Performance Metrics

- classification
- Regression

Classification Metrics { Orange / Apple }

- Confusion Matrix
- Accuracy
- Precision, Recall
- F1-Score
- AU-ROC

$$\text{Accuracy} = \frac{\#\text{Correct Pred.}}{\#\text{Total}}$$

15

80 20

→ Dataset Balanced

- Confusion Matrix

Null Hypothesis, H_0 $\longrightarrow$ Cancerous

		Prediction	
		Y	N
Actual	Y	TP	FN Type-II
	N	FP Type-1	TN

Precision

Prediction

90 10

e.g. 100

80 20

Actual

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

Type - 1

$$= \frac{80}{80+10}$$

→ Type-1 error

↓

Null Hypothesis ✗

Low Precision

Recall / Sensivity / Hit-rate

Type-2 error $\dfrac{TP}{TP+FN}$

Recall = 0.5

- High number of FN

Precision - Recall Tradeoff

- FP
- FN

→ Precision → ≈100% $\check{F}\check{P}$

→ Recall → ≈100% $\check{F}\check{N}$

F1-Score | Comb of { Precision
Recall

Harmonic Mean

$$F1 = 2\left(P^{-1} + R^{-1}\right)^{-1}$$

F1-score ↑ , P-R ↑

F1-score ↓ , nothing

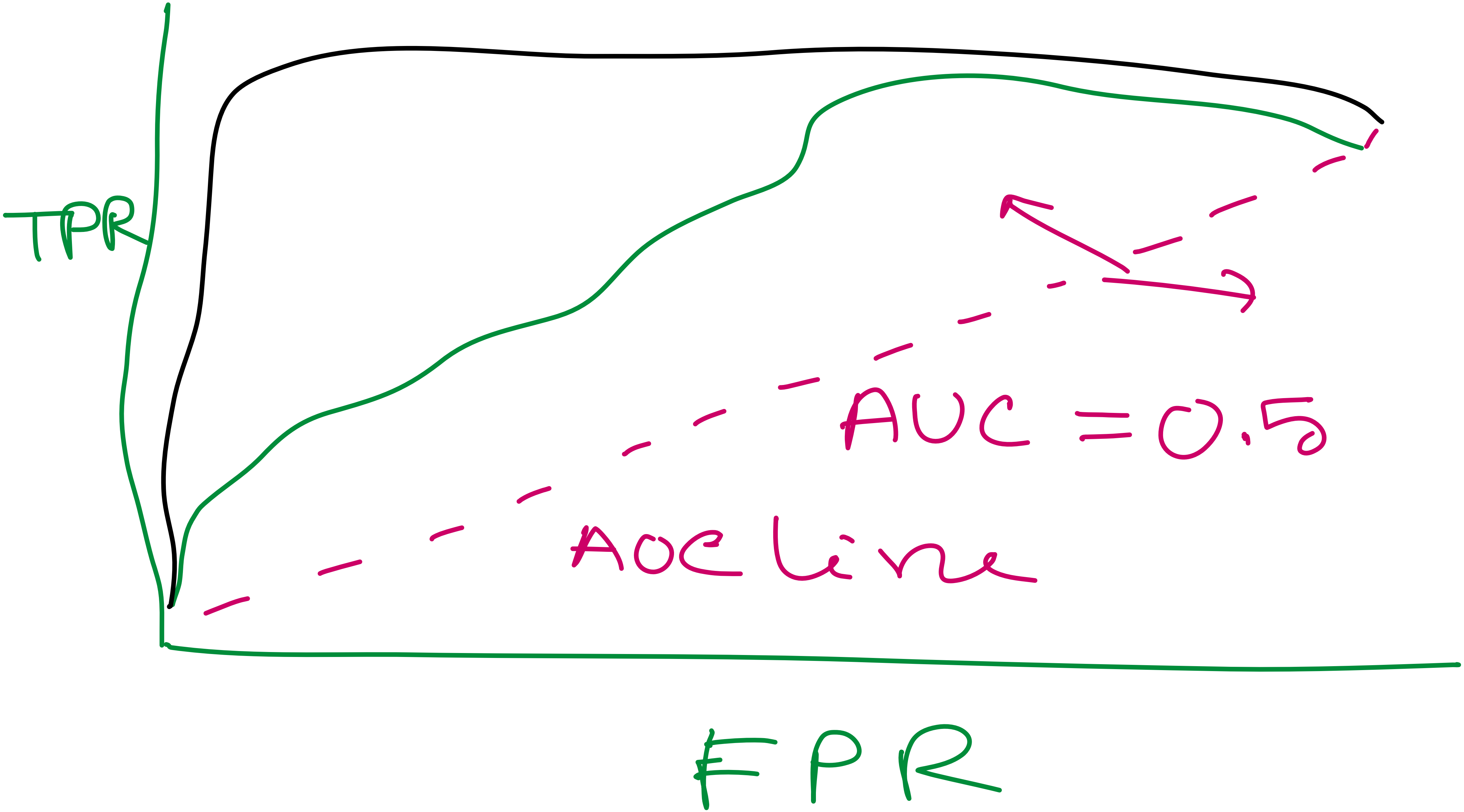
AU - ROC

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

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

$\downarrow$

Fallout


TPR
AUC = 0.5
Aoc line
FPR

→ Quality of pred.

NOT

- class. error minimize

- scale-invariant

Regression Metrics

① Mean Squared Error

(MSE)

$$\frac{1}{N} \sum_{j=1}^{N} (y_j - \hat{y}_j)^2$$

- optimizable
- penalizes small error
- overestimate
- more prone outliers

Mean Absolute Error
(MAE)

$$\frac{1}{N} \sum | y_i - \hat{y}_j |$$

- robust to outliers
- proper estimation
- non-differentiable

RMSE $\rightarrow$ Root $\leftarrow$ Mean Squared Error

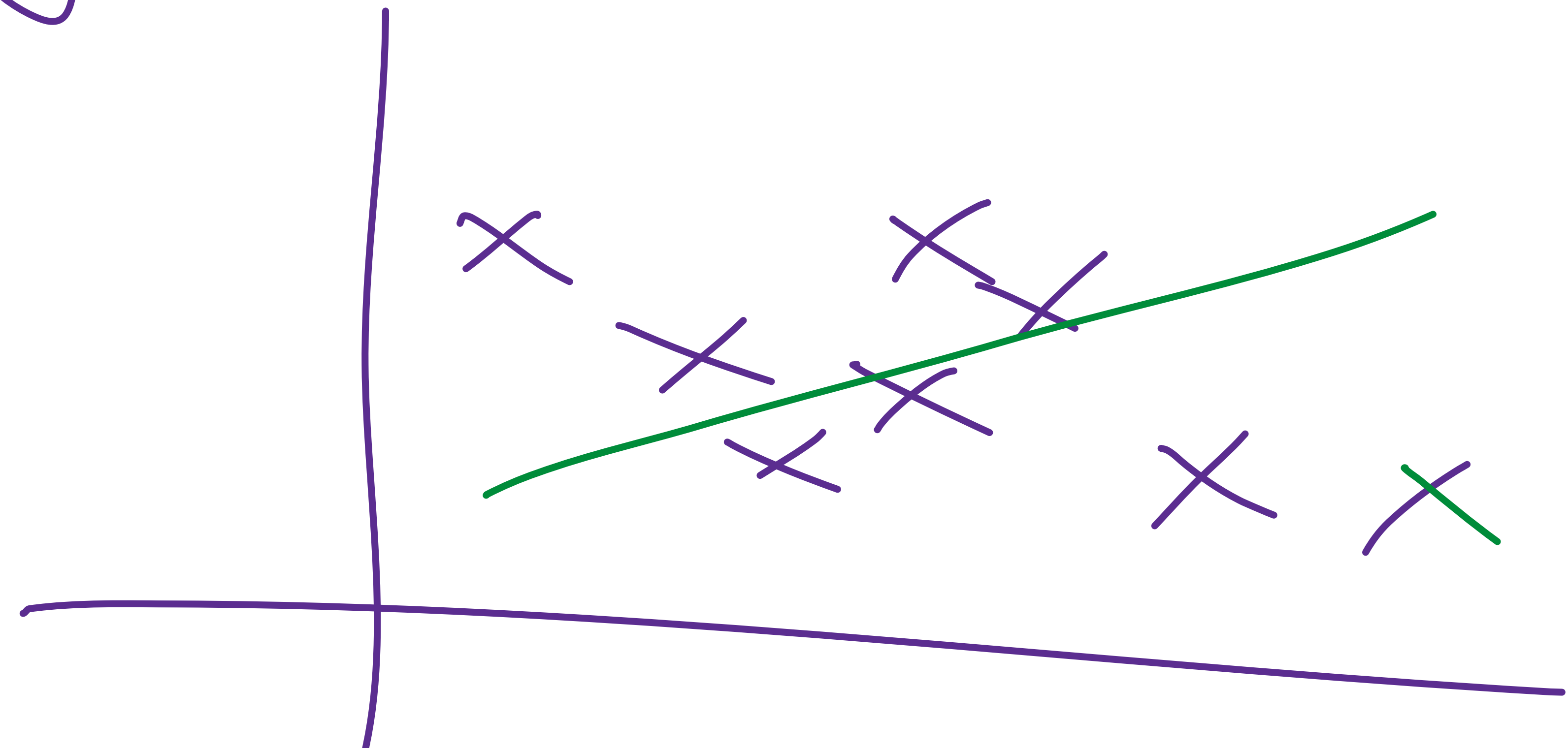
$$\sqrt{\frac{1}{N} \sum (y_j - \hat{y}_j)^2}$$

- differentiable
- handles penalization
- smooth
- normalized
  → less prone outlier

1

R^2 coefficient

target → variations



$$SE = \sum (y_i - \hat{y})^2$$

percentage of variation

$$\frac{SE(\text{line})}{SE(\hat{y})} \quad \begin{array}{l} \rightarrow MSE(\text{Model}) \\ \rightarrow MSE(\text{base line}) \end{array}$$

$$\text{coeff } (R^2) = 1 -$$

$R^2 \longrightarrow 1$ (ideal)

100% of variance

↓

captured

R^2 range $\rightarrow$ $\cancel{\boxed{(0, 1)}}$

$(-\infty, 1)$

worst

best

Adjusted R^2

$$R_a^2 = 1 - \left[\frac{n-1}{n-k-1} \times (1 - R^2)\right]$$