# Mean Average Precision

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- When we want to assess how well an object detection model is performing, we use a metric called the Mean Average Precision (mAP).

- The mAP measures the model's performance by comparing the actual location of the object (known as the ground-truth bounding box) with the location identified by the model (the detected box), and then assigns a score.

- A higher score indicates that the model is more precise in identifying objects.

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

$$\text{Recall} = \frac{TP}{TP + FN}$$
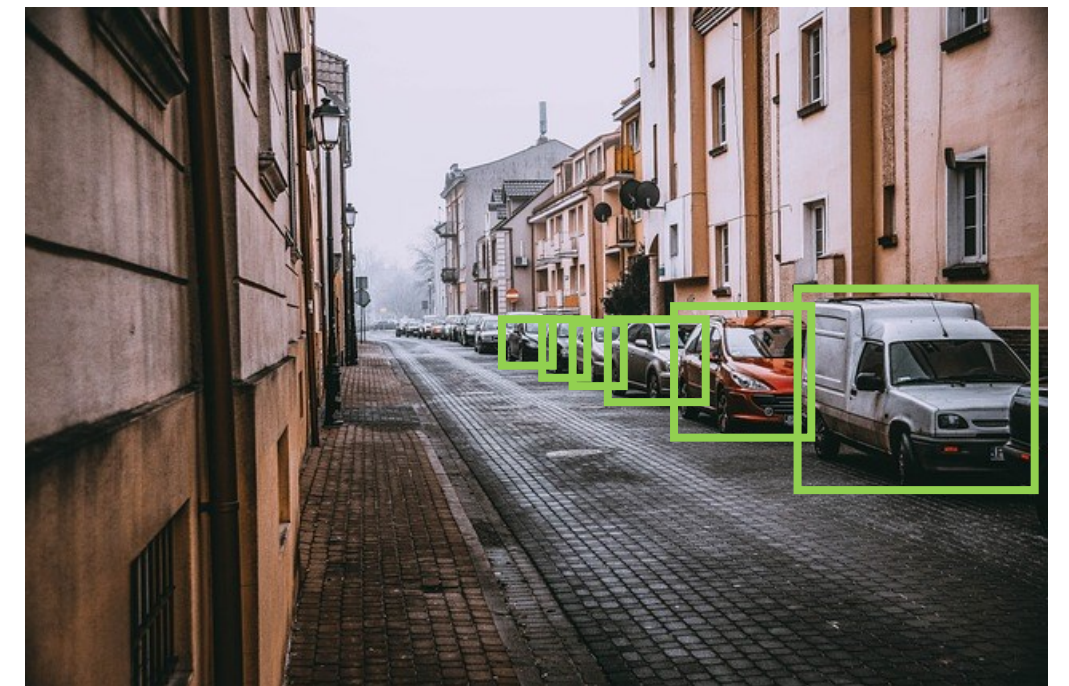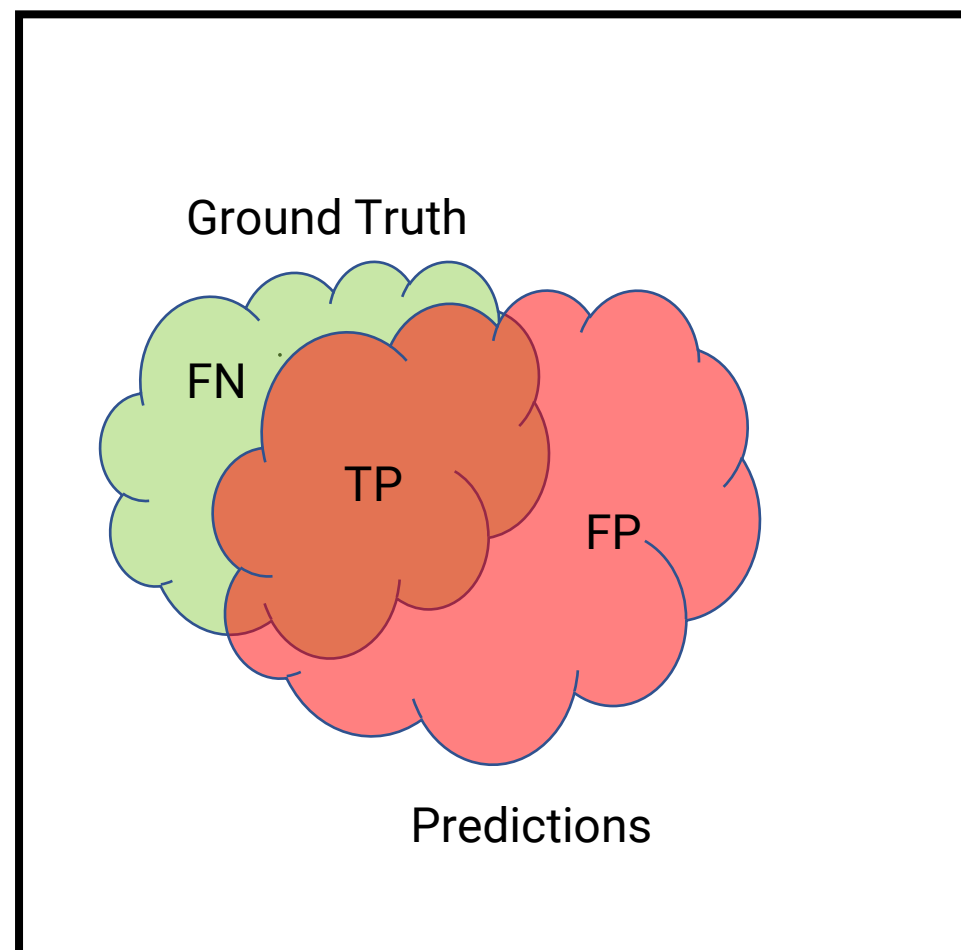
- When we input samples into the model, it gives us back scores that represent probabilities.

- To turn these probability scores into specific class labels, we use a cut-off value known as a threshold.

- If a sample's score is equal to or higher than this threshold, it's assigned to one class. If it's lower, it's assigned to the other class.

Precision-Recall Curve

- A precision-recall curve is a graph that illustrates the balance between precision and recall for various threshold settings.

- Typically, we assess object detection models using various Intersection over Union (IoU) thresholds.

- Each threshold can lead to different predictions.

- It's a useful tool for choosing the optimal threshold that will give us the best balance between precision and recall.
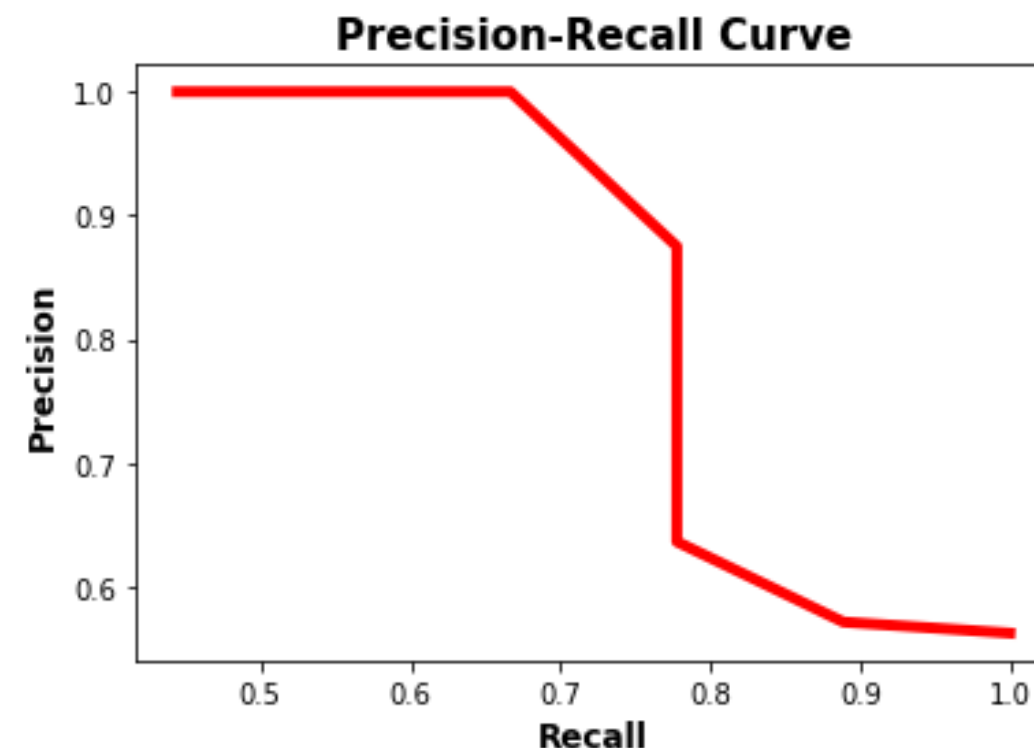
Average Precision (AP)

- Average Precision (AP) is a method used to condense the information from the precision-recall curve into a single number.

- This number represents the average of all precision values.

$$\text{Average Precision (AP)} = \int_{r=0}^{1} p(r)dr$$

Mean Average Precision

- We can calculate an Average Precision (AP) value for each class.

- The Mean Average Precision (mAP) is then determined by averaging the AP values across all the classes we're considering.

$$\text{mAP} = \frac{1}{k} \sum_{i}^{k} AP_i$$