Compute performance metrics for the given Y and Y_score without sklearn

In [1]:

```
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}
$= [0 \text{ if y\_score} < 0.5 \text{ else } 1]$

1. Compute Confusion Matrix
2. Compute F1 Score
3. Compute AUC Score, you need to compute different thresholds and for each thres hold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_arra y) https://stackoverflow.com/q/53603376/4084039, https://stackoverflow.com/a/39 678975/4084039 Note: it should be numpy.trapz(tpr_array, fpr_array) not numpy.t rapz(fpr_array, tpr_array)
   Note- Make sure that you arrange your probability scores in descending order wh ile calculating AUC
4. Compute Accuracy Score

In [4]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount
("/content/drive", force_remount=True).
```

In [8]:

```
df_a=pd.read_csv('/content/drive/MyDrive/5_Performance_metrics/5_a.csv')
df_a.head()
df_a['y_pred'] = df_a['proba'].apply(lambda x: 0.0 if x < 0.5 else 1.0 )
df_a.head()
```

Out[8]:

	y	proba	y_pred
0	1.0	0.637387	1.0
1	1.0	0.635165	1.0
2	1.0	0.766586	1.0

3	1.0	0.7[illegible]	y_pred
4	1.0	0.889199	1.0

In [10]:

```
len(df_a)
```

Out[10]:

10100

In [40]:

```
# write your code here for task A
#1. compute confusion matrix
def confusion_matrix(y_true,y_pred):
  tp,tn,fp,fn = 0,0,0,0
  y_zip = zip(y_true,y_pred)
  for record in y_zip:
    if record[0] == 1 and record[1] == 1:
      tp+=1
    elif record[0] == 0 and record[1] == 0:
      tn+=1
    elif record[0] == 0 and record[1] == 1:
      fp+=1
    elif record[0] == 1 and record[1] == 0:
      fn+=1
    else:
      pass
    # https://scikit-learn.org/stable/modules/generated/sklearn.metrics.confusion_matrix.
html
  return tp,tn,fp,fn

tp,tn,fp,fn = confusion_matrix(df_a['y'],df_a['y_pred'])
print('confusion matrix : \n',  np.array([[tn,fp],[fn,tp]]))
print("-"*20+'consusion_matrix using pandas' +'-'*20)
pd.DataFrame(data = np.array([[tn,fp],[fn,tp]]),index = ['Actual_0','Actual_1'],columns
= ['predicted_0','predicted_1']).style.background_gradient(cmap ='viridis').set_propertie
s(**{'font-size': '20px'})
```

```
confusion matrix :
 [[    0   100]
 [    0 10000]]
--------------------consusion_matrix using pandas--------------------
```

Out[40]:

	predicted_0	predicted_1
Actual_0	0	100
Actual_1	0	10000

In [15]:

```
# 2. Compute F1 Score
def f1_Score(y_true,y_pred):
  tp,tn,fp,fn = confusion_matrix(y_true,y_pred)
  precision = tp/(tp+fp)
  recall = tp/(fn+tp)
  f1_score = 2*((precision*recall)/(precision+recall))
  return f1_score
print('f1_score :', f1_Score(df_a['y'],df_a['y_pred']))
```

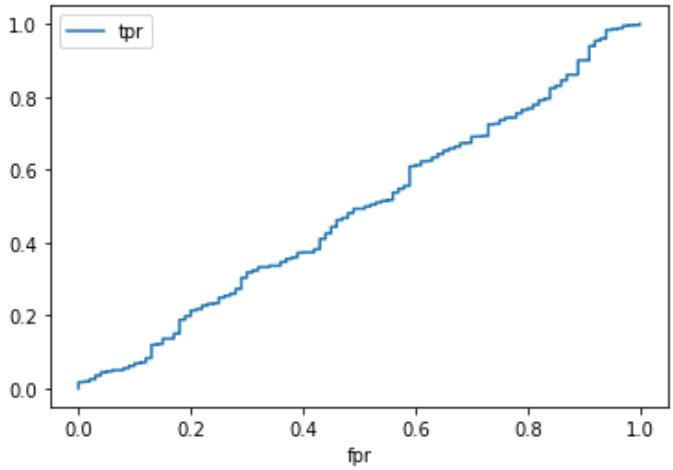
```
f1_score : 0.9950248756218906
```

In [34]:

```
# 3. Compute AUC Score
```

```
def auc_score(y_true,y_prob):
  y_data = pd.DataFrame(list(zip(y_true,y_prob)), columns = ['y_true','y_prob'])
  y_data = y_data.sort_values(by='y_prob',ascending = False).reset_index(drop=True)
  prob_unique = np.sort(np.unique(y_data['y_prob']),)[::-1]
  fpr = []
  tpr = []
  for threshold in prob_unique:
    y_pred = y_data.y_prob.apply(lambda x: 0.0 if x < threshold else 1.0)
    fpr.append(fp/(tn+fp))
    tpr.append(tp/(fn+tp))
  auc_data = pd.DataFrame(list(zip(fpr,tpr)), columns = ['fpr','tpr'])
  auc_data.plot.line('fpr','tpr')
  return np.trapz(tpr, fpr)
print('AUC Score : ' , auc_score(df_a['y'],df_a['proba']))
```

```
AUC Score :  0.48829900000000004
```



In [36]:

```
# 4. Compute Accuracy Score
def accuracy_score(y_true,y_pred):
  tp,tn,fp,fn = confusion_matrix(y_true,y_pred)
  return ((tp+tn)/(tp+tn+fp+fn))
print('accuracy_score : ',accuracy_score(df_a['y'],df_a['y_pred']))
```

```
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 negative s 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

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

1. Compute Confusion Matrix
2. Compute F1 Score
3. Compute AUC Score, you need to compute different thresholds and for each thres hold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_arra y) https://stackoverflow.com/q/53603376/4084039, https://stackoverflow.com/a/39 678975/4084039
   Note- Make sure that you arrange your probability scores in descending order wh ile calculating AUC
4. Compute Accuracy Score

In [42]:

```
df_b=pd.read_csv('/content/drive/MyDrive/5_Performance_metrics/5_b.csv')
df_b.head()
df_b['y_pred'] = df_b['proba'].apply(lambda x: 0.0 if x < 0.5 else 1.0 )
df_b.head()
```

Out[42]:

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

In [44]:

```
# write your code here for task B
# confusion matrix with defined funcitons
tp,tn,fp,fn = confusion_matrix(df_b['y'],df_b['y_pred'])
print('confusion matrix : \n',  np.array([[tn,fp],[fn,tp]]))
print("-"*20+'consusion_matrix using pandas' +'-'*20)
pd.DataFrame(data = np.array([[tn,fp],[fn,tp]]),index = ['Actual_0','Actual_1'],columns
= ['predicted_0','predicted_1']).style.background_gradient(cmap ='viridis').set_propertie
s(**{'font-size': '20px'})
```

```
confusion matrix :
 [[9761  239]
 [  45   55]]
--------------------consusion_matrix using pandas--------------------
```

Out[44]:

	predicted_0	predicted_1
Actual_0	9761	239
Actual_1	45	55

In [45]:

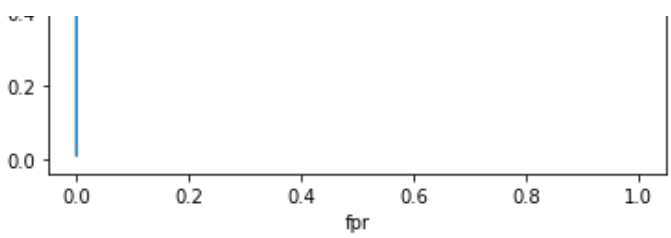
```
#F1_score with predifined funcitons
print('f1_score :', f1_Score(df_b['y'],df_b['y_pred']))
```

```
f1_score : 0.2791878172588833
```

In [46]:

```
# auc using predifined function
print('AUC Score : ' , auc_score(df_b['y'],df_b['proba']))
```

```
AUC Score :  0.9377570000000001
```



In [47]:

```
# computing accuracy with predifined functions
print('accuracy_score : ',accuracy_score(df_b['y'],df_b['y_pred']))
```

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

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

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 [48]:

```
df_c=pd.read_csv('/content/drive/MyDrive/5_Performance_metrics/5_c.csv')
df_c.head()
```

Out[48]:

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

In [58]:

```
# write your code for task C
def best_threshold(y_true,y_prob):
  y_data = pd.DataFrame(list(zip(y_true,y_prob)), columns = ['y_true','y_prob'])
  y_data = y_data.sort_values(by='y_prob',ascending = False).reset_index(drop=True)
  prob_unique = np.sort(np.unique(y_data['y_prob']),)[::-1]
  #took A as infinity for calculation
  A = 78943465735678
  best_threshold = None
  fn_out = None
  fp_out = None
  for threshold in prob_unique:
    y_pred = y_data.y_prob.apply(lambda x: 0.0 if x < threshold else 1.0)
    tp,tn,fp,fn = confusion_matrix(y_data['y_true'],y_pred)
    if A > ((500 * fn) + (100 * fp)):
      #print('old A : ',A)
      #print('old threshold : ',best_threshold)
      A = ((500 * fn) + (100 * fp))
      best_threshold = threshold
```

```
      fn_out = fn
      fp_out = fp
      #print('fn : {0} and fp : {1}'.format(fn,fp))
      #print('new A : ',A)
      #print('new threshold : ',best_threshold)
    else:
      pass
  return best_threshold,A,fn_out,fp_out
best_threshold,A,fn,fp = best_threshold(df_c['y'],df_c['prob'])
print("Best Threshold identified as : {0} which have A value : {1} for false negetive : {
2} and flase positive : {3} ".format(best_threshold,A,fn,fp))
```

```
Best Threshold identified as : 0.2300390278970873 which have A value : 141000 for false n
egetive : 78 and flase positive : 1020
```

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 [59]:

```
df_d=pd.read_csv('/content/drive/MyDrive/5_Performance_metrics/5_d.csv')
df_d.head()
```

Out[59]:

	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 [75]:

```
# write your code for task 5d

# calculating Mean Square Error
def mean_square_error(y_true,y_pred):
  dataframe = pd.DataFrame(data = list(zip(y_true,y_pred)),columns = ['y_true','y_pred']
)
  dataframe['error'] =  dataframe['y_pred'] - dataframe['y_true']
  dataframe['square error'] =  dataframe['error'].apply(lambda X:X**2)
  mean_square_error = dataframe['square error'].mean()
  return mean_square_error
print('mean sqaured error : ',mean_square_error(df_d['y'],df_d['pred']))
```

```
mean sqaured error :  177.16569974554707
```

In [82]:

In [92]:

```
# calculating MAPE (mean obsolute percentage error)
def MAPE(y_true,y_pred):
  dataframe = pd.DataFrame(data = list(zip(y_true,y_pred)),columns = ['y_true','y_pred']
)
  dataframe['error'] = dataframe['y_true'] - dataframe['y_pred']
  dataframe['obsolute error'] =  dataframe['error'].apply(lambda X:np.abs(X))
  modeified_mean_obsolute_percentage_error = (dataframe['obsolute error'].sum() / datafr
ame['y_true'].sum())
  #print(dataframe.head())
  return modeified_mean_obsolute_percentage_error
print('MAPE : ',MAPE(df_d['y'],df_d['pred']))
```

```
MAPE :  0.1291202994009687
```

In [95]:

```
# computing R^2 value

def r_squared(y_true,y_pred):
  dataframe = pd.DataFrame(data = list(zip(y_true,y_pred)),columns = ['y_true','y_pred']
)
  ss_total = ((dataframe['y_true'] - dataframe['y_true'].mean()).apply(lambda x : x**2))
.sum()
  ss_residual = ((dataframe['y_true'] - dataframe['y_pred']).apply(lambda x: x**2)).sum(
)
  return (1- (ss_residual/ss_total))
print('r_squared : ',r_squared(df_d['y'],df_d['pred']))
```

```
r_squared :  0.9563582786990937
```

In [ ]:

```

```