ted2-3

June 7, 2017

1 Exercise 2: Part 3

2 Import the necessary libraries and open the data set

```
In [215]: import pandas as pd
          import numpy as np
          from sklearn.model_selection import KFold
          from sklearn.tree import DecisionTreeClassifier
          from sklearn.ensemble import RandomForestClassifier
          from sklearn.cross_validation import train_test_split, ShuffleSplit, cross_val_score
          from sklearn import preprocessing
          from sklearn.naive_bayes import MultinomialNB
          from sklearn import svm
          from sklearn.metrics import accuracy_score
          import matplotlib.pyplot as plt
          import csv
          from math import log

          df = pd.read_csv('train.tsv', sep='\t')
          target = df["Label"]
```

3 Entropy Calculation Function

```
In [216]: def entropy(data):
              count = data.shape[0]
              if(count==0):
                  return 0
              good = len(data[data["Label"]==1])
              bad = len(data[data["Label"]==2])
              goodper = good / count
              badper = bad/count
              goodentropy =0.0
              if(good>0):
                  goodentropy = -(goodper*log(goodper, 2))
              badentropy =0.0
              if(bad>0):
                  badentropy = -(badper*log(badper, 2))
              entropy = goodentropy+badentropy
              return entropy
```

4 Calculate the train set's category.

```
In [217]: data_set_entropy=entropy(df)
          count = len(df)
```

5 Because those 3 numerical attributes have a big variety of values we have to convert them to categorical.

```
In [218]: Attributes = list(df.columns.values)
          Attributes.remove('Id')
          Attributes.remove('Label')

          ndf = df.copy()

          NumericalAttributes = ['Attribute2', 'Attribute5',  'Attribute13']
          for Attribute in NumericalAttributes:
              ndf[Attribute] = pd.qcut(df[Attribute], 5)
```

6 Calculate the Information Gain for each Attribute.

```
In [219]: Attributes = list(df.columns.values)
          Attributes.remove('Id')
          Attributes.remove('Label')

          InformationGain_list=[]
          for Attribute in Attributes:
              Attribute_values= list(ndf[Attribute].unique())
              attr_entropy = 0.0
              for value in Attribute_values:
                  value_set= ndf[ndf[Attribute]==value]
                  attr_entropy += (len(value_set)/count)*entropy(value_set)
              InformationGain_list.append((Attribute, data_set_entropy-attr_entropy))
```

7 Sort the Information Gain List, convert the categorical to numerical.

```
In [220]: InformationGain_list.sort(key=lambda tup: tup[1])

          categories = ["Attribute1","Attribute3","Attribute4","Attribute6","Attribute7","Attrib
          target = df["Label"]
```

```
new_df = df.copy()
for x in categories:
    converted = pd.Categorical(df[x])
    new_df[x] = converted.codes
```

8 Print the Array with the Attribute Removal Queue and the Information Gain for each one.

```
In [221]: for n in range(len(InformationGain_list)):
              print('Exclude No: ',n,' \tAttribute: ', InformationGain_list[n][0],' \tInformatio
```

```
Exclude No:  0          Attribute:  Attribute18          Information Gain:  0.000129665701927850
Exclude No:  1          Attribute:  Attribute11          Information Gain:  0.000220571349274112
Exclude No:  2          Attribute:  Attribute19          Information Gain:  0.001202862591077602
Exclude No:  3          Attribute:  Attribute16          Information Gain:  0.002395770112591733
Exclude No:  4          Attribute:  Attribute17          Information Gain:  0.002940316631288131
Exclude No:  5          Attribute:  Attribute10          Information Gain:  0.005674399790160045
Exclude No:  6          Attribute:  Attribute14          Information Gain:  0.007041506325139002
Exclude No:  7          Attribute:  Attribute8          Information Gain:  0.007330500076830004
Exclude No:  8          Attribute:  Attribute20          Information Gain:  0.007704386546436126
Exclude No:  9          Attribute:  Attribute15          Information Gain:  0.011618886823694607
Exclude No:  10          Attribute:  Attribute13          Information Gain:  0.0117447128999153
Exclude No:  11          Attribute:  Attribute9          Information Gain:  0.012746841156174304
Exclude No:  12          Attribute:  Attribute7          Information Gain:  0.014547865230223445
Exclude No:  13          Attribute:  Attribute12          Information Gain:  0.014905530877295540
Exclude No:  14          Attribute:  Attribute5          Information Gain:  0.015294038701320956
Exclude No:  15          Attribute:  Attribute6          Information Gain:  0.0221989660524343 2
Exclude No:  16          Attribute:  Attribute4          Information Gain:  0.026897452033083 69
Exclude No:  17          Attribute:  Attribute2          Information Gain:  0.031782332193863394
Exclude No:  18          Attribute:  Attribute3          Information Gain:  0.03788940622151615
Exclude No:  19          Attribute:  Attribute1          Information Gain:  0.09382796302345509
```

9 Loop where we remove an attribute each time, we do 10-fold cross validation and we record the accuracy.

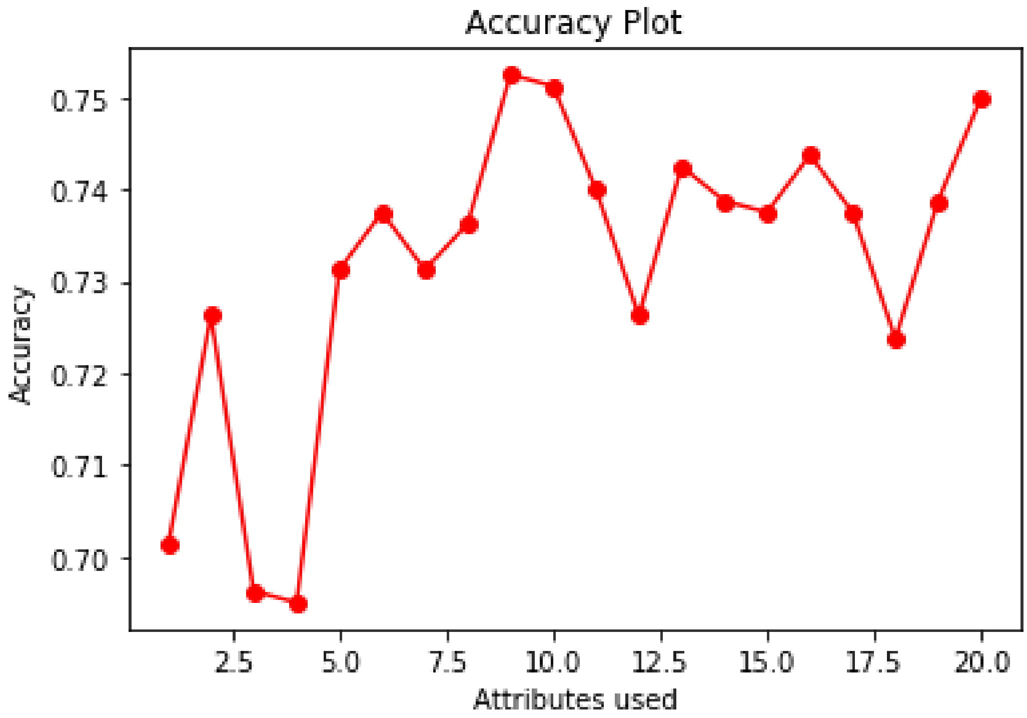
10 We keep the max accuracy in order to use it in testSet_Predictions.

```
In [222]: kf = KFold(n_splits=10)

          cutted_df = df.copy()
          exclude=["Id", "Label"]
          xlist =[]
          ylist =[]
          max = 0.0
          maxcount =0
```

```
for count in range(len(InformationGain_list)):
    if(count>0):
        attr = InformationGain_list[count-1][0]
        exclude.append(attr)

    my_df = new_df.copy()

    excl =df.columns.difference(exclude)
    new_df_to_use = new_df[excl]

    xlist.append(len(InformationGain_list)-count)
    RANDOM_STATE = 123

    accuracy = 0.0

    for x,y in kf.split(new_df_to_use):
        test = new_df_to_use.loc[y,new_df_to_use.columns]
        train = new_df_to_use.loc[x, new_df_to_use.columns]
        current_target = target[x]

        classifier= RandomForestClassifier(random_state=RANDOM_STATE)
        clf = classifier.fit(train,current_target)
        yPred = clf.predict(test)
        acc = accuracy_score(target[y], yPred)
        accuracy += acc

    accuracyRF = accuracy/10
    if(max < accuracyRF):
        max = accuracyRF
        maxcount =len(InformationGain_list)-count
    ylist.append(accuracyRF)
```

11 Show the Accuracy Plot

In [223]:
```
plt.plot(xlist, ylist, "ro-")
plt.title('Accuracy Plot')
plt.ylabel('Accuracy')
plt.xlabel('Attributes used')
plt.show()
```



12 We create the exclude list in order to get the max accuracy by removing them.

```
In [224]: exclude=["Id", "Label"]
          for count in range(maxcount):
              if(count>0):
                  attr = InformationGain_list[count-1][0]
                  exclude.append(attr)
```

13 Open test.tsv convert its attributes to numerical and cut the attributes we don't need.

```
In [225]: dfT = pd.read_csv('test.tsv', sep='\t')
          categories = ["Attribute1","Attribute3","Attribute4","Attribute6","Attribute7","Attrib
          new_dfT = dfT.copy()

          IDs = dfT["Id"]
          for x in categories:
              converted = pd.Categorical(dfT[x])
              new_dfT[x] = converted.codes
```

```
excl =df.columns.difference(exclude)
new_df_to_use = new_df[excl]

dfneT =dfT.columns.difference(exclude)
new_dfT = new_dfT[dfneT]

category_dict = {1:'Good', 2:'Bad'}
```

14 Call the Random Forest Classifier, as he had the best accuracy.

15 Print the results in the testSet_Predictions.csv.

In [226]:

```
classifier = RandomForestClassifier(random_state=RANDOM_STATE)
classifier.fit(new_df_to_use, target)
prediction = classifier.predict(new_dfT)

id =0
with open('testSet_categories_Predictions.csv', 'w') as csvfile:
    fieldnames = ['ID', 'Label']
    writer = csv.DictWriter(csvfile, fieldnames = fieldnames, delimiter='\t')
    writer.writeheader()
    for i in range(len(prediction)):
        writer.writerow({'ID': IDs[i], 'Label': category_dict[prediction[i]]})
        id +=1
print('Created testSet_categories_Predictions.csv')
```

```
Created testSet_categories_Predictions.csv
```