_count.tolist()):
        dict_class_label[index] += value
print('max count predicted rating: ',max(dict_class_label, key=lambda key: dict_class_l
abel[key]))

list_of_rating = [val for val in dict_class_label if dict_class_label[val] > 0]
print('mean predicted rating: ',int(sum(list_of_rating)/len(list_of_rating)))
```

```
max count predicted rating:  1
mean predicted rating:  1
Wall time: 5.2 s
```