CONFUSION MATRIX

What is a Confusion Matrix?

It is a performance measurement for machine learning classification problem where output can be two or more classes. It is a table with 4 different combinations of predicted and actual values.

What is the need of Confusion matrix?

It is extremely useful for measuring Recall, Precision, Specificity, Accuracy and most importantly AUC-ROC Curve.

Lets' understand the terms used in the Confusion Matrix and their usefulness in the evaluation of a model:

1.True Positive-

We predicted true and it's actually true.

2. True Negative-

We predicted false and it's actually false.

3. False Positive-

 We predicted true and it's actually false.

4. False Negative-

We predicted false and it's actually true.

5. Recall-

Out of all the positive classes, how much we predicted correctly. It should be high as possible.

$$Recall = \frac{TP}{TP + FN}$$

6. Precision-

Out of all the positive classes we have predicted correctly, how many are actually positive.

$$Precision = \frac{TP}{TP + FP}$$

7.F-measure

It is difficult to compare two models with low precision and high recall or vice versa. So to make them comparable, we use F-Score. F-score helps to measure Recall and Precision at the same time. It uses Harmonic Mean in place of Arithmetic Mean by punishing the extreme values more.

$$F - measure = \frac{2*Recall*Precision}{Recall + Precision}$$

What is AUC-ROC curve?

AUC - ROC curve is a performance measurement for classification problem. ROC is a probability curve and AUC represents degree or measure of separability. It tells how much model is capable of distinguishing between classes. Higher the AUC, better the model is at predicting 0s as 0s and 1s as 1s. By analogy, Higher the AUC, better the model is at distinguishing

Lets' understand how the curve is plotted:

The ROC curve is plotted with TPR against the FPR where TPR is on y-axis and FPR is on the x-axis.
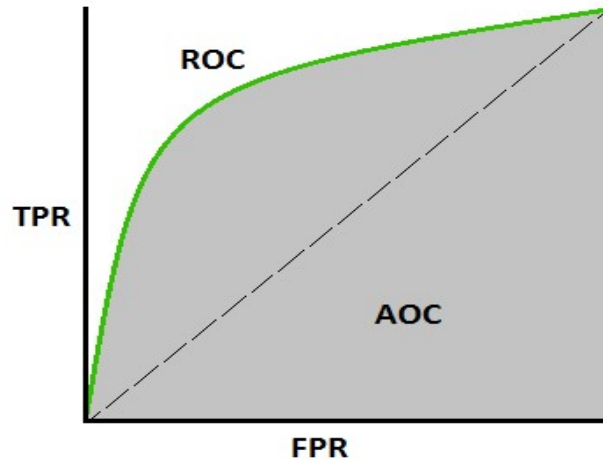
TPR (True Positive Rate)/Recall/Sensitivity:

$$\text{TPR /Recall / Sensitivity} = \frac{TP}{TP + FN}$$

Specificity:

$$\text{Specificity} = \frac{TN}{TN + FP}$$

FPR (False Positive Rate):

$$\text{FPR} = 1 - \text{Specificity}$$

$$= \frac{FP}{TN + FP}$$

An excellent model has AUC near to the 1 which means it has good measure of separability. A poor model has AUC near to the 0 which means it has worst measure of separability.

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