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February 20, 2020

1 Compute performance metrics for the given Y and Y_score without sklearn

1.1 Imports

[1]:
```
import numpy as np
import pandas as pd
# other than these two you should not import any other packages
```

1.2 Defining Reusable Function

[25]:
```
def confusion_matrix(y_array,y_pred_array):
    tp,tn,fp,fn = 0,0,0,0
    for y, y_pred in zip(y_array,y_pred_array):
        if y == y_pred:
            if y_pred == 1:
                tp += 1
            else:
                tn += 1
        else:
            if y_pred == 1:
                fp += 1
            else:
                fn += 1
    return [[tn,fn],[fp,tp]]

def precision_func(conf):
#   correctly predicted +ve points/ total predicted + ve points
    tp = conf[1][1]
    fp = conf[1][0]
    return tp / (tp + fp)

def recall_func(conf):
#   Correctly predicted +ve points / total positive points
    tp = conf[1][1]
```

```
    fn = conf[0][1]
    return tp / (fn+tp)

def f1_score(precision,recall):
    return 2* ( (precision * recall) / (precision + recall) )

def accuracy(conf):
    correct = conf[1][1] + conf[0][0]
    total = sum(conf[0]) + sum(conf[1])
    return correct / total


import matplotlib.pyplot as plt
%matplotlib inline
def auc_score(y,proba):
    tau = 0
    tpr =[]
    fpr = []
    for ele in proba:
        y_pred = np.where(proba >= ele ,1,0)
        conf = confusion_matrix(y,y_pred)
        tpr.append(conf[1][1] / (conf[1][1] + conf[0][1]))
        fpr.append(conf[1][0] / (conf[1][0] + conf[0][0]))

    fig,axes = plt.subplots(nrows=1,ncols=1)
    axes.plot(np.array(fpr),np.array(tpr))
    axes.set_xlabel('FPR')
    axes.set_ylabel('TPR')
    axes.set_title('AUC Score')
    return np.trapz( np.array(tpr),np.array(fpr))
```

2 Solving the assignment

2.1 A

2.1.1 Question

y_pred = [0 if y_score < 0.5 else 1]

2.1.2 Solution

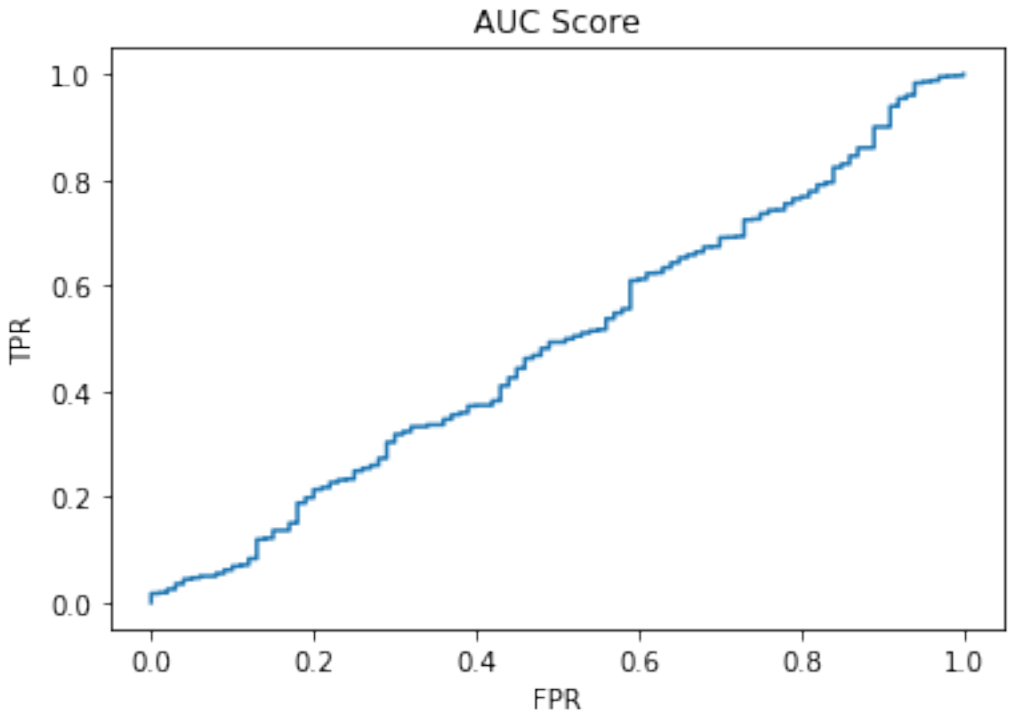
[26]:
```
# write your code here
df = pd.read_csv('/home/parth/AppliedAI/assignments/7 Compute Performance␣
 ↪metrics without Sklearn/5_a.csv')
```

```
df['y_pred'] = df['proba'].apply(lambda x: 1 if x > 0.5 else 0)
df.sort_values(by=['proba'],ascending=False,inplace=True)
df.head().transpose()
```

[26]:

	1664	2099	1028	9592	8324
y	1.000000	1.000000	1.000000	1.000000	1.000000
proba	0.899965	0.899828	0.899825	0.899812	0.899768
y_pred	1.000000	1.000000	1.000000	1.000000	1.000000

[27]:
```
conf = confusion_matrix(df['y'].values , df['y_pred'].values)
pre = precision_func(conf)
rec = recall_func(conf)
f1 = f1_score(pre,rec)
acc = accuracy(conf)
auc = auc_score(df['y'].values,df['proba'].values)
```



[28]:
```
print('Confusion Matrix \n',conf)
print('\nPrecision\n',pre)
print('\nRecall\n',rec)
print('\nF1 Score\n',f1)
print('\nAccuracy \n', acc)
print('\nAuc Score \n',auc)
```

```
Confusion Matrix
```

```
 [[0, 0], [100, 10000]]

Precision
 0.9900990099009901

Recall
 1.0

F1 Score
 0.9950248756218906

Accuracy
 0.9900990099009901

Auc Score
 0.48829900000000004
```

2.2 B

2.2.1 Question

```
  y_pred =  [0  if y_score < 0.5 else  1]
```

2.2.2 Solution

[29]:
```
df = pd.read_csv('/home/parth/AppliedAI/assignments/7 Compute Performance␣
 ↪metrics without Sklearn/5_b.csv')
df['y_pred'] = df['proba'].apply(lambda x: 1 if x > 0.5 else 0)
df.sort_values(by=['proba'],ascending=False,inplace=True)
df.head().transpose()
```

[29]:

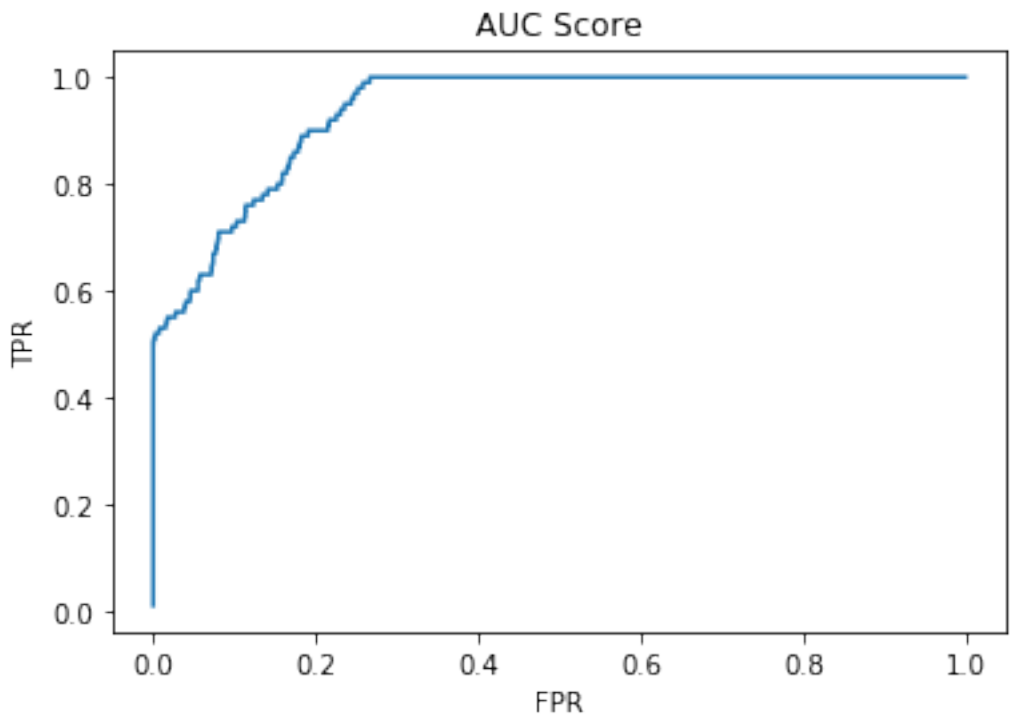
	8446	1978	1657	110	8578
y	1.000000	1.000000	1.000000	1.000000	1.000000
proba	0.595294	0.594808	0.592198	0.590171	0.588718
y_pred	1.000000	1.000000	1.000000	1.000000	1.000000

[30]:
```
# write your code
conf = confusion_matrix(df['y'].values,df['y_pred'].values)

f1 = f1_score(precision_func(conf),recall_func(conf))

auc = auc_score(df['y'].values,df['proba'].values)

acc = accuracy(conf)
```



[31]:
```
print('Confsion Matrix')
print(conf)
print('F1 Score')
print(f1)
print('Auc Score')
print(auc)
print('Accuracy')
print(acc)
```

```
Confsion Matrix
[[9761, 45], [239, 55]]
F1 Score
0.2791878172588833
Auc Score
0.9377570000000001
Accuracy
0.9718811881188119
```

2.3 C

2.3.1 Question

C. Compute the best threshold (similarly to ROC curve computation) of probability which gives lowest values of metric A for the given data 5_c.csv

you will be predicting label of a data points like this: y_pred = [0 if y_score < 0.5 else 1]

A = 500 x number of false negative + 100 x number of false positive

2.3.2 Solution

[9]:
```
df = pd.read_csv('/home/parth/AppliedAI/assignments/7 Compute Performance␣
 ↪metrics without Sklearn/5_c.csv')
df['y_pred'] = df['prob'].apply(lambda x: 1 if x > 0.5 else 0)
df.sort_values(by=['prob'],ascending=False,inplace=True)
df.reset_index(inplace=True)
df.head().transpose()
```

[9]:

	0	1	2	3	4
index	2634.000000	2548.000000	2447.000000	2788.000000	2456.000000
y	1.000000	1.000000	1.000000	1.000000	1.000000
prob	0.957747	0.951437	0.948638	0.944094	0.941113
y_pred	1.000000	1.000000	1.000000	1.000000	1.000000

[10]:
```
 # write your code
def auc_score_conf(y,proba):
    tau = 0
    conf = []
    for ele in proba:
        y_pred = np.where(proba >= ele ,1,0)
        conf.append(confusion_matrix(y,y_pred))
    return conf

conf_list = auc_score_conf(df['y'].values,df['prob'].values)
```

[11]:
```
A = []
for conf in conf_list:
    A.append((500 * conf[0][1]) + (100 * conf[1][0]) )
x = np.array(A)
print('Lowest Value of A')
print(x.min())
print('The threshold value is')
print(df['prob'].loc[x.argmin()])
```

```
Lowest Value of A
141000
```

```
The threshold value is
0.2300390278970873
```

2.4 D

2.4.1 Question

2.4.2 Solution

[12]:
```
df = pd.read_csv('/home/parth/AppliedAI/assignments/7 Compute Performance␣
↪metrics without Sklearn/5_d.csv')
df.head().transpose()
```

[12]:

	0	1	2	3	4
y	101.0	120.0	131.0	164.0	154.0
pred	100.0	100.0	113.0	125.0	152.0

[13]:
```
# Mean Square Error
def mse(y,pred):
    return sum(((y -pred )**2))/len(y)

# MAPE
def mape(y,pred):
    return sum(np.absolute(y-pred))/sum(y)

# R Squared
def r_squared(y,pred):
    mean = np.mean(y)
    ss_t = sum((y-mean)**2)
    ss_r = sum((y-pred)**2)
    return 1- ((ss_r)/(ss_t))
```

[14]:
```
print('Mean Square Error')
print(mse(df['y'].values,df['pred'].values))

print('MAPE')
print(mape(df['y'].values,df['pred'].values))

print('R Squared')
print(r_squared(df['y'].values,df['pred'].values))
```

```
Mean Square Error
177.16569974554707
MAPE
0.1291202994009687
R Squared
0.9563582786990964
```