AmazonFineFoodReviews_DT

September 2, 2018

1 Decision Tree Amazon Fine Food Reviews

```
In [15]: %matplotlib inline

         import sqlite3
         import pandas as pd #for data frames
         import numpy as np #numpy array operations
         import nltk #natural lang processing, for processing text
         import string
         import matplotlib.pyplot as plt
         import seaborn as sns #for plotting
         from sklearn.feature_extraction.text import TfidfTransformer
         from sklearn.feature_extraction.text import TfidfVectorizer
         from sklearn.feature_extraction.text import CountVectorizer

         from nltk.stem.porter import PorterStemmer
         import pickle
         import seaborn as sn

         import matplotlib.pyplot as plt
         from sklearn.cross_validation import train_test_split
         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.model_selection import train_test_split
         from sklearn.metrics import average_precision_score,f1_score,precision_score,recall_s
         from sklearn.grid_search import GridSearchCV
         from sklearn.model_selection import RandomizedSearchCV

         from sklearn.svm import SVC
         from sklearn.manifold import TSNE

         from scipy.stats import expon
         import random
         from sklearn.tree import DecisionTreeClassifier

In [16]: pickle_in=open("cleanedData.pickle","rb")
         final = pickle.load(pickle_in)

         '''pickle_in = open("BOW_tfidf_avgW2V_TfidfW2V.pickle","rb")
         count_vect = pickle.load(pickle_in) #BOW
         final_counts = pickle.load(pickle_in) #BOW

         tf_idf_vect = pickle.load(pickle_in) #TFIDF
         final_tf_idf = pickle.load(pickle_in) #TFIDF
         features = pickle.load(pickle_in) #TFIDF

         w2v_model = pickle.load(pickle_in) #w2v
         words = pickle.load(pickle_in) #w2v

         sent_vectors = pickle.load(pickle_in) #avg W2V'''

         import pickle
         pickle_in = open("BOW_tfidf_avgW2V_Train_test_data.pickle","rb")

         count_vect = pickle.load(pickle_in) #BOW
         final_counts_train = pickle.load(pickle_in) #BOW
         final_counts_test = pickle.load(pickle_in) #BOW
         tf_idf_vect = pickle.load(pickle_in) #tfidf
         final_tf_idf_train = pickle.load(pickle_in) #tfidf
         final_tf_idf_test = pickle.load(pickle_in) #tfidf
         features = pickle.load(pickle_in)
         sent_vectors_train = pickle.load(pickle_in) #avgW2v Vectors
         sent_vectors_test = pickle.load(pickle_in) #avgW2v Vectors
```

```
C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\base.py:315: UserWarning: Trying to unpickle
  UserWarning)
C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\base.py:315: UserWarning: Trying to unpickle
  UserWarning)
C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\base.py:315: UserWarning: Trying to unpickle
  UserWarning)
```

```
In [17]: train_data = final.head(int(0.80*final.shape[0]))
         test_data = final.head(int(0.20*final.shape[0])+1)

         scores = final['Score'].get_values()
         len(scores)

Out[17]: 364171
```

Util Functions

```
In [19]: def convScores(scores):
             li = lambda x: 1 if x=='positive'  else 0
             final_scores = []
             for i in range(0,len(scores)):
                 final_scores.append(li(scores[i]))
             return final_scores

         def convToNpArray(arr):
             if(type(arr) == list):
                 arr = np.array(arr)
                 return arr
             else:
                 return arr;
         def confusionMatrix(y_test,pred):

             df_cm = pd.DataFrame(confusion_matrix(y_test, pred), index = ['False','True'],
                                  columns = ['False','True'])
             sn.heatmap(df_cm, annot=True)
             plt.title('Confusion Matrix')
             plt.ylabel('Actual')
             plt.xlabel('Predicted')
             plt.show()

         def show_most_informative_features(vectorizer, clf, n=10):
             feature_names = vectorizer.get_feature_names()
             coefs_with_fns = sorted(zip(clf.feature_importances_, feature_names))
             top = coefs_with_fns[:-(n + 1):-1]
             print("Top 10 Features:")
             for (coef_1, fn_1) in top:
                 print("")
                 print("%-15s" % (fn_1))
```

1.1 Avg w2v DT

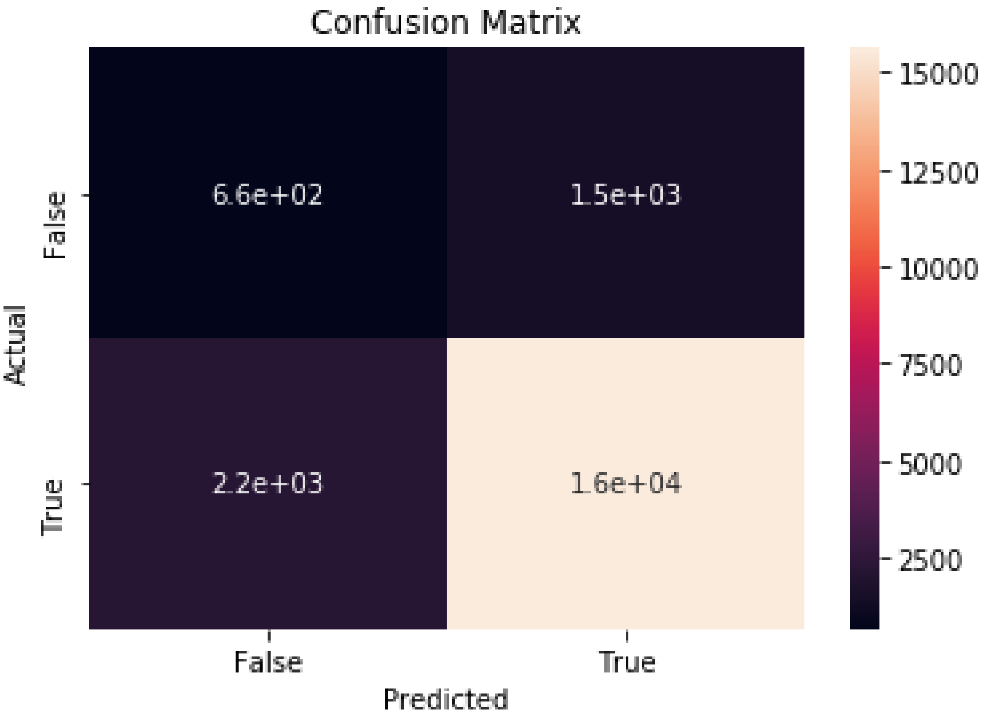
```
In [12]: x_1 = sent_vectors_train[0:100000]


         # this is only Score/rating  of data

         y_1 = convScores(train_data['Score'].get_values())[0:100000]

         x_test = sent_vectors_test[0:20000]
         y_test = convScores(test_data['Score'].get_values())[0:20000]


         x_1 = convToNpArray(x_1)
         x_test = convToNpArray(x_test)
         y_1 = convToNpArray(y_1)
         y_test = convToNpArray(y_test)
```

```
In [13]: tuned_parameters = {'max_depth':[11,21,41,61]}


         DT_model = DecisionTreeClassifier(class_weight='balanced')
         model = GridSearchCV(DT_model,tuned_parameters,
                              scoring='f1',cv=5,n_jobs=-1)

         model.fit(x_1,y_1)

         print(model.best_estimator_)
         print("Score: ",model.score(x_test,y_test))
```

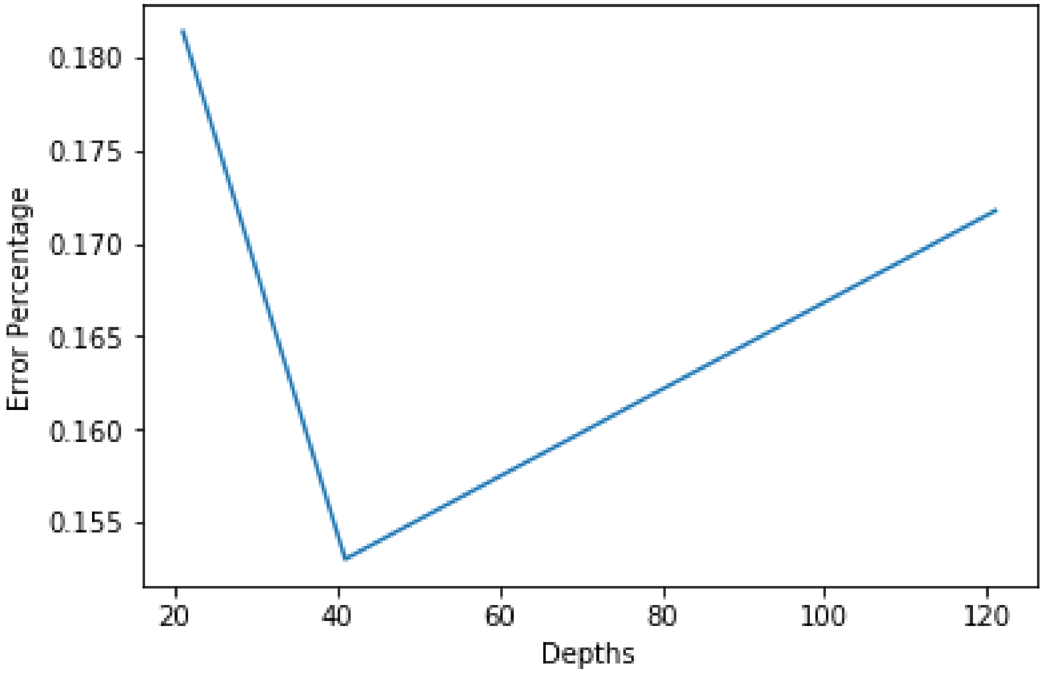
```
DecisionTreeClassifier(class_weight='balanced', criterion='gini',
            max_depth=61, max_features=None, max_leaf_nodes=None,
            min_impurity_split=1e-07, min_samples_leaf=1,
            min_samples_split=2, min_weight_fraction_leaf=0.0,
            presort=False, random_state=None, splitter='best')
Score:  0.911167653078
```

```
C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\grid_search.py:438: ChangedBehaviorWarning: T
  ChangedBehaviorWarning)
```

```
In [14]: best_DT_model = model.best_estimator_
         best_DT_model.fit(x_1,y_1)
         pred = best_DT_model.predict(x_test)
         confusionMatrix(y_test,pred)
```



```
In [7]: def plotCVvsErr(li_of_depths,x_test,y_test):
            #li_of_depths = [5,7,9,11]
            li_of_errors=[]
            for i in li_of_depths:
                model = DecisionTreeClassifier(max_depth=i,class_weight='balanced')
                model.fit(x_1,y_1)
                err_val = 1-model.score(x_test,y_test);
                li_of_errors.append(err_val)

            plt.plot(li_of_depths,li_of_errors)
            plt.xlabel('Depths')
            plt.ylabel('Error Percentage')
            plt.show()

In [20]: plotCVvsErr([21,41,121],x_test,y_test)
```



Observation: From the graph we can see that min Error is 0.1 at Depth 41, so best possible value of hyper parameter Depth is 41.

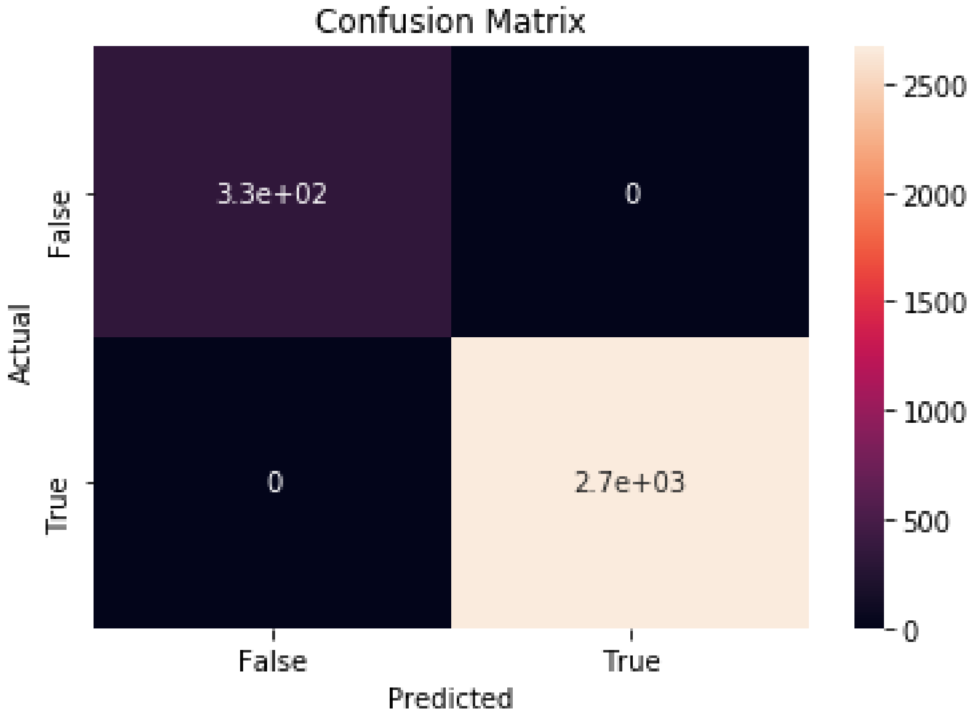
1.2 BOW DT

```
In [13]: x_1 = final_counts_train[0:10000]


         # this is only Score/rating  of data

         y_1 = convScores(train_data['Score'].get_values())[0:10000]

         x_test = final_counts_test[0:3000]
         y_test = convScores(test_data['Score'].get_values())[0:3000]

         #x_1, x_test, y_1, y_test = train_test_split(x,y, test_size=0.3, random_state=0)

         x_1 = convToNpArray(x_1)
         x_test = convToNpArray(x_test)
         y_1 = convToNpArray(y_1)
         y_test = convToNpArray(y_test)
```

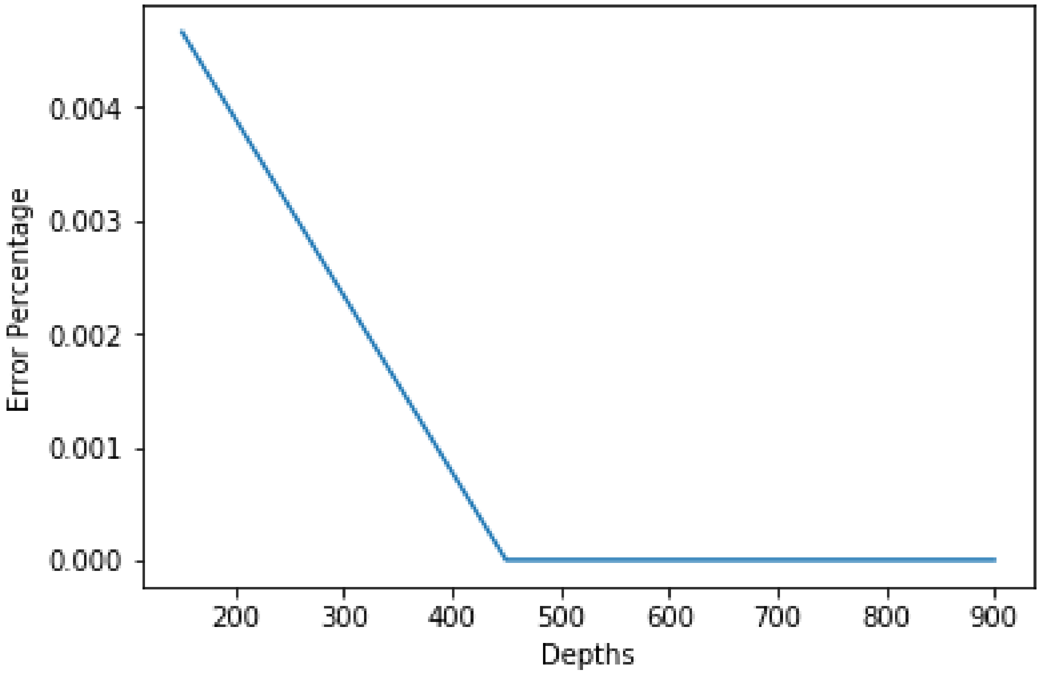
```
In [14]: tuned_parameters = {'max_depth':[151,450,600,900]}


         DT_model = DecisionTreeClassifier(class_weight='balanced')
         model = GridSearchCV(DT_model,tuned_parameters,
                              scoring='f1',cv=5,n_jobs=-1)

         model.fit(x_1,y_1)

         print(model.best_estimator_)
         print("Score: ",model.score(x_test,y_test))
```

```
DecisionTreeClassifier(class_weight='balanced', criterion='gini',
            max_depth=900, max_features=None, max_leaf_nodes=None,
            min_impurity_split=1e-07, min_samples_leaf=1,
            min_samples_split=2, min_weight_fraction_leaf=0.0,
            presort=False, random_state=None, splitter='best')
Score:  1.0


C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\grid_search.py:438: ChangedBehaviorWarning: T
  ChangedBehaviorWarning)
```

```
In [15]: best_DT_model = model.best_estimator_
         best_DT_model.fit(x_1,y_1)
         pred = best_DT_model.predict(x_test)
         confusionMatrix(y_test,pred)
```



```
In [34]: plotCVvsErr([151,450,600,900],x_test,y_test)
```



1.2.1 Important Features

```
In [33]: show_most_informative_features(count_vect,best_DT_model,10)
```

```
Top 10 Features:

great

best

love

delici

perfect

use

excel

nice

thought
```

```
good
```

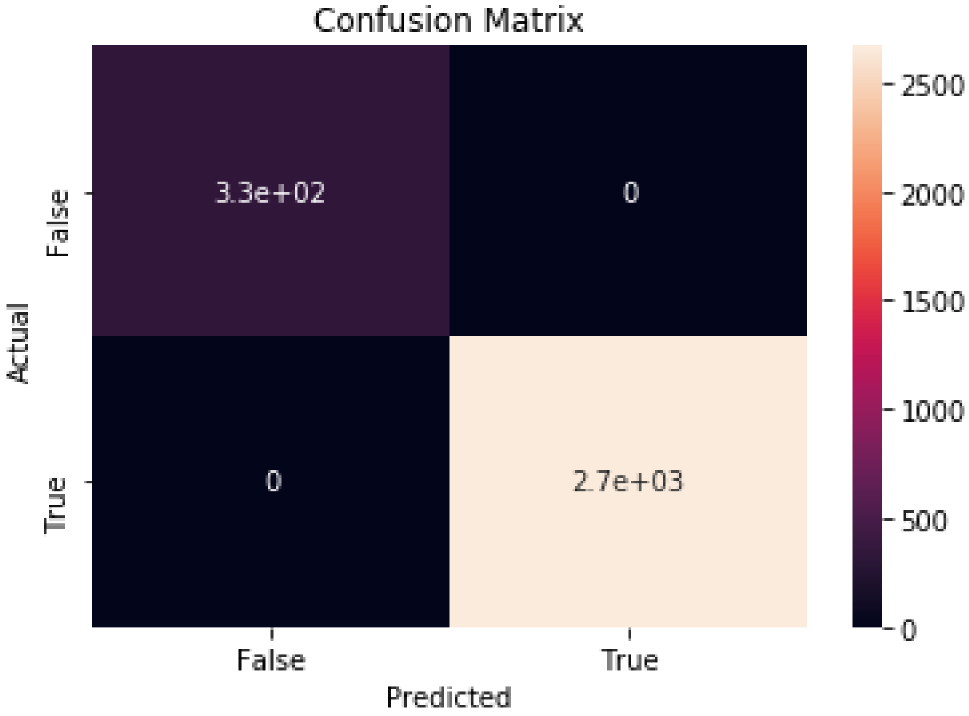
1.3 TFIDF DT

```
In [8]: x_1 = final_tf_idf_train[0:10000]

        y_1 = convScores(train_data['Score'].get_values())[0:10000]

        x_test = final_tf_idf_test[0:3000]
        y_test = convScores(test_data['Score'].get_values())[0:3000]

        x_1 = convToNpArray(x_1)
        x_test = convToNpArray(x_test)
        y_1 = convToNpArray(y_1)
        y_test = convToNpArray(y_test)
```

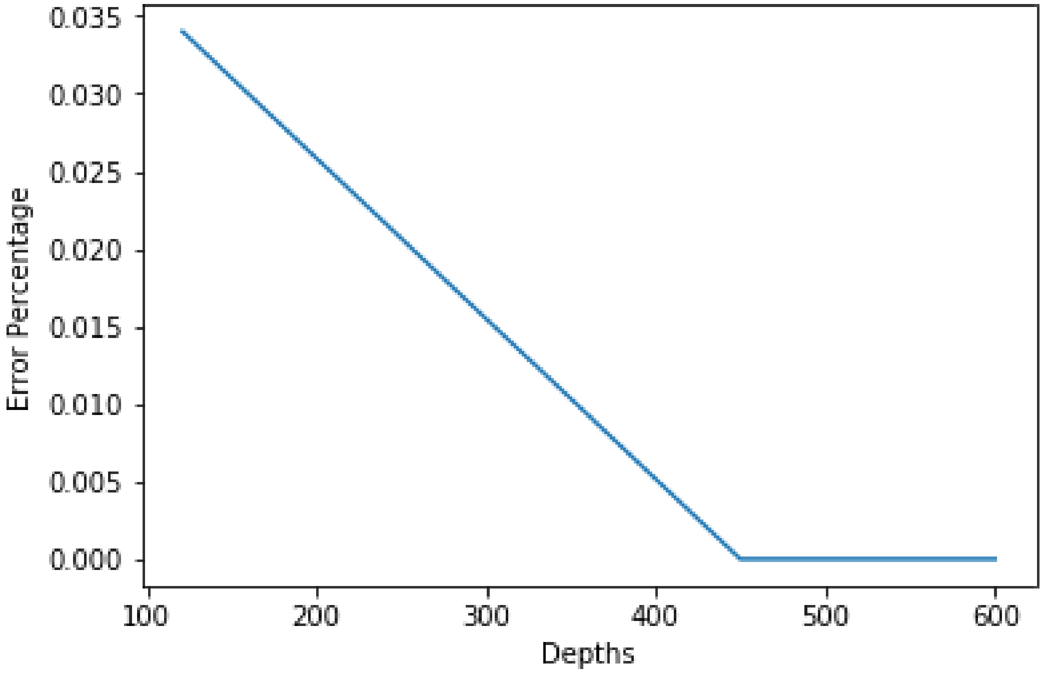
```
In [9]: tuned_parameters = {'max_depth':[151,451,651]}


        DT_model = DecisionTreeClassifier(class_weight='balanced')
        model = GridSearchCV(DT_model,tuned_parameters,
                             scoring='f1',cv=5,n_jobs=-1)

        model.fit(x_1,y_1)

        print(model.best_estimator_)
        print("Score: ",model.score(x_test,y_test))
```

```
DecisionTreeClassifier(class_weight='balanced', criterion='gini',
            max_depth=451, max_features=None, max_leaf_nodes=None,
            min_impurity_split=1e-07, min_samples_leaf=1,
            min_samples_split=2, min_weight_fraction_leaf=0.0,
            presort=False, random_state=None, splitter='best')
Score:  1.0


C:\Users\Dell\Anaconda3\lib\site-packages\sklearn\grid_search.py:438: ChangedBehaviorWarning:
  ChangedBehaviorWarning)
```

```
In [10]: best_DT_model = model.best_estimator_
         best_DT_model.fit(x_1,y_1)
         pred = best_DT_model.predict(x_test)
         confusionMatrix(y_test,pred)
```



```
In [28]: plotCVvsErr([121,450,600],x_test,y_test)
```



```
In [11]: show_most_informative_features(tf_idf_vect,best_DT_model,10)
```

```
Top 10 Features:

great

best

love

delici

perfect

good

tea

excel

nice

favorit
```

1.4 Important Features

Observation:

```
<tr>
    <th>Vectorizer</th>
    <th>Depth(Hyper Parameter)</th>

</tr>
<tr>
    <td>Avg W2v</td>
    <td>41</td>

</tr>
<tr>
    <td>BOW</td>
    <td>450</td>

</tr>
<tr>
    <td>TfIdf</td>
    <td>450</td>

</tr>
```