Compute performance metrics for the given Y and Y_score without sklearn

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

A. Compute performance metrics for the given data '5_a.csv'

Note 1: in this data you can see number of positive points >> number of negatives points
Note 2: use pandas or numpy to read the data from **5_a.csv**
Note 3: you need to derive the class labels from given score

1. Compute Confusion Matrix
2. Compute F1 Score
3. Compute AUC Score, you need to compute different thresholds and for each threshold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_array) https://stackoverflow.com/q/53603376/4084039, https://stackoverflow.com/a/39678975/4084039 Note: it should be numpy.trapz(tpr_array, fpr_array) not numpy.trapz(fpr_array, tpr_array)
Note- Make sure that you arrange your probability scores in descending order while calculating AUC
4. Compute Accuracy Score

In [2]:
```
df_a=pd.read_csv('5_a.csv')
threshold = 0.5
df_a.head(5)
```

Out[2]:

	y	proba
0	1.0	0.637387
1	1.0	0.635165
2	1.0	0.766586
3	1.0	0.724564
4	1.0	0.889199

In [3]:
```
def Y_pred(df_a,threshold):
    y_pred = []
    for index in range(len(df_a)):
        if  df_a['proba'][index] < threshold:
            y_pred.append('0')
        else:
            y_pred.append('1')
    df_a['y_pred'] = y_pred
    return(df_a)
```

In [4]:
```
def confusion_matix(df_a,threshold):
    df_a = Y_pred(df_a,threshold)
    TN = 0
    FN = 0
    TP = 0
    FP = 0
    for y in range(len(df_a)):
        if((df_a['y'][y]== 0) and (df_a['y_pred'][y]== '0')):
            TN += 1
        elif((df_a['y'][y]== 1) and (df_a['y_pred'][y]=='0')):
            FN += 1
        elif((df_a['y'][y]== 0) and (df_a['y_pred'][y]== '1')):
            FP += 1
        elif((df_a['y'][y]== 1) and (df_a['y_pred'][y]== '1')):
            TP += 1
    return({"confusion_matix":[{"TN":TN,"FN":FN,"FP":FP,"TP":TP}]})
```

In [5]:
```
def F_1_score(df_a,threshold):
    result = confusion_matix(df_a,threshold)
    precision = result['confusion_matix'][0]['TP']/(result['confusion_matix'][0]['TP']+result['confusion_matix'
    value_y = df_a.y.value_counts()
    recall = result['confusion_matix'][0]['TP'] / value_y[1]
    F_1_Score = 2*(precision * recall)/(precision + recall)
    return({"F_1_score":F_1_Score,"precision":precision,"recall":recall})
```

In [6]:
```
from tqdm import tqdm
def auc(df_a):
    df_a = df_a.sort_values(by='proba',ascending=False)
    df_a.reset_index(drop=True, inplace=True)
    value_y = df_a.y.value_counts()
    P_ve = value_y[1]
    N_ve = value_y[0]
    TPR = []
    FPR = []
    for index in tqdm(range(len(df_a))):
        threshold = df_a['proba'][index]
        result = confusion_matix(df_a,threshold)
        TPR.append(result['confusion_matix'][0]['TP'] / P_ve)
        FPR.append(result['confusion_matix'][0]['FP'] / N_ve)
        df_a.drop(columns=['y_pred'])
    AUC = np.trapz(TPR,FPR)
    x = FPR
    y = TPR
    plt.plot(x, y)
    plt.xlabel('FPR')
    plt.ylabel('TPR')
    plt.show()
    return({"AUC":AUC})
```

In [7]:
```
def accuracy_score(df_a,threshold):
    result = confusion_matix(df_a,threshold)
    Accuracy_Score = (result['confusion_matix'][0]['TP']+result['confusion_matix'][0]['TN'])/len(df_a)
    return({"Accuracy_Score":Accuracy_Score})
```

In [8]:
```
confusion_matix(df_a,threshold)
```

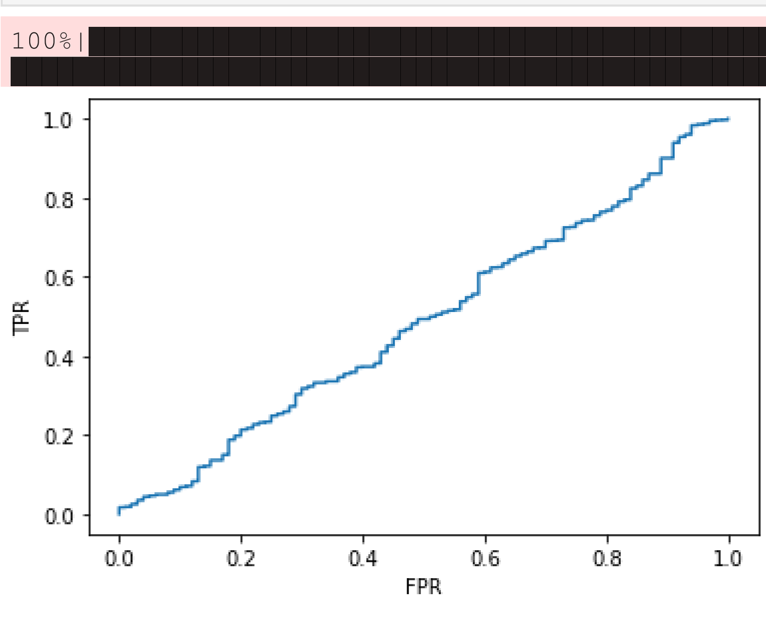
Out[8]:
```
{'confusion_matix': [{'TN': 0, 'FN': 0, 'FP': 100, 'TP': 10000}]}
```

In [9]:
```
 F_1_score(df_a,threshold)
```

Out[9]:
```
{'F_1_score': 0.9950248756218906,
 'precision': 0.9900990099009901,
 'recall': 1.0}
```

In [10]:
```
result = auc(df_a)
result["AUC"]
```

```
100%|██████████████████████████████| 10100/10100 [1:21:24<00:00,  2.07it/s]
```



Out[10]:
```
0.48829900000000004
```

In [11]:
```
accuracy_score(df_a,threshold)
```

Out[11]:
```
{'Accuracy_Score': 0.9900990099009901}
```

B. Compute performance metrics for the given data '5_b.csv'

Note 1: in this data you can see number of positive points << number of negatives points
Note 2: use pandas or numpy to read the data from **5_b.csv**
Note 3: you need to derive the class labels from given score

1. Compute Confusion Matrix
2. Compute F1 Score
3. Compute AUC Score, you need to compute different thresholds and for each threshold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_array) https://stackoverflow.com/q/53603376/4084039, https://stackoverflow.com/a/39678975/4084039
Note- Make sure that you arrange your probability scores in descending order while calculating AUC
4. Compute Accuracy Score

In [12]:
```
df_b=pd.read_csv('5_b.csv')
threshold = 0.5
df_b.head(5)
```

Out[12]:

	y	proba
0	0.0	0.281035
1	0.0	0.465152
2	0.0	0.352793
3	0.0	0.157818
4	0.0	0.276648

In [13]:
```
confusion_matix(df_b,threshold)
```

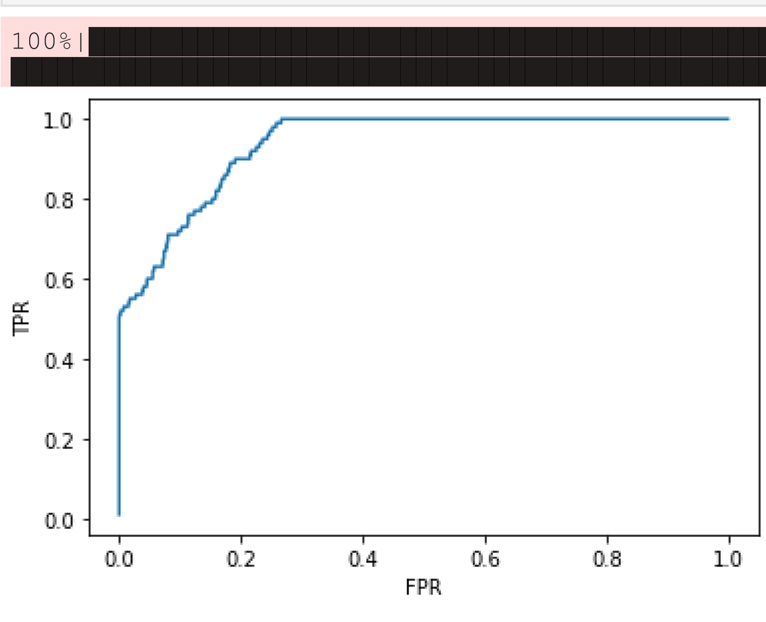
Out[13]:
```
{'confusion_matix': [{'TN': 9761, 'FN': 45, 'FP': 239, 'TP': 55}]}
```

In [14]:
```
F_1_score(df_b,threshold)
```

Out[14]:
```
{'F_1_score': 0.2791878172588833,
 'precision': 0.1870748299319728,
 'recall': 0.55}
```

In [15]:
```
result = auc(df_b)
result["AUC"]
```

```
100%|██████████████████████████████| 10100/10100 [1:11:00<00:00,  2.37it/s]
```



Out[15]:
```
0.9377570000000001
```

In [16]:
```
accuracy_score(df_b,threshold)
```

Out[16]:
```
{'Accuracy_Score': 0.9718811881188119}
```

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

you will be predicting label of a data points like this:

Note 1: in this data you can see number of negative points > number of positive points
Note 2: use pandas or numpy to read the data from **5_c.csv**

In [17]:
```
df_c=pd.read_csv('5_c.csv')
df_c.head(5)
```

Out[17]:

	y	prob
0	0	0.458521
1	0	0.505037
2	0	0.418652
3	0	0.412057
4	0	0.375579

In [18]:
```
df_c = df_c.rename({'prob': 'proba'}, axis=1)
```

In [19]:
```
from tqdm import tqdm
def matrix(df_a):
    df_a = df_a.sort_values(by='proba',ascending=False)
    df_a.reset_index(drop=True, inplace=True)
    value_y = df_a.y.value_counts()
    P_ve = value_y[1]
    N_ve = value_y[0]
    MA = {}
    for index in tqdm(range(len(df_a))):
        threshold = df_a['proba'][index]
        result = confusion_matix(df_a,threshold)
        m_value = (500*result['confusion_matix'][0]['FN'])+(100*result['confusion_matix'][0]['FP'])
        MA[threshold] = m_value
    df_a.drop(columns=['y_pred'])
    return({"Matric":MA})
```

In [20]:
```
values_mat = matrix(df_c)
min_value = min(values_mat['Matric'].values())
for y,x in values_mat['Matric'].items():
    if min_value == x:
        print(y,":",x)
```

```
100%|██████████████████████████████| 2852/2852 [08:25<00:00,  5.64it/s]
0.2300390278970873 : 141000
```

D. Compute performance metrics(for regression) for the given data 5_d.csv

Note 2: use pandas or numpy to read the data from **5_d.csv**
Note 1: **5_d.csv** will having two columns Y and predicted_Y both are real valued features

1. Compute Mean Square Error
2. Compute MAPE: https://www.youtube.com/watch?v=ly6ztgIkUxk
3. Compute R^2 error: https://en.wikipedia.org/wiki/Coefficient_of_determination#Definitions

In [21]:
```
df_d=pd.read_csv('5_d.csv')
df_d.head(5)
```

Out[21]:

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

In [22]:
```
def error(df):
    error_value = []
    for index in tqdm(range(len(df))):
        error_value.append(df['y'][index] - df['pred'][index])
    df['error'] = error_value
    return(df)
```

In [23]:
```
def mean_square_error(df):
    df = error(df)
    sum_value = 0
    for index in range(len(df)):
        sum_value += (df['error'][index])**2
    return({"mean_square_error":sum_value/index})
```

In [24]:
```
mean_square_error(df_d)
```

```
100%|██████████████████████████████| 157200/157200 [00:04<00:00, 32808.49it/s]
```

Out[24]:
```
{'mean_square_error': 177.1668267609845}
```

In [25]:
```
def MAPE(df):
    sum_error, sum_y = 0 , 0
    for index in tqdm(range(len(df))):
        sum_error += abs(df['error'][index])
        sum_y += abs(df['y'][index])
    mape = (sum_error/sum_y)
    return({"mape":mape})
```

In [26]:
```
MAPE(df_d)
```

```
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```

Out[26]:
```
{'mape': 0.1291202994009687}
```

In [27]:
```
def R_2_error(df):
    ss_res, ss_tot = 0 , 0
    y_mean = df['y'].mean()
    for index in tqdm(range(len(df))):
        ss_res += (abs(df['error'][index]))**2
        ss_tot += (abs(df['y'][index])-y_mean)**2
    R_2_error = 1-(ss_res/ss_tot)
    return({"R_2_error":R_2_error})
```

In [28]:
```
R_2_error(df_d)
```

```
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```

Out[28]:
```
{'R_2_error': 0.9563582786990964}
```