Evaluation Metrics for Classification

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$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

$$\text{Precision} = \frac{TP}{TP + FP}$$ → correctly classified

1. out of total positively predicted result how many are actually positive.
2. how many are correctly classified out of total predicted positive results.

1 → TP
2 → FN
3 → TN
4 → FP

$$= \frac{TP}{TP+FP} = \frac{TP}{TP+FP} = \frac{1}{1+1} = \frac{1}{2} = 0.5$$

TP+FP → These are positively predicted

TP → actual positive values

ex. 100 samples 51 + 10 $\frac{51}{51+10} = \frac{51}{61}$ $\frac{51}{51} = 1$

$$\text{Recall} = \frac{TP}{TP+FN}$$ → positive predicted result

→ actual positive result

actual
P N P

ex. 150 sample

TP	FP
FN	TN

62	20
12	56

Actual

74	0
0	76

74 - TP+FN

74	0
0	76

$74 = TP + FN$

$76 = TN + FP$

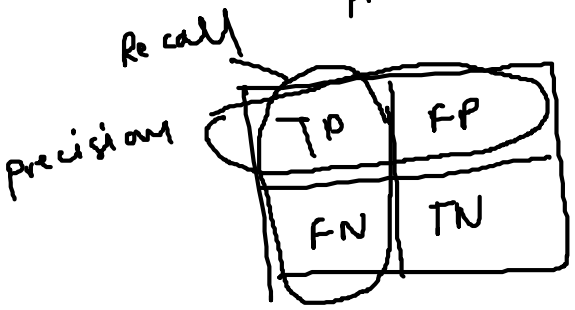
$$P = \frac{62}{62+20} = \frac{62}{82} = 0.756$$

$$R = \frac{62}{62+12} = \frac{62}{74} = 0.837$$

$$\text{Recall} = \frac{TP}{TP + FN}$$ → predicted positive correctly classified

→ total actual positive results.

how many actual positive case were able to predict correctly



$$\text{Recall} = \frac{TP}{TP+FN} = y_q = p_0 \quad y_p = N$$

medical :-

FN

$$\text{precision} = \frac{TP}{TP+FP} = y_q = N \quad y_p = P$$

$$\text{Precision} :- \frac{TP}{TP+FP} : y_q = N \quad y_p = P.$$

good invest | bad investment

good invest → y_q = bad invest

finance - | e commerce

bad invest → y_1 = good invest

positive | Negative
sansun | huawei FP

huawei → bad product

$\times \frac{P+R}{2} = \frac{0.7+0.1}{2} = 0.85$

F1-score :- $\frac{2PR}{P+R}$ >> harmonic mean

$P = 1$
$R = 0$
$\frac{2 \times 1 \times 0}{} = 0$

if F1 is max = P = R

F1-score = $F\beta$-score

β is < 1 FP is important = Precision

β is > 1 FN is important = Recall

β is equal 1 = FP & FN will be given same importance

$$F_\beta = (1+\beta^2) \frac{P \times R}{\beta^2 \times P + R}$$

when $\beta = 1$

$$F_1 = \frac{2PR}{P+R}$$

Reciprocal : $2 = \frac{2}{1} = \frac{1}{2} = \underline{0.5}$ shifting numerator & denominator

$= 0.4 = \frac{0.4}{1} = \frac{1}{0.4} = \underline{2.5}$

normal mean = $\frac{P+R}{2}$ =

harmonic = $\frac{2PR}{P+R}$

P = 0.756 F1 = $\frac{2 \times 0.756 \times 0.837}{0.756 + 0.837}$

R = 0.837 = 0.79

simple avg = $\frac{0.756 + 0.837}{2}$

= 0.79

Ex P = 0.67 R = 0.13

simple avg = $\frac{0.67 + 0.10}{2}$

= 0.4

F1 = $2 \times \frac{0.67 \times 0.13}{0.67 + 0.13}$

= 0.21

Imbalanced data.

ex - 150 samples

	spam	not spam
Target:	20	130
	$\frac{20}{150} \times 100 = 13.33$	$\frac{130}{150} \times 100 = 86.67$
=	13.33	86.67

df['target'].value_count (normalize = True)

spam 20 → 13.33 → 20
non-spam 130 → 86.67 → 20 40

spam = 25
not spam = 75

Imblearn smote → Oversampling
→ Undersampling → not tourl

Minor class : 20 - 20 Undersampling
Major class = 80 - 80 Oversampling

undersampling = 20+20 = 40
oversampling : 80+80 = 160

. 20 - 25

35-65 , 40-60 , 30-70
45-55 60-40

25-75
20-80
15-85

hiii