Deep Dive Into Metrics

When is High Accuracy Bad ?

- Not research Worthy
- Imbalanced Dataset

Imbalanced Dataset

A dumb Model which predicts ALWAYS dog

Dataset - 99 dog & 1 cat

Dataset - 20 dog & 80 cat .

Calculate the Accuracy now.

The solution ?

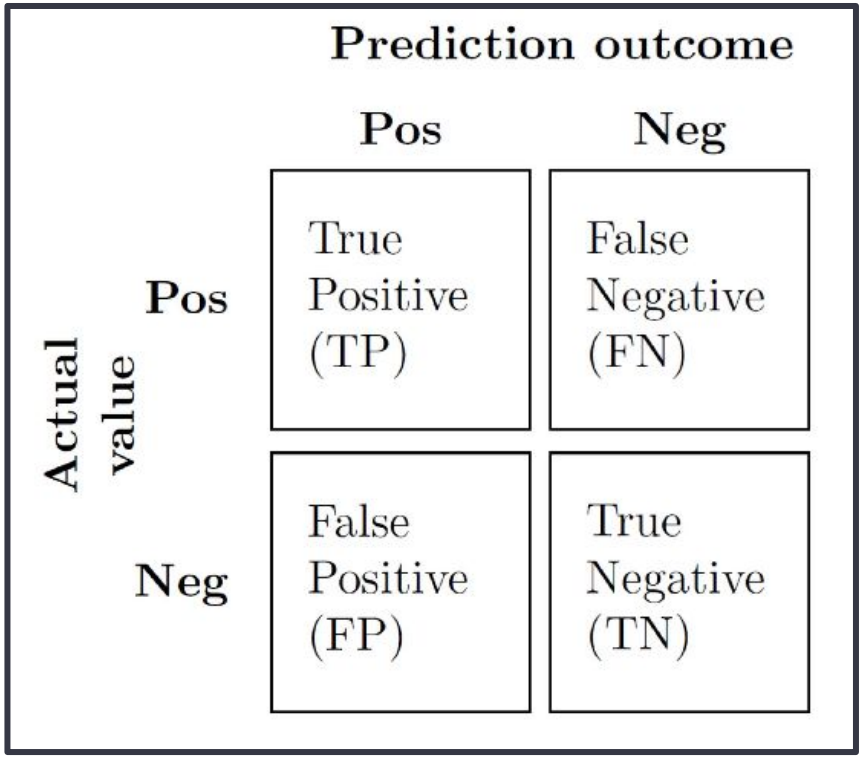
Metrics for Supervised Learning

1. Classification ➜ Accuracy, Recall , precision , F1 - Score.

2. Regression ➜ MSE, RMSE, MAE, R^2

CLASSIFICATION

Confusion Matrix



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

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

$$F1 = \frac{2 \times precision \times recall}{precision + recall}$$

$$accuracy = \frac{TP + TN}{TP + FN + TN + FP}$$

Why F1 - Score (Harmonic Mean) instead of Normal Mean

Recall - 100

Precision - 20

Now Calculate Normal Mean.

Low precision means a bad model, but we our mean does SIGNIFY that.

The solution ? Now calculate F1- Score

Recall VS Precision Priority

High Recall = Low False Negative (FN)

High Precision = Low False Positive (FP)

Case 1

Cancer Research :

1 : Cancer (Positive)

0 : Not Cancer (Negative)

What is More Dangerous? Actual Cancer being labelled as Non - Cancer (FN)
OR Non - Cancer being labelled as Cancer (FP)

We will prioritize RECALL

Case 2

Spam Mail :

1 : Spam (Positive)

0 : Not Spam (Negative)

What is More Dangerous? Actual Spam being labelled as Non - Spam (FN)
OR Non - Spam being labelled as Spam (FP)

We will prioritize Precision

Classification Report of Binary Classification

	precision	recall	f1-score	support
0	0.62	0.52	0.56	440
1	0.85	0.89	0.87	1321
accuracy			0.80	1761
macro avg	0.73	0.70	0.72	1761
weighted avg	0.79	0.80	0.79	1761

Why are there multiple values of Recall-Precision ?

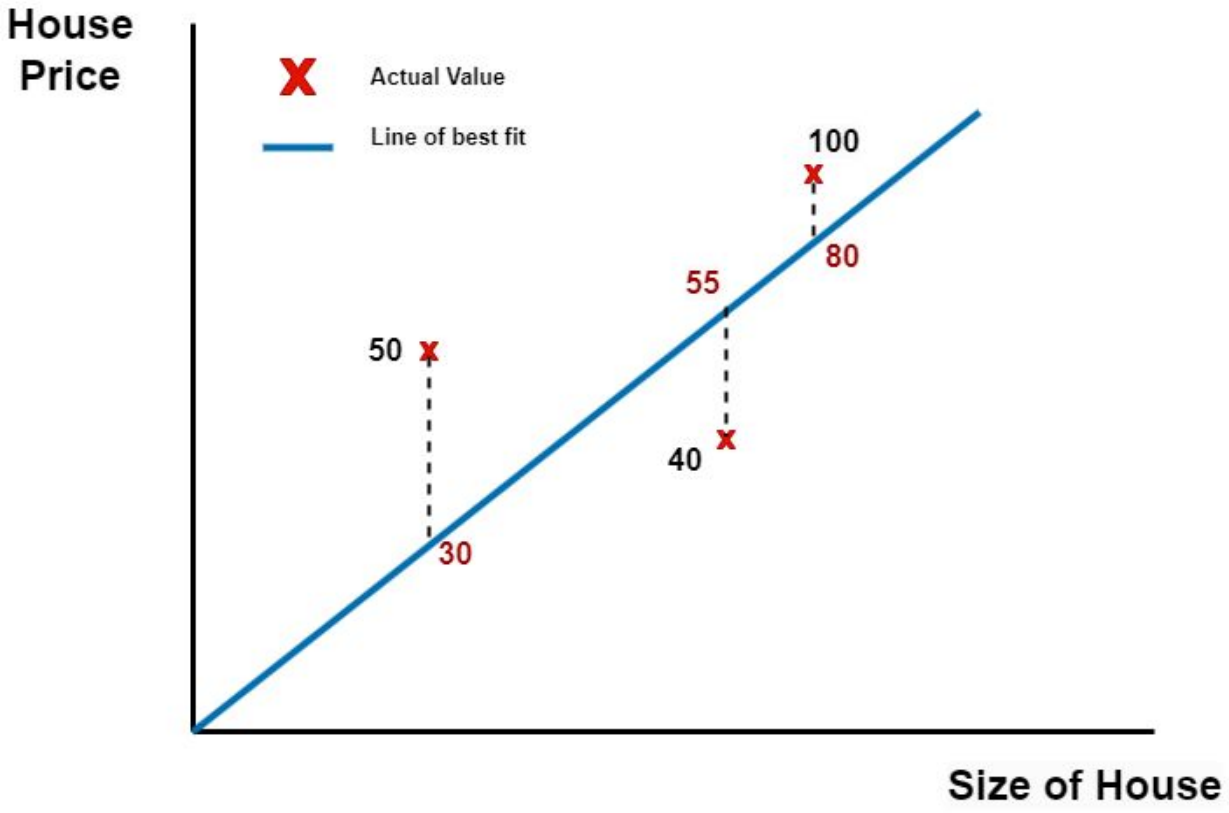
From perspective of label **1**

- 1 → 0 (False Negative)
- 0 → 1 (False Positive)

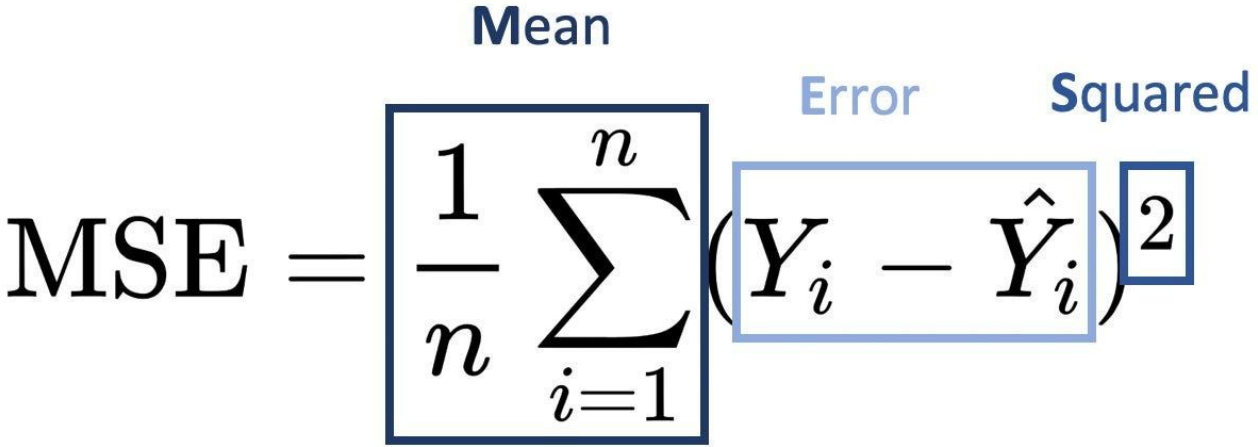
From perspective of label **0**

- 1 → 0 (False Positive)
- 0 → 1 (False Negative)

Regression Task



The solution? Mean - Squared Error (MSE)



Calculating MSE

Summation of squared error = $(50 - 30)^2 + (40 - 55)^2 + (100 - 80)^2$

Mean = Summation of squared error / N

What do you think (Root Mean Squared Error) RMSE is?

ANS: Root of MSE

Why square?

Normal error = (50 - 30) + (40 - 55) + (100 - 80)

The (40 - 55) = -15 will decrease the overall value.

ALTERNATIVE Solution : Using Modulus. Mean Absolute error (MAE)

Accuracy vs MSE

Is higher accuracy better? Yes

Is higher MSE better? No