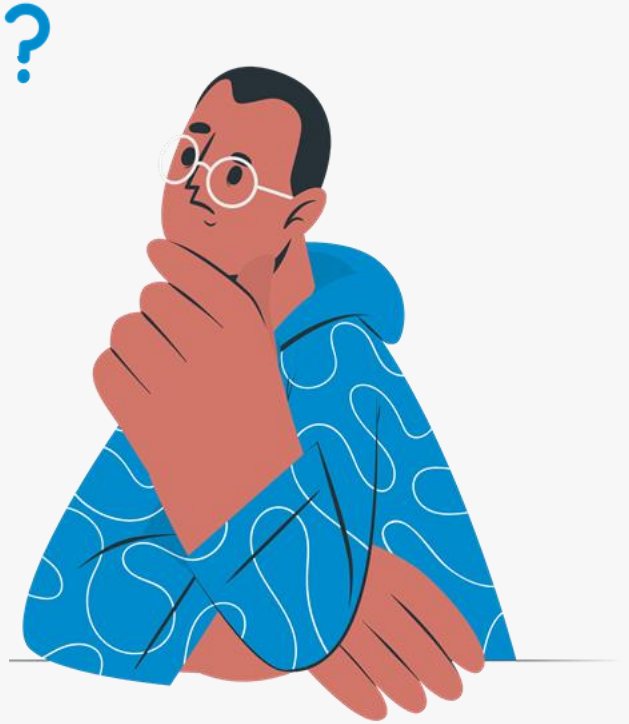
Is Accuracy a reliable evaluation metric?

Is Accuracy a Reliable Metric?

When a majority of the data belongs to **one class (units sold > 1000)** and only a minority belongs to the **other class (units sold < 1000)** it causes a **class imbalance**.

Model will achieve high accuracy by predicting just the majority class.



Precision & Recall

Precision

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

"What proportion of positive predictions were actually correct?"

High Precision: Use Cases

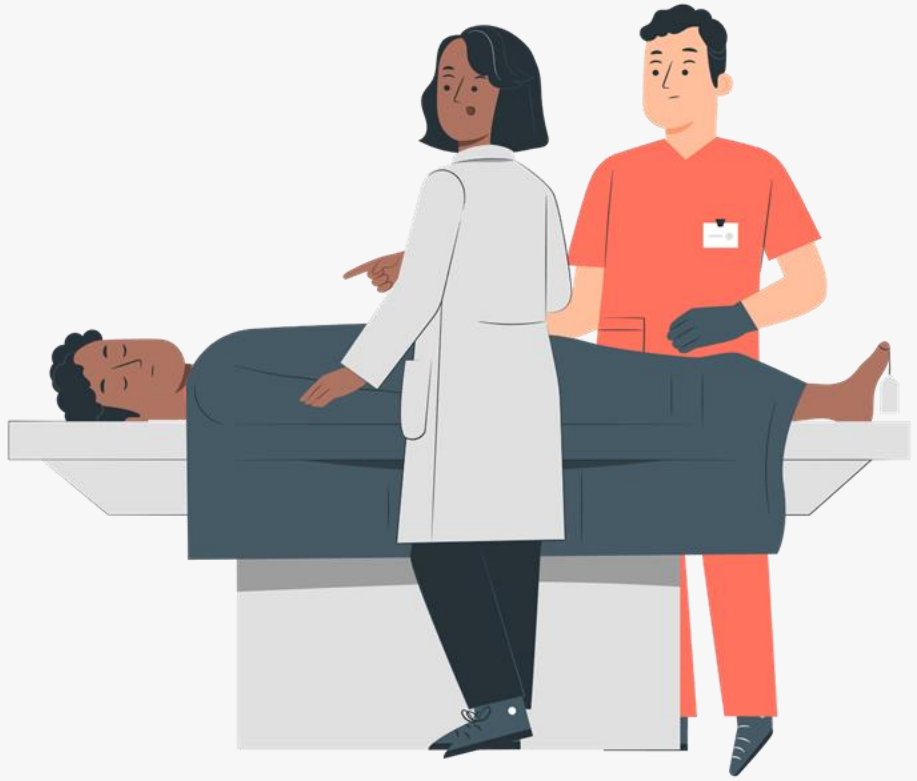
- **Marketing Luxury Goods**

High precision ensures marketing efforts are focused on relevant customers.

High Precision: Use Cases

- **Specific Medical Scenarios**

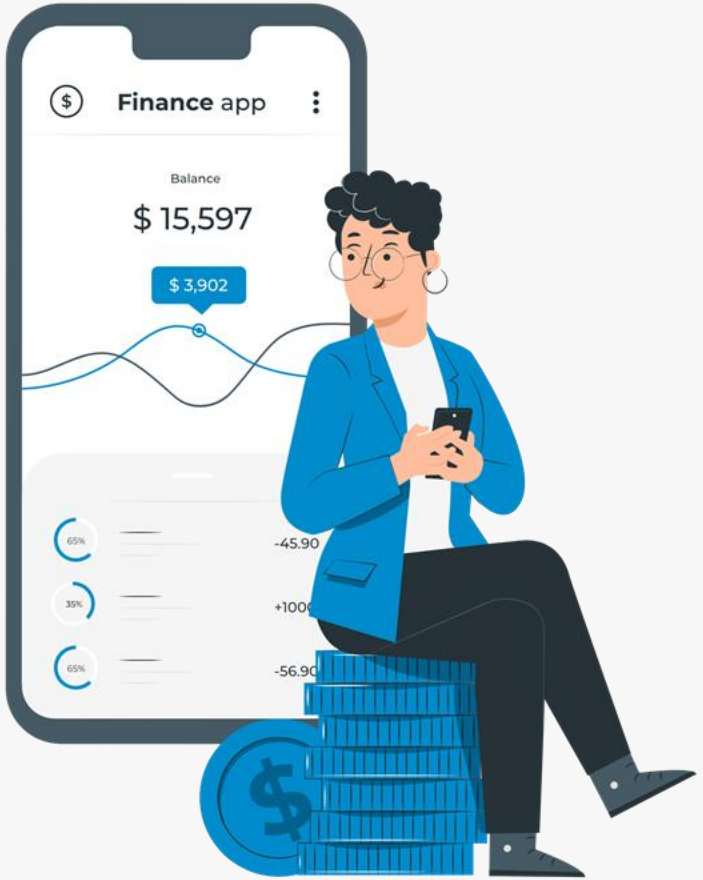
High precision is required for matching donors and recipients for organ transplants.



High Precision: Use Cases

- **Banking Sector**

High precision can help focus on high credit score customers.



Recall (Sensitivity or Hit Rate)

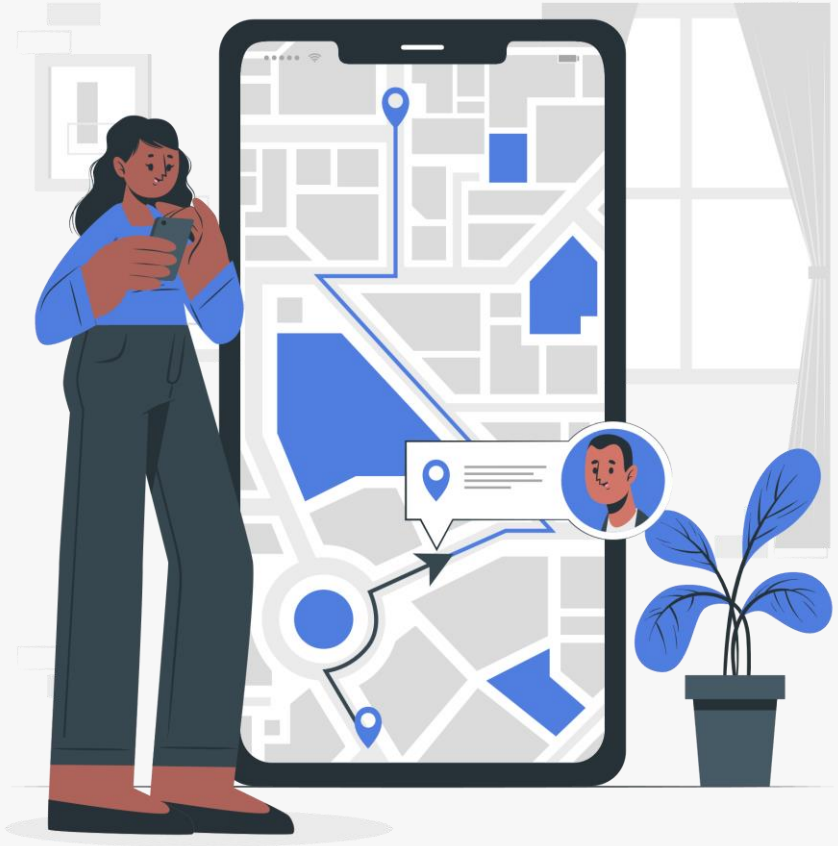
$$\text{Recall} = \frac{TP}{TP + FN}$$

"What proportion of actual positives were detected correctly?"

High Recall: Use Cases

- **Search and Rescue Missions**

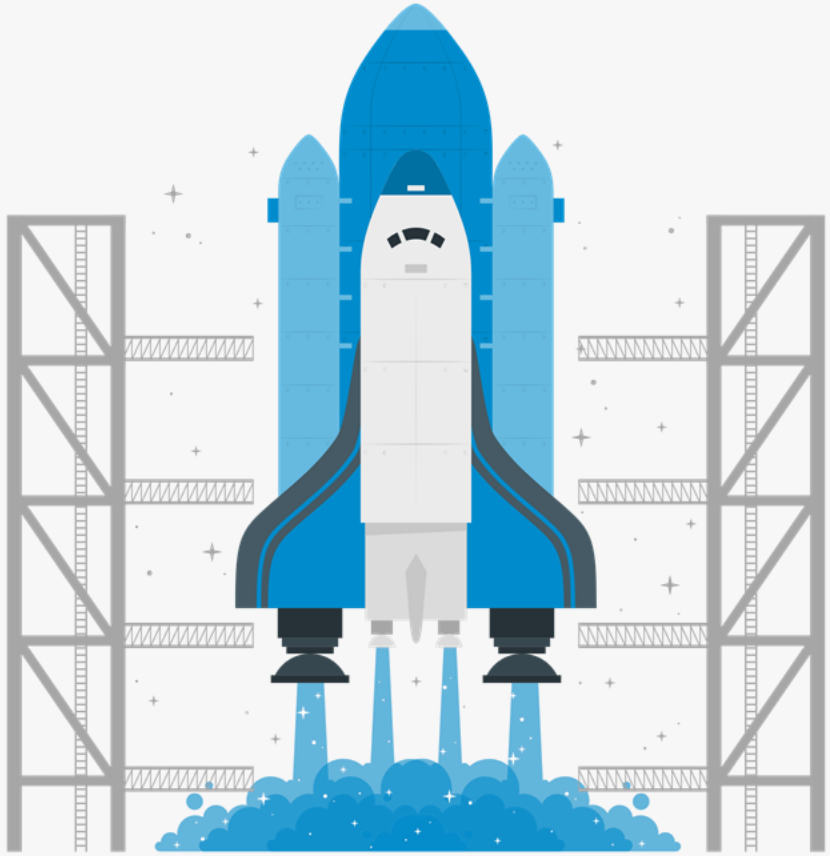
High recall can help in finding target locations for rescue missions.



High Recall: Use Cases

- **Detecting Defective Products**

High recall in aerospace industries helps detect defective products.



High Recall: Use Cases

- **Detecting Advanced Threats and Malware**

High recall in cybersecurity helps detects most threats.

“Precision” or “Recall”
&
When and Why?

When to use Precision / Recall?

Confusion matrix: Test Data_Synergix to predict **a product sells more than 1000 units or not.**

Confusion Matrix		Predicted value		Total
		NO (Units_sold<1000)	**YES (Units_sold>1000)**	
Actual value	**NO (Units_sold<1000)**	*True Negative - 2354 (TN)*	*False Positive - 0 (FP)*	*2354*
	YES (Units_sold>1000)	*False Negative - 3534 (FN)*	***True Positive - 2 (TP)***	*3536*

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

Precision = 100%

When to use Precision / Recall?

Confusion matrix: Test Data_Synergix to predict **a product sells more than 1000 units or not.**

Confusion Matrix		Predicted value		Total
		NO (Units_sold<1000)	**YES (Units_sold>1000)**	
Actual Value	**NO (Units_sold<1000)**	*True Negative - 0 (TN)*	*False Positive - 2354 (FP)*	*2354*
	YES (Units_sold>1000)	*False Negative - 0 (FN)*	***True Positive - 3536 (TP)***	*3536*

$$\text{Recall} = \frac{TP}{TP + FN}$$

Recall = 100%

F1 Score

F1 Score

F1-Score is the **harmonic mean of precision and recall.**

$$\text{F1 Score} = \frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

If:
Precision/ Recall = 0

Then:
F1 Score= 0

F1 Score:
Synergix Classification Problem

Why F1 Score for Synergix?

1. Synergix dataset also suffers from class imbalance.
2. There is an equal importance to precision and recall.
   A. If **FP increases**, Synergix may **overstock products**.
   B. If **FN increases**, Synergix may **understock products**.

Confusion Matrix		Predicted value	
		NO (Units_sold<1000)	**YES (Units_sold>1000)**
Actual value	**NO (Units_sold<1000)**	*True Negative - 1500 (TN)*	*False Positive - 854 (FP)*
	YES (Units_sold>1000)	*False Negative - 1036 (FN)*	*True Positive - 2500 (TP)*

Total
2354
3536