Sentimental_Analysis

February 4, 2019

```
In [10]: import pandas as pd
         import numpy as np
         import os
         import time
         from nltk.stem.wordnet import WordNetLemmatizer
         from sklearn.feature_extraction.text import CountVectorizer
         import itertools
         from nltk.corpus import stopwords
         from nltk.tokenize import word_tokenize
         import string
         import matplotlib.pyplot as plt
         from sklearn.model_selection import train_test_split
         from sklearn import svm
         import pickle
         from sklearn.feature_extraction.text import TfidfVectorizer
         from sklearn.naive_bayes import MultinomialNB
         from sklearn.decomposition import PCA
         from sklearn.decomposition import TruncatedSVD
```

```
In [2]: import nltk
        nltk.download('stopwords')
        nltk.download('wordnet')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Unzipping corpora/wordnet.zip.
```

```
Out[2]: True
```

```
In [3]: from google.colab import drive
        drive.mount('/content/drive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-

Enter your authorization code:
ůůůůůůůůůů
```

```
Mounted at /content/drive
```

```
In [ ]: data=pd.read_csv("drive/My Drive/Machine Learning-Colab/Sentimental Analysis/movie_dat
```

Information About Data

```
In [5]: print ("Number of Data Points :", data.shape[0])
        print ("Number of Features /Variables:" ,data.shape[1])
```

```
Number of Data Points : 50000
Number of Features /Variables: 2
```

Data Preprocessing

```
In [ ]: lmtzr = WordNetLemmatizer()
        stop_words = set(stopwords.words('english'))
        def remove_punctuation(s):
            s = ''.join([i for i in s if i not in frozenset(string.punctuation)])
            return s

        def nlp_preprocessing(total_text, index, column):
            if type(total_text) is not int:
                string = ""
                for words in total_text.split():
                    # remove the special chars in review like '"#$@!%^&*()_+-~?>< etc.
                    word = ("".join(e for e in words if e.isalpha()))
                    # Conver all letters to lower-case
                    word = word.lower()
                    # stop-word removal
                    if not word in stop_words:
                        string += lmtzr.lemmatize(word) + " "
                data[column][index] = string
```

```
In [8]: start_time = time.clock()
        data['review'] = data['review'].apply(remove_punctuation)
        print("Time for Punctuation removal",(time.clock() - start_time)/60, "minutes")
        start_time = time.clock()
        for index, row in data.iterrows():
            nlp_preprocessing(row['review'], index, 'review')
        print("Time for Preprocesing",(time.clock() - start_time)/60, "minutes")
```

```
Time for Punctuation removal 0.84782265 minutes
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:18: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.htm
```

```
Time for Preprocesing 120.33746326666666 minutes
```

```
In [ ]: pd.to_hdf('movie_data.h5','data')
```

New Starting

```
In [2]: data=pd.read_hdf('movie_data.h5','data')

In [3]: data.shape

Out[3]: (50000, 2)

In [4]: data.columns

Out[4]: Index(['review', 'sentiment'], dtype='object')

In [5]: Y=data['sentiment']
```

BOW Model

```
In [6]: vectorizer=CountVectorizer()
        X=vectorizer.fit_transform(data['review'])

In [7]: X.shape

Out[7]: (50000, 164728)

In [9]: X_train, X_test, y_train, y_test = train_test_split(X, Y,test_size=.2,random_state=42)

In [10]: print (X_train.shape, y_train.shape)
         print (X_test.shape, y_test.shape)

(40000, 164728) (40000,)
(10000, 164728) (10000,)
```

RBF Kernel

```
In [11]: start_time = time.clock()
         model_svm = svm.SVC(C=1,gamma=1)
         model_svm.fit(X_train,y_train)
         y_pred= model_svm.predict(X_test)
         print((time.clock() - start_time)/60, "minutes")

102.20228001622887 minutes
```

```
In [12]: print("Accuracy",model_svm.score(X_test,y_test))

Accuracy 0.5065
```

```
In [20]: svm_pkl_model=open("svm_model_rbf_bow.pkl","wb")
```

```
In [21]: pickle.dump(model_svm,svm_pkl_model)
```

```
In [22]: svm_pkl_model.close()
```

Linear Kernel

```
In [23]: start_time = time.clock()
         model_svm = svm.SVC(kernel='linear',C=1,gamma=1)
         model_svm.fit(X_train,y_train)
         print((time.clock() - start_time)/60, "minutes")
```

```
144.38460584875347 minutes
```

```
In [24]: print("Accuracy",model_svm.score(X_test,y_test))
```

```
Accuracy 0.8625
```

```
In [25]: svm_pkl_model=open("svm_model_linear_bow.pkl","wb")
         pickle.dump(model_svm,svm_pkl_model)
         svm_pkl_model.close()
```

Tf-Idf Model

```
In [8]: tfidf_review_vectorizer_train1 = TfidfVectorizer()
        tfidf_review_features_train1= tfidf_review_vectorizer_train1.fit_transform(data['revie
```

```
In [ ]: X_train1, X_test1, y_train1, y_test1 = train_test_split(tfidf_review_features_train1, 
        print (X_train1.shape, y_train1.shape)
        print (X_test1.shape, y_test1.shape)
```

Linear kernel

```
In [27]: start_time = time.clock()
         model_svm = svm.SVC(kernel='linear',C=1,gamma=1)
         model_svm.fit(X_train1,y_train1)
         print((time.clock() - start_time)/60, "minutes")
         print("Accuracy:",model_svm.score(X_test1,y_test1))
```

```
26.57927562000556 minutes
Accuracy: 0.896
```

```
In [28]: svm_pkl_model=open("svm_model_linear_TfIDF.pkl","wb")
         pickle.dump(model_svm,svm_pkl_model)
         svm_pkl_model.close()
```

Rbf Kernel

```
In [29]: start_time = time.clock()
         model_svm = svm.SVC(C=1,gamma=1)
         model_svm.fit(X_train1,y_train1)
         print((time.clock() - start_time)/60, "minutes")
         print("Accuracy:",model_svm.score(X_test1,y_test1))
```

```
52.326281867188605 minutes
Accuracy: 0.89736
```

```
In [30]: svm_pkl_model=open("svm_model_rbf_TfIDF.pkl","wb")
         pickle.dump(model_svm,svm_pkl_model)
         svm_pkl_model.close()
```

1 Naive bayes Model

Tf-Idf Model

```
In [35]: start_time = time.clock()
         clf = MultinomialNB()
         clf.fit(X_train1, y_train1)
         print("Accuracy:",clf.score(X_test1,y_test1))
         print((time.clock() - start_time)/60, "minutes")
```

```
Accuracy: 0.86528
0.0027276288708283874 minutes
```

```
In [36]: nb_pkl_model=open("nb_model_multinb.pkl","wb")
         pickle.dump(clf,nb_pkl_model)
         nb_pkl_model.close()
```

Bow Model

```
In [37]: start_time = time.clock()
         clf = MultinomialNB()
         clf.fit(X_train, y_train)
         print("Accuracy:",clf.score(X_test,y_test))
         print((time.clock() - start_time)/60, "minutes")
```

```
Accuracy: 0.8598
0.01507356905543323 minutes
```

```
In [38]: nb_pkl_model=open("nb_model_multinb_Bow.pkl","wb")
         pickle.dump(clf,nb_pkl_model)
         nb_pkl_model.close()
```

2 Dimensionality Reduction

Latent Semantic analysis on BOW Model

```
In [11]: start_time = time.clock()
         svd = TruncatedSVD(n_components=1000, random_state=42)
         bow_X_svd=svd.fit_transform(X)
         print((time.clock() - start_time)/60, "minutes")
```

```
4.982865505514079 minutes
```

```
In [12]: svd.singular_values_.size
```

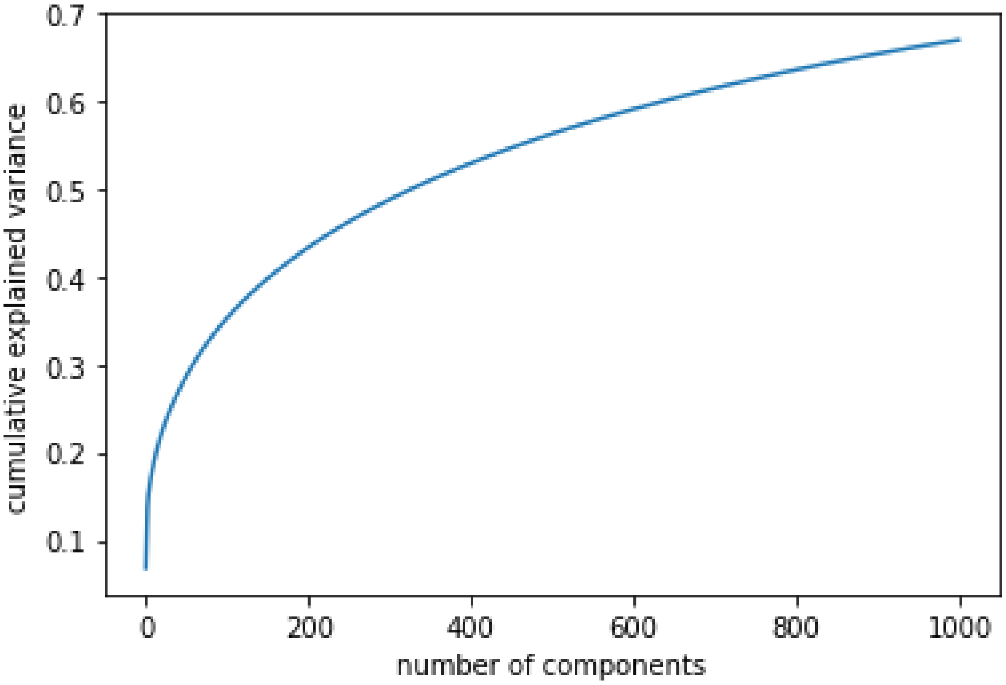
```
Out[12]: 1000
```

```
In [13]: bow_X_svd.size
```

```
Out[13]: 50000000
```

```
In [14]: arr=svd.explained_variance_ratio_
```

```
In [15]: plt.plot(np.cumsum(arr))
         plt.xlabel('number of components')
         plt.ylabel('cumulative explained variance');
         plt.show()
```



```
In [16]: X_train, X_test, y_train, y_test = train_test_split(bow_X_svd, Y,test_size=.2,random_
         print (X_train.shape, y_train.shape)
         print (X_test.shape, y_test.shape)
```

```
(40000, 1000) (40000,)
(10000, 1000) (10000,)
```

SVM-Linear model

```
In [17]: start_time = time.clock()
         model_svm = svm.SVC(kernel='linear',C=1,gamma=1)
         model_svm.fit(X_train,y_train)
         print((time.clock() - start_time)/60, "minutes")
         print("Accuracy:",model_svm.score(X_test,y_test))
```

```
339.4825693216163 minutes
Accuracy: 0.8677
```

```
In [19]: svm_pkl_model=open("SVM_Bow_svd_linear.pkl","wb")
         pickle.dump(model_svm,svm_pkl_model)
         svm_pkl_model.close()
```

SVM-RBf model

```
In [20]: start_time = time.clock()
         model_svm = svm.SVC(C=1,gamma=1)
         model_svm.fit(X_train,y_train)
         print((time.clock() - start_time)/60, "minutes")
         print("Accuracy:",model_svm.score(X_test,y_test))
```

```
102.48039741238603 minutes
Accuracy: 0.507
```

```
In [22]: svm_pkl_model=open("SVM_Bow_svd_rbf.pkl","wb")
         pickle.dump(model_svm,svm_pkl_model)
         svm_pkl_model.close()
```

Naive Bayes-Multinomial

```
In [23]: start_time = time.clock()
         clf = MultinomialNB()
         clf.fit(X_train, y_train)
         print("Accuracy:",clf.score(X_test,y_test))
         print((time.clock() - start_time)/60, "minutes")
```

```
    ---------------------------------------------------------------------------

    ValueError                                Traceback (most recent call last)

    <ipython-input-23-e3872ec50907> in <module>()
      1 start_time = time.clock()
      2 clf = MultinomialNB()
----> 3 clf.fit(X_train, y_train)
      4 print("Accuracy:",clf.score(X_test,y_test))
      5 print((time.clock() - start_time)/60, "minutes")


    C:\ProgramData\Anaconda3\lib\site-packages\sklearn\naive_bayes.py in fit(self, X, y, sa
    602         self.feature_count_ = np.zeros((n_effective_classes, n_features),
    603                                        dtype=np.float64)
--> 604         self._count(X, Y)
    605         alpha = self._check_alpha()
    606         self._update_feature_log_prob(alpha)


    C:\ProgramData\Anaconda3\lib\site-packages\sklearn\naive_bayes.py in _count(self, X, Y
    706         """Count and smooth feature occurrences."""
    707         if np.any((X.data if issparse(X) else X) < 0):
--> 708             raise ValueError("Input X must be non-negative")
    709         self.feature_count_ += safe_sparse_dot(Y.T, X)
    710         self.class_count_ += Y.sum(axis=0)


    ValueError: Input X must be non-negative
```

```
In [ ]: nb_pkl_model=open("nb_multinb_Bow_svd.pkl","wb")
        pickle.dump(clf,nb_pkl_model)
        nb_pkl_model.close()
```

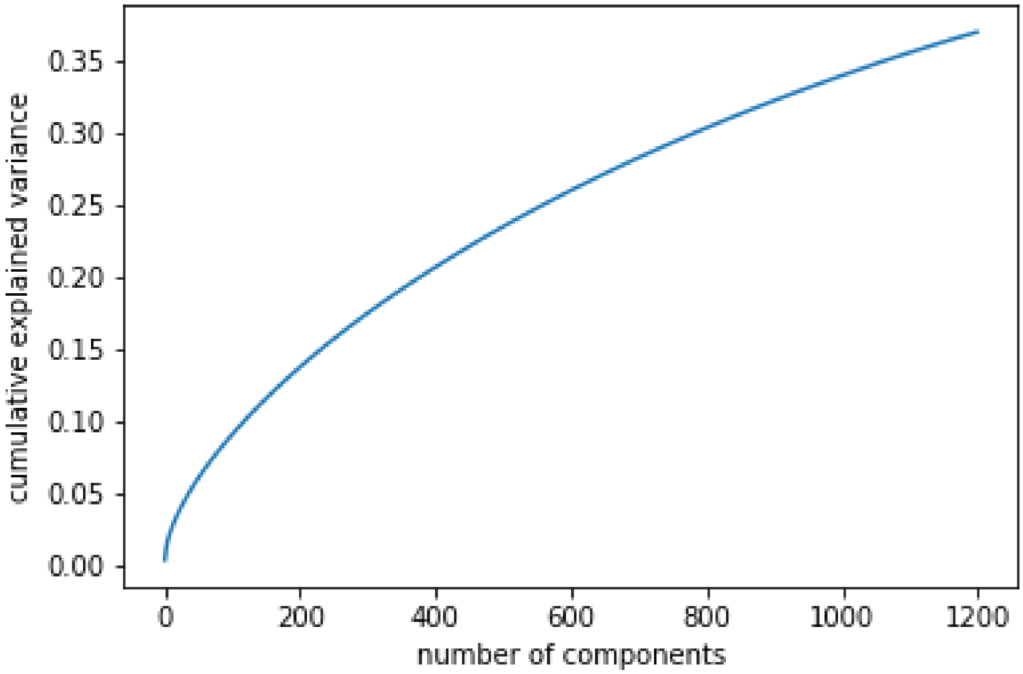
LSA on TF-Idf Model

```
In [22]: start_time = time.clock()
         svd = TruncatedSVD(n_components=1200, random_state=42)
         tfidf_X_svd=svd.fit_transform(tfidf_review_features_train1)
         print((time.clock() - start_time)/60, "minutes")
```

```
5.798072893612114 minutes
```

```
In [23]: arr=svd.explained_variance_ratio_
```

```
In [24]: plt.plot(np.cumsum(arr))
         plt.xlabel('number of components')
         plt.ylabel('cumulative explained variance');
         plt.show()
```



```
In [24]: X_train
```

```
Out[24]: array([[ 2.12447051, -0.03228676,  0.29067576, ...,  0.24663943,
                   0.04047853,  0.04541219],
                 [ 4.05783146, -0.04988795, -1.5744011 , ..., -0.10864942,
                   0.01682121, -0.06681876],
                 [ 3.20489633,  1.77343513, -2.66986934, ..., -0.03232666,
                   0.03877565, -0.02720532],
                 ...,
                 [ 6.65206367, -3.61785917, -0.84308064, ...,  0.28863736,
                   0.16373976,  0.00965855],
                 [ 1.04586061, -0.81502337, -0.55916851, ...,  0.11974926,
                  -0.01409467, -0.15647588],
                 [ 2.65948237,  2.45103453, -2.32014083, ..., -0.01964958,
                  -0.05120869, -0.01799557]])
```

3 PCA

PCA on Bow

```
In [26]: start_time = time.clock()
         pca = PCA(n_components=150)
```

```
 pca_X_bow=pca.fit_transform(tfidf_review_features_train1)
 print((time.clock() - start_time)/60, "minutes")
```

```
---------------------------------------------------------------------------

TypeError                                 Traceback (most recent call last)

<ipython-input-26-adecf8d266b1> in <module>()
  1 start_time = time.clock()
  2 pca = PCA(n_components=150)
----> 3 pca_X_bow=pca.fit_transform(tfidf_review_features_train1)
  4 print((time.clock() - start_time)/60, "minutes")


C:\ProgramData\Anaconda3\lib\site-packages\sklearn\decomposition\pca.py in fit_transfo
346
347         """
--> 348         U, S, V = self._fit(X)
349         U = U[:, :self.n_components_]
350


C:\ProgramData\Anaconda3\lib\site-packages\sklearn\decomposition\pca.py in _fit(self, X
364         # This is more informative than the generic one raised by check_array.
365         if issparse(X):
--> 366             raise TypeError('PCA does not support sparse input. See '
367                             'TruncatedSVD for a possible alternative.')
368


TypeError: PCA does not support sparse input. See TruncatedSVD for a possible alternat
```

```
In [ ]: arr=pca.explained_variance_ratio_
        plt.plot(np.cumsum(arr))
        plt.xlabel('number of components')
        plt.ylabel('cumulative explained variance');
        plt.show()
```