Agenda :
1. Classification metrics

Classification Metrics

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1. Accuracy :

Actuals : 0 0 1 1 0 1 0 0 1 1
Preds : 0 0 0 1 1 1 1 0 0 1

Total correct predictions/Total Predictions
6/10

Lets say

Actuals : NC NC NC NC NC C NC NC NC NC

I will not use any ML over here. I will just say all the predictions are 1

Preds : NC NC NC NC NC NC NC NC NC NC

Accuracy = 90%

But the problem is that 90% does not justify the predictions because the predictions are not at all based on any training but its purely based on assumptions.

2. Confusion Matrix

A more granular way of representing the predictions

Actuals : 0 0 1 1 0 1 0 0 1 1
Preds : 0 0 0 1 1 1 1 0 0 1

		Predictions	
		0	1
Actuals	0	3	2
	1	2	3

Actuals : 0 1 1 1 0 1 0 0 1 1 1 0 0 1 1 1 1 0 0
Preds : 0 0 0 1 1 1 1 0 0 1 0 0 0 0 1 1 1 1 1

		Predictions 0	1	
Actuals	0	4	4	- 8 (50% correct)
	1	5	6	- 11 (45% incorrect)

3.

Actual : - + - - - + + + + -
Pred : + + - - + + - - + +

	-	+	
			What is the prediction ? Negative
-	2	3	Is the actual Positive? False

+	2	3	

TN = 2, FN = 2, FP = 3, TP = 3

Examples :

1. Cancer dataset

cell -> cancerous or not

	+	-

Actual -> cancerous ; Pred -> cancerous (TP)
Actual -> cancerous ; Pred -> Non cancerous (FN)
Actual -> Non cancerous ; Pred -> cancerous (FP)
Actual -> Non cancerous ; Pred -> Non cancerous(TN)

Out of these 4 metrics which is the most critical metric?
We find that FN is the most critical metric over here
Hence when we are building a model we need to ensure that the FN are as low as possible.

2. Designing an automated firing machine

A person is actually a threat -> +ve
A person is not a threat -> -ve

Actual -> Threat ; Pred -> Threat (TP)
Actual -> Threat ; Pred -> Non Threat (FN)
Actual -> Non Threat ; Pred -> Threat (FP)
Actual -> Non Threat ; Pred -> Non Threat(TN)

Out of these 4 which is critical ??

Airport 1 | Airport 2

FN > 0 FP > 0
FP = 0 FN = 0

In this case FP is more critical and you want it to be no other value than 0.

3. Automated Self Driving Car

To apply a brake the vehicle has to detect obstacle ahead

There is an obstacle -> +ve
There is no obstacle -> -ve

Actual -> obstacle ; Pred -> obstacle (TP)
Actual -> obstacle ; Pred -> Non obstacle (FN)
Actual -> Non obstacle ; Pred -> obstacle (FP)

Actual -> Non obstacle ; Pred -> Non obstacle (TN)

Which one is critical ?

FN is highly critical. We want FN = 0

4. Air Defence system

On arrival of any threat it automatically fires a missile towards
it to nullify the threat.

It is a threat -> +ve
Not a threat -> -ve

Actual -> Threat ; Pred -> Threat (TP)
Actual -> Threat ; Pred -> Non Threat (FN)
Actual -> Non Threat ; Pred -> Threat (FP)
Actual -> Non Threat ; Pred -> Non Threat(TN)

Which one is critical ?
Both FP and FN are critical.

4. Precision

= TP/(TP+FP)

Out of total predicted positives, how many are actually positives

We use this metric when we want out FP to be as low as possible

5. Recall

= TP/(TP+FN)

Out of total actual positives, how many are predicted as positives

We use this metric when we want FN to be low

6. F1-score

= Harmonic mean of Precision and Recall

= 2*Precision*Recall/(Precision+Recall)

Task :

1. Think of a scenario where precision will be more important and think of another scenario where recall will be my focus while building a model

2. There are few other metrics like sensitivity, specificity, AUC and ROC. They are similar to the ones we saw above. Try to go through them and come up with an example of the same