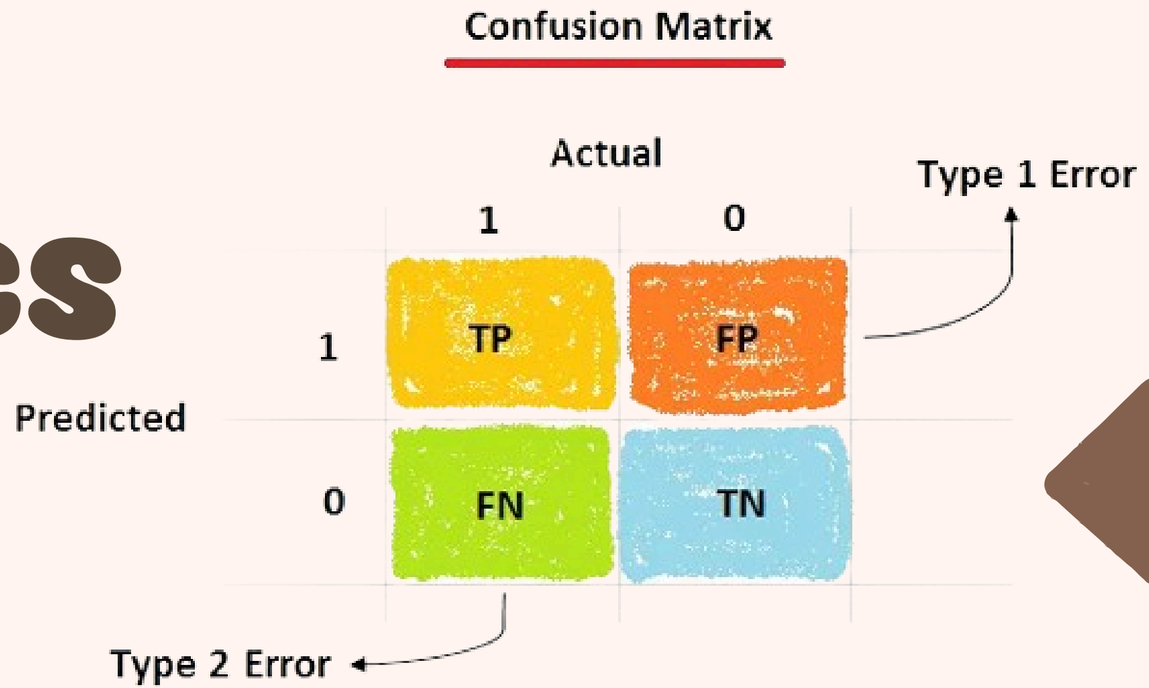
Confusion Matrix & Metrics



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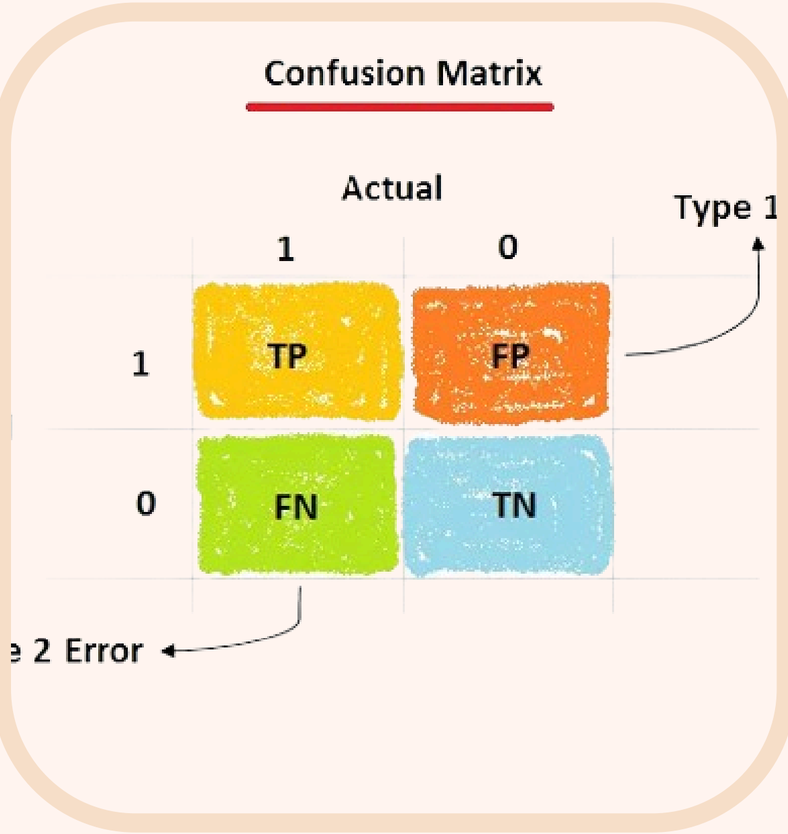
WHAT IS A CONFUSION MATRIX?

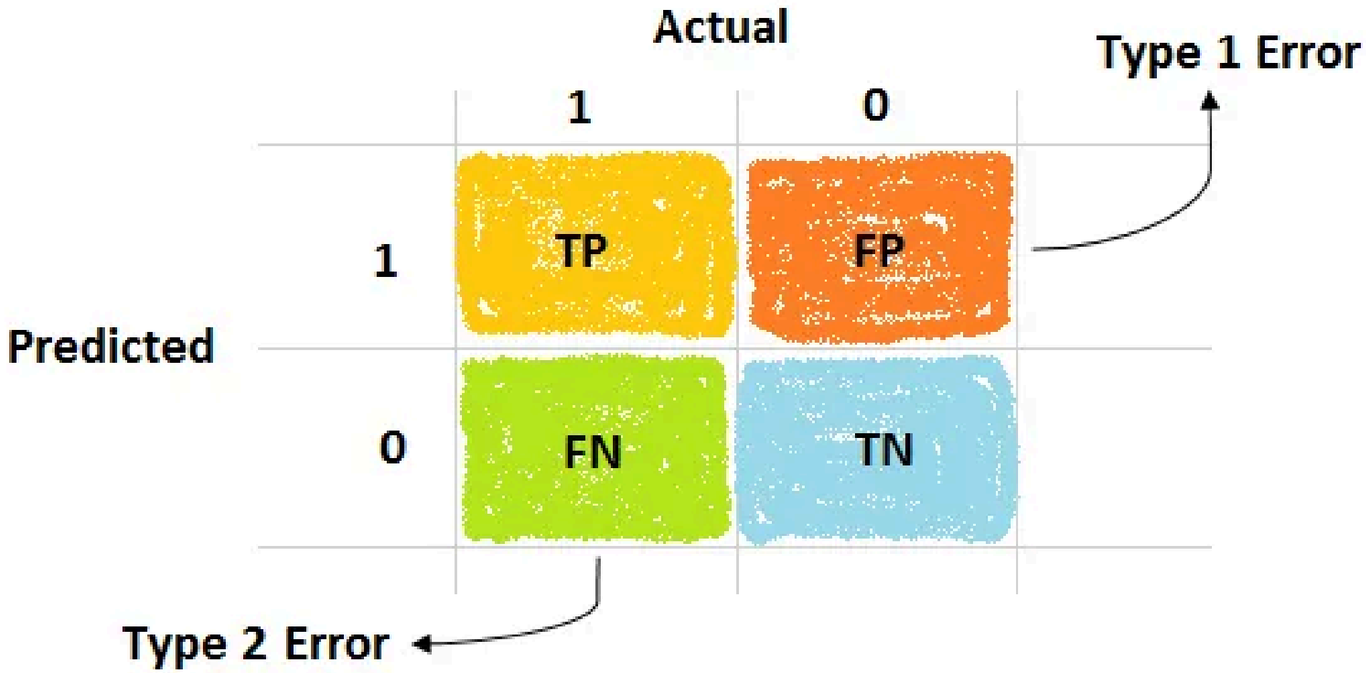
- Confusion matrix is a tool in machine learning to evaluate the performance of classification model

- Table that describes performance of a classification model by comparing the actual labels with the predicted labels

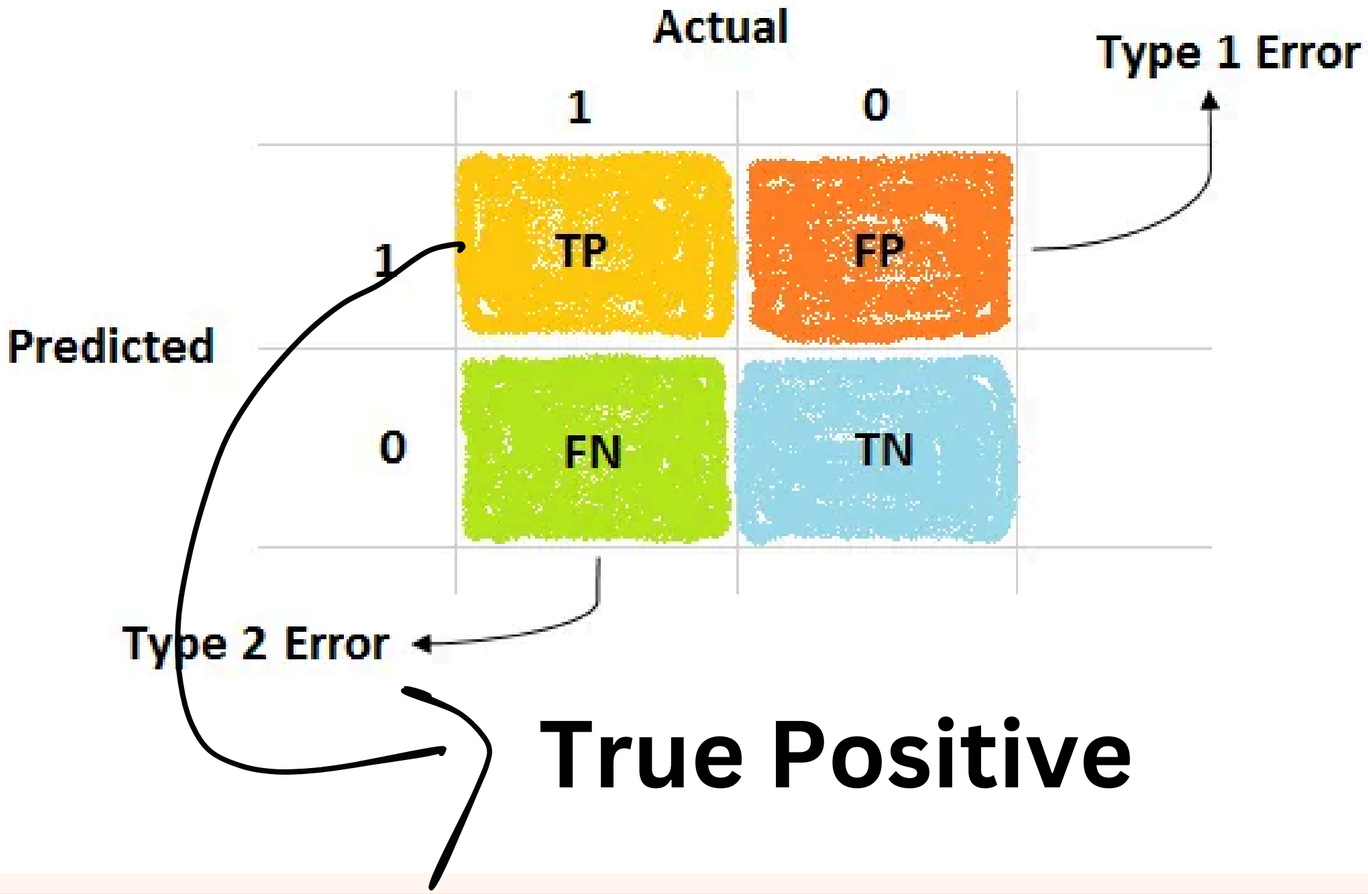


HI!

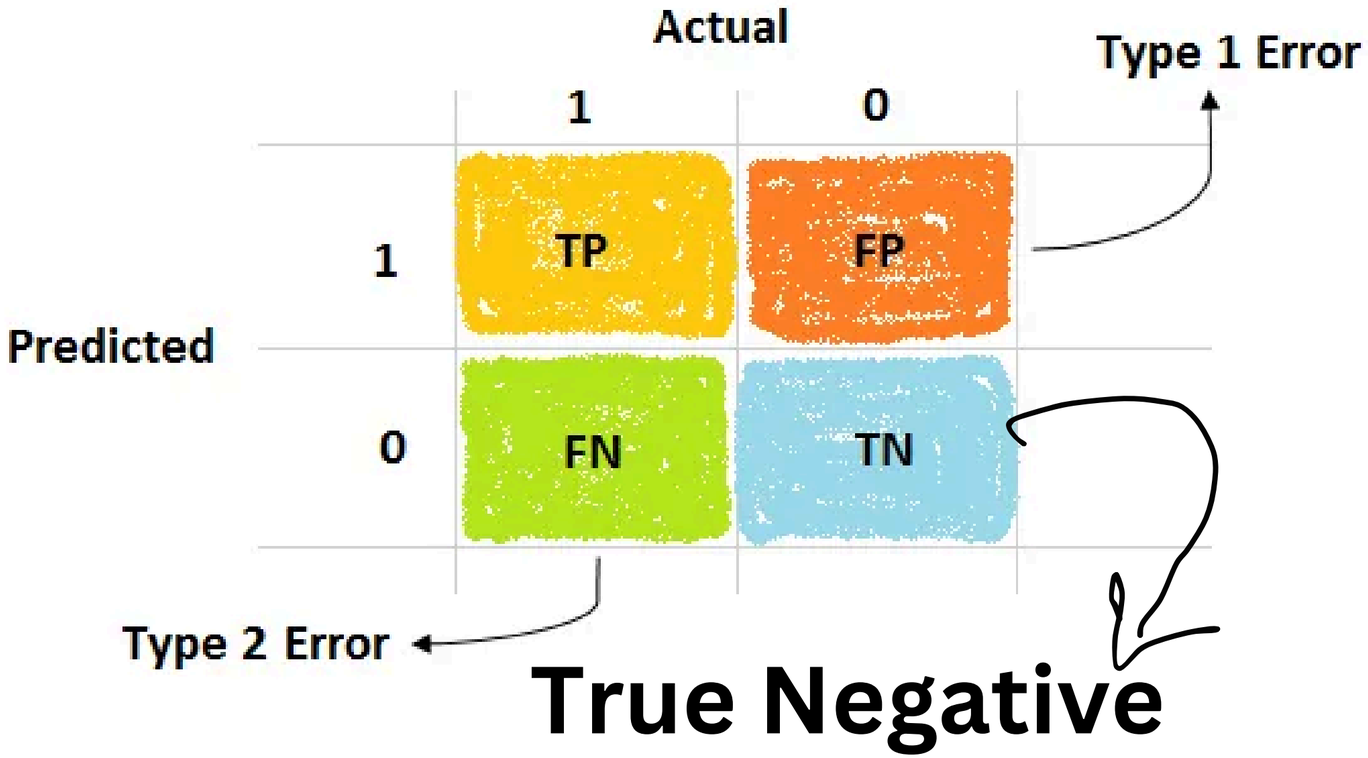
Confusion Matrix



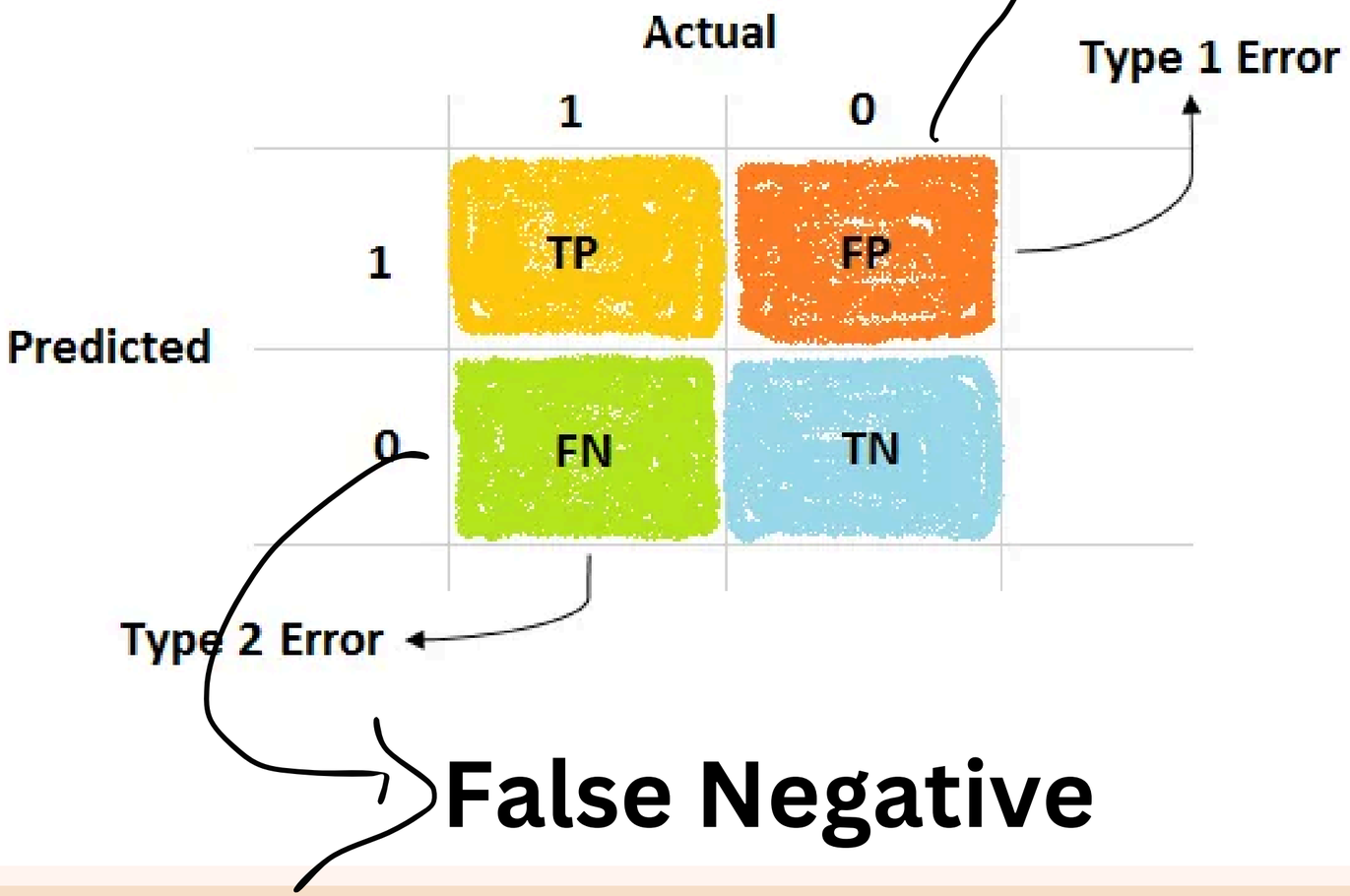
Confusion Matrix



Confusion Matrix



Confusion Matrix



True Positive

THE NUMBER OF INSTANCES CORRECTLY PREDICTED AS POSITIVE.

False Positive

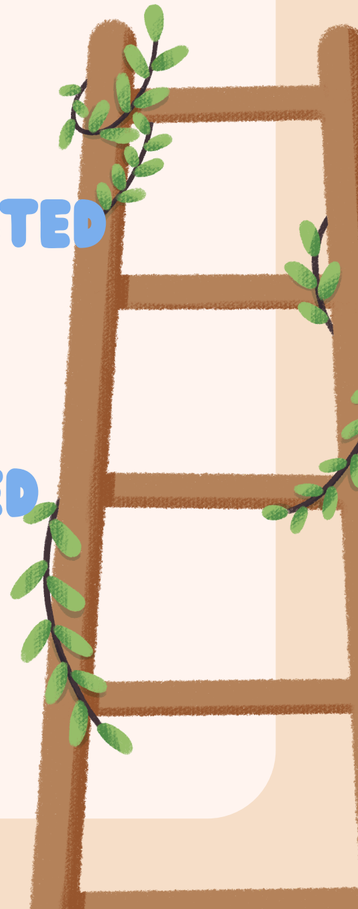
THE NUMBER OF INSTANCES INCORRECTLY PREDICTED AS POSITIVE (TYPE I ERROR)

False Negative

THE NUMBER OF INSTANCES INCORRECTLY PREDICTED AS NEGATIVE (TYPE II ERROR).

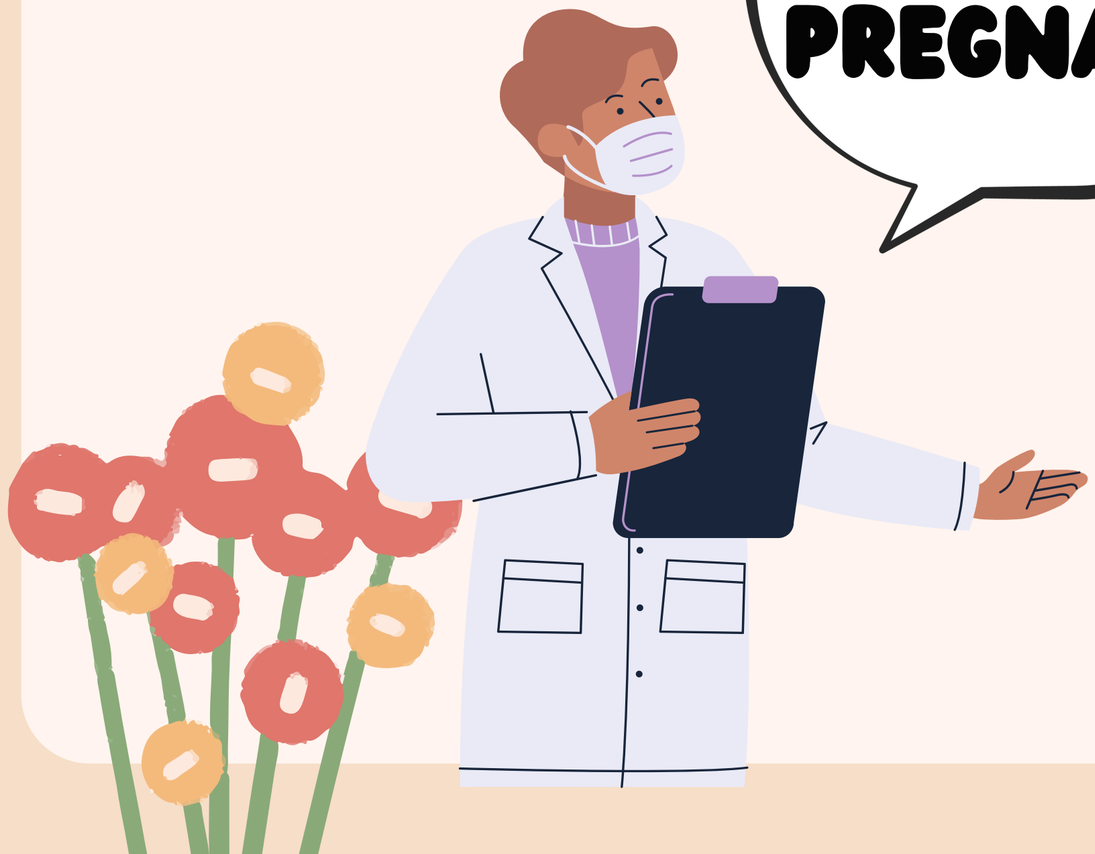
True Negative

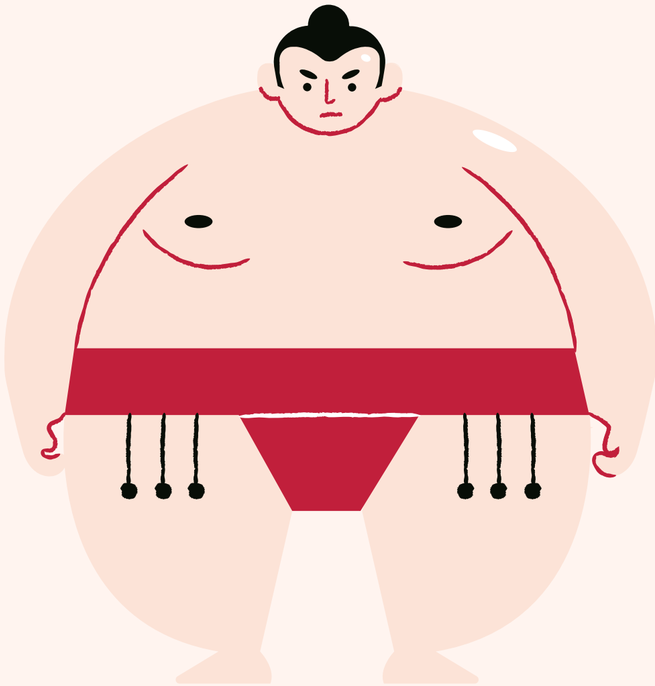
THE NUMBER OF INSTANCES CORRECTLY PREDICTED AS NEGATIVE.



True Positive

False Positive





False Negative

True Negative

Accuracy

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

- **Use Case:** Suitable when the classes are balanced means balanced datasets
- Can be inadequate in cases of imbalanced classes or when the cost of errors varies. Metrics like precision, recall, and F1 score provide more nuanced insights

Precision

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

- **Use Case:** Important when the cost of false positives is high (e.g., spam detection).
- In Medical diagnosis where immuno-suppressive drugs or other drug are prescribed
- here cost of false positive is very high

Recall

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

- **Use Case:** Crucial when the cost of false negatives is high (e.g., cancer screening).
- Detecting as many survivors as possible.
- Missing a survivor (false negative) could be catastrophic,
- so the operation will aims for high recall,
- even if it means more false alarms (false positives).

F1-Score

$$\frac{2 * PRECISION * RECALL}{PRECISION + RECALL}$$

- Use Case: F1-score provides a harmonic mean of precision and recall,
- offers a single metric that balances the two.

- This is useful when both false positives and false negatives carry significant consequences and you need a balance between the two

Specificity

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

- **Use Case:** Important in medical diagnostics where identifying true negatives is crucial.
- Variant of recall for undesired label or prediction

TYPE 1 ERROR

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

TYPE 2 ERROR

$$\frac{FN}{TN+FN}$$

Thank you!

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