Compute performance metrics for the given Y and Y_score without sklearn

In [197]:

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

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

$y^{pred}= \text{[0 if y_score < 0.5 else 1]}$

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)
4. Compute Accuracy Score

In [198]:

```
pwd
```

Out[198]:

```
'C:\\Users\\Abhishek\\Downloads'
```

In [199]:

```
cd C:\Users\Abhishek\Downloads
```

```
C:\Users\Abhishek\Downloads
```

In [200]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')
```

In [201]:

```
df=pd.read_csv('5_a.csv')
```

In [202]:

```
df.head()
```

Out[202]:

	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 [203]:

```
df['y~']=[1 if x>0.5 else 0 for x in df['proba']]
```

In [204]:

```
df.head()
```

Out[204]:

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

In [205]:

```
def true_positive(y_true,y_pred):
    tp=0
    for yt,yp in zip(y_true,y_pred):
        if yt==1 and yp==1:
            tp+=1
    return tp
```

In [206]:

```
def false_positive(y_true,y_pred):
    fp=0
    for yt,yp in zip(y_true,y_pred):
        if yp==1 and yt==0:
            fp+=1
    return fp
```

In [207]:

```
def true_negative(y_true,y_pred):
    tn=0
    for yt,yp in zip(y_true,y_pred):
        if yp==0 and yt==0:
            tn+=1
    return tn
```

In [208]:

```
def false_negative(y_true,y_pred):
    fn=0
    for yt,yp in zip(y_true,y_pred):
        if yt==1 and yp==0:
            fn+=1
    return fn
```

1.Printing the confusion matrix

In [209]:

```
print('True Positive :',true_positive(df['y'],df['y~']))
print('True Negative :',true_negative(df['y'],df['y~']))
print('False Positive :',false_positive(df['y'],df['y~']))
print('False Negative :',false_negative(df['y'],df['y~']))
```

```
True Positive : 10000
True Negative : 0
False Positive : 100
False Negative : 0
```

In [ ]:

```

```

In [210]:

```
def recall(y_true,y_pred):
    tp=true_positive(y_true,y_pred)
    fn=false_negative(y_true,y_pred)
    return tp/(tp+fn)
```

In [211]:

```
def precision(y_true,y_pred):
    tp=true_positive(y_true,y_pred)
    fp=false_positive(y_true,y_pred)
    return tp/(tp+fp)
```

In [212]:

```
def f1_score(y_true,y_pred):
    pr=precision(y_true,y_pred)
    re=recall(y_true,y_pred)
    f1_scores=(2*(pr*re))/(pr+re)
    return f1_scores
```

F1 Score

In [213]:

```
print('F1 Score :',f1_score(df['y'],df['y~']))
```

```
F1 Score : 0.9950248756218906
```

In [ ]:

```

```

In [214]:

```
df.sort_values(['proba'],ascending=False,inplace=True)
df.head()
df = df.reset_index(drop=True)
df.head()
```

Out[214]:

	y	proba	y~
0	1.0	0.899965	1

	y	proba	y~
1	1.0	0.899828	1
2	1.0	0.899825	1
3	1.0	0.899812	1
4	1.0	0.899768	1

In [215]:

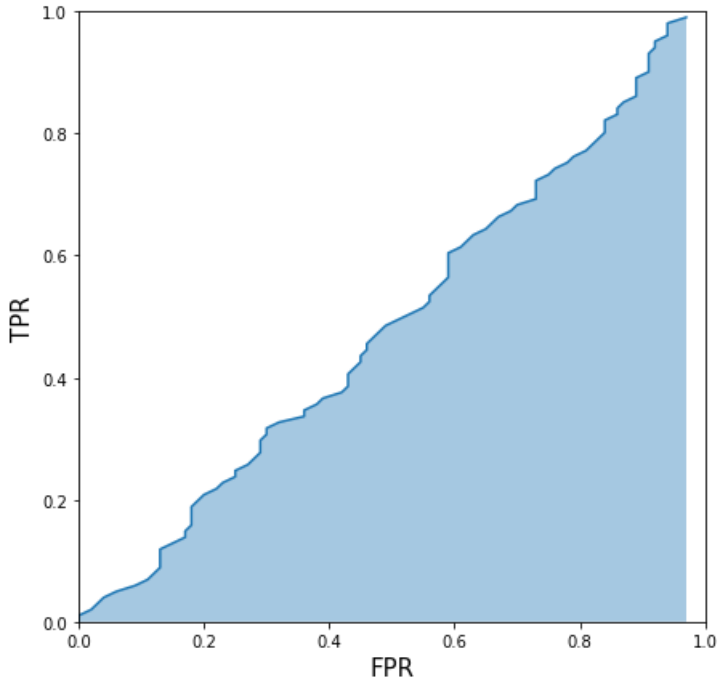
```
def cal_tpr_fpr(y_true,y_pred):
    tpr_list=[]
    fpr_list=[]
    for i in range(0,len(df['proba']),1):
        thres=df.loc[i,'proba']
        temp_prediction=[1 if x>thres else 0 for x in y_pred]
        tpr=true_positive(y_true,temp_prediction)/10000
        fpr=false_positive(y_true,temp_prediction)/100
        tpr_list.append(tpr)
        fpr_list.append(fpr)
    return tpr_list,fpr_list
```

In [216]:

```
tpr=[]
fpr=[]
tpr_count=0
fpr_count=0
for i in range(0,len(df),100):
    thres=df.loc[i,'proba']
    #print(thres)
    df['y~']=df.proba.apply(lambda x: 1 if x>=thres else 0)
    tpr_count=len(df[(df['y']==1) & df['y~']==1])
    fpr_count=len(df[ (df['y']==0) & (df['y~']==1)])
    tpr.append(tpr_count/10000)
    fpr.append(fpr_count/100)
```

In [217]:

```
plt.figure(figsize=(7,7))
plt.fill_between(fpr,tpr,alpha=0.4)
plt.plot(fpr,tpr)
plt.xlim(0,1.0)
plt.ylim(0,1.0)
plt.xlabel('FPR',fontsize=15)
plt.ylabel('TPR',fontsize=15)
plt.show()
```



In [218]:

```
sums=0;
for i in range(1,len(tpr)):
    sums+=( (fpr[i]-fpr[i-1]) * (tpr[i]+tpr[i-1]) )/2
print(sums)
```

```
0.4580424999999999
```

Roc Score

In [219]:

```
print('Roc Score is: ',sums)
```

```
Roc Score is:  0.4580424999999999
```

In [ ]:

```

```

Accuracy

In [220]:

```
TP=true_positive(df['y'],df['y~'])
TN=true_negative(df['y'],df['y~'])
FP=false_positive(df['y'],df['y~'])
FN=false_negative(df['y'],df['y~'])
acc=(TP+TN)/(TP+TN+FP+FN)
print(acc)
```

```
0.9808910891089109
```

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

$y^{pred}= \text{[0 if y_score < 0.5 else 1]}$

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
4. Compute Accuracy Score

In [221]:

```
df=pd.read_csv('5_b.csv')
df.head()
```

Out[221]:

	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 [222]:

```
df['y'].value_counts()
```

Out[222]:

```
0.0    10000
1.0      100
Name: y, dtype: int64
```

In [223]:

```
df['y~']=df['proba'].apply(lambda x: 1 if x>0 else 0 )
```

1 Printing the confusion matrix

In [224]:

```
print('True Positive :',true_positive(df['y'],df['y~']))
print('True Negative :',true_negative(df['y'],df['y~']))
print('False Positive :',false_positive(df['y'],df['y~']))
print('False Negative :',false_negative(df['y'],df['y~']))
```

```
True Positive : 100
True Negative : 0
False Positive : 10000
False Negative : 0
```

In [ ]:

```

```

2. F1 Score

In [225]:

```
print('F1 Score :',f1_score(df['y'],df['y~']))
```

```
F1 Score : 0.0196078431372549
```

In [ ]:

```

```

In [226]:

```
df.sort_values(['proba'],ascending=False,inplace=True)
df=df.reset_index(drop=True)
df.head()
```

Out[226]:

	y	proba	y~

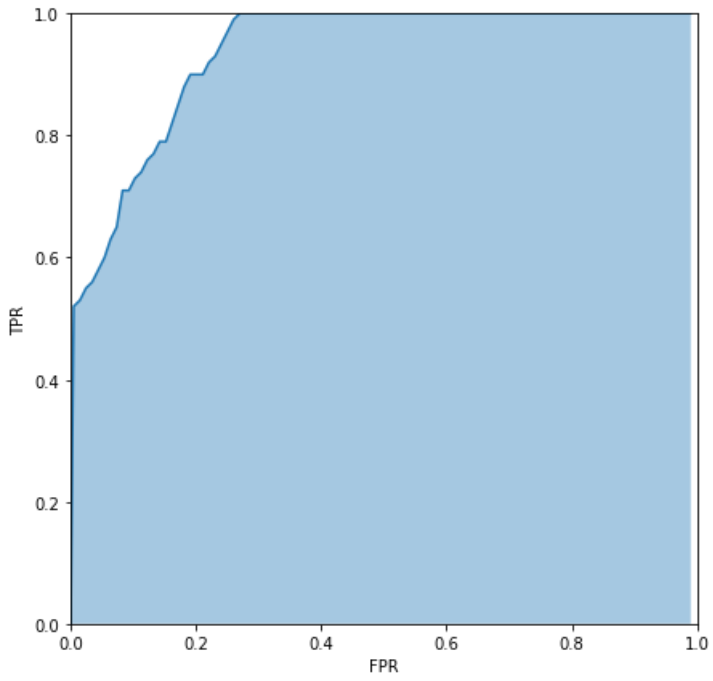
	y	proba	y~
0	1.0	0.595294	1
1	1.0	0.594808	1
2	1.0	0.592198	1
3	1.0	0.590171	1
4	1.0	0.588718	1

In [227]:

```
tpr=[]
fpr=[]
tpr_count=0
fpr_count=0
for i in range(0,len(df),100):
    thres=df.loc[i,'proba']
    df['y~']=df.proba.apply(lambda x: 1 if x>thres else 0)
    tpr_count=len(df[(df['y']==1) & (df['y~']==1)])
    fpr_count=len(df[(df['y']==0) & (df['y~']==1)])
    tpr.append(tpr_count/100)
    fpr.append(fpr_count/10000)
```

In [228]:

```
plt.figure(figsize=(7,7))
plt.fill_between(fpr,tpr,alpha=0.4)
plt.plot(fpr,tpr)
plt.xlim(0,1.0)
plt.ylim(0,1.0)
plt.xlabel('FPR')
plt.ylabel('TPR')
plt.show()
```



Roc score

In [229]:

```
sums=0;
for i in range(1,len(tpr)):
    sums+=( (fpr[i]-fpr[i-1]) * (tpr[i]+tpr[i-1]) )/2
print('Roc score is: ',sums)
```

```
Roc score is:  0.9263
```

In [ ]:

```
```

Accuracy

In [230]:

```
acc=(TP+TN)/(TP+TN+FN+FP)
print('accuracy is: ',acc)
```

```
accuracy is:  0.9808910891089109
```

In [ ]:

```
```

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: $y^{pred}= \text{[0 if y_score < threshold else 1]}$

$ A = 500 \times \text{number of false negative} + 100 \times \text{numebr of false positive}$

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 [231]:

```
df=pd.read_csv('5_c.csv')
df.head()
```

Out[231]:

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

In [232]:

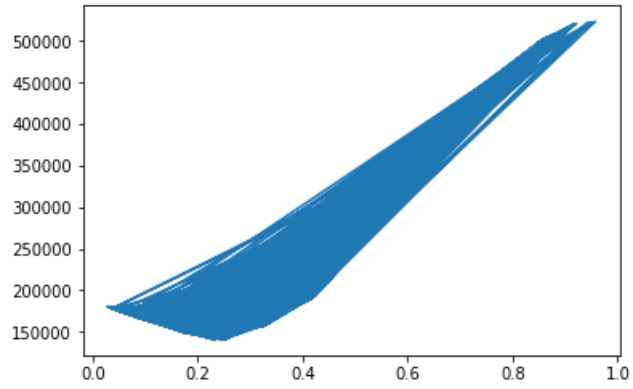
```
A={}
key_list=[]
value_list=[]
value=0

for  thres in df['prob']:
    df['y~']=[1 if x>thres else 0 for x in df['prob']]
    value=((500*false_negative(df['y'],df['y~']))+(100*false_positive(df['y'],df['y~'])))
    key_list.append(thres)
    value_list.append(value)
    A[thres]=value
```

Threshold value which give minimum score for metric A

In [233]:

```
plt.plot(key_list,value_list)
```

```
plt.show()
```



In [234]:

```
inverse = [(value, key) for key, value in A.items()]
min_thres=min(inverse)[1]
print(min_thres)
print(A.get(min_thres))
```

```
0.22987164436159915
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 [235]:

```
df=pd.read_csv('5_d.csv')
df.head()
```

Out[235]:

	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 [236]:

```
def mean_square_error(y_true,y_pred):
    error=0
    for yt,yp in zip(y_true,y_pred):
        error+=(yt-yp)**2
    return error/len(y_true)
```

In [237]:

```
df.isnull().sum()
```

Out[237]:

```
y       0
pred    0
dtype: int64
```

In [238]:

```
df.shape
```

Out[238]:

```
(157200, 2)
```

Computing Mean Square error

In [239]:

```
print(mean_square_error(df['y'],df['pred']))
```

```
177.16569974554707
```

In [ ]:

```

```

In [240]:

```
def mean_absolute_percentage_error(y_true,y_pred):
    error=0
    avg_yt=np.mean(y_true)
    for yt,yp in zip(y_true,y_pred):
        error+=(np.abs(yt-yp)/avg_yt)
        #print(error)
    return (error/len(y_true))
```

MAPE

In [241]:

```
print(mean_absolute_percentage_error(df['y'],df['pred']))
```

```
0.12912029940096315
```

In [ ]:

```

```

In [242]:

```
def r_square(y_true,y_pred):
    mean_true_value=np.mean(y_true)
    num=0
    deno=0
    ratio=0
    for yt,yp in zip(y_true,y_pred):
        num+=(yt-yp)**2
        deno+=(yt-mean_true_value)**2
        ratio=num/deno
    return 1-ratio
```

R^2

In [243]:

```
print(r_square(df['y'],df['pred']))
```

```
0.9563582786990964
```