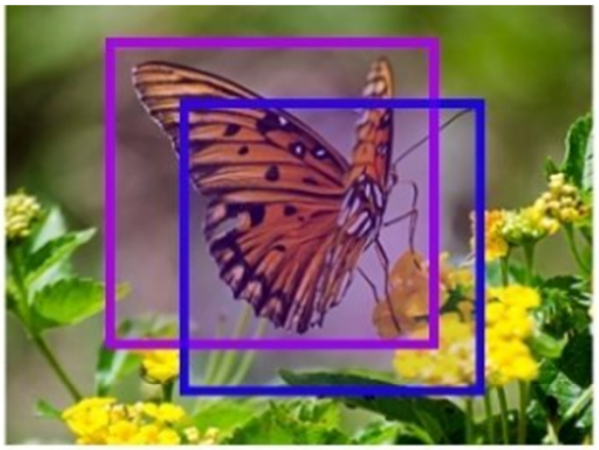
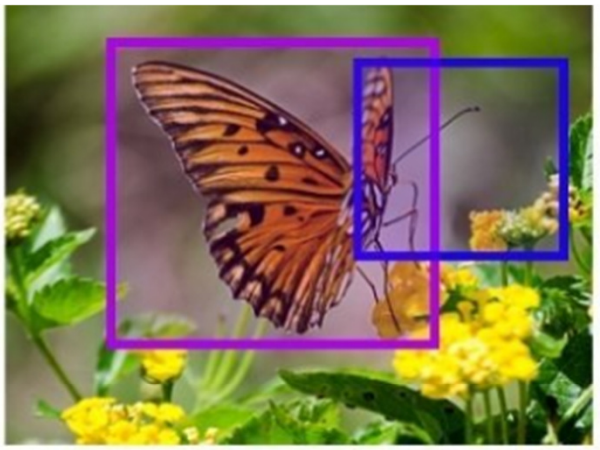
Intersect Over Union (IOU)

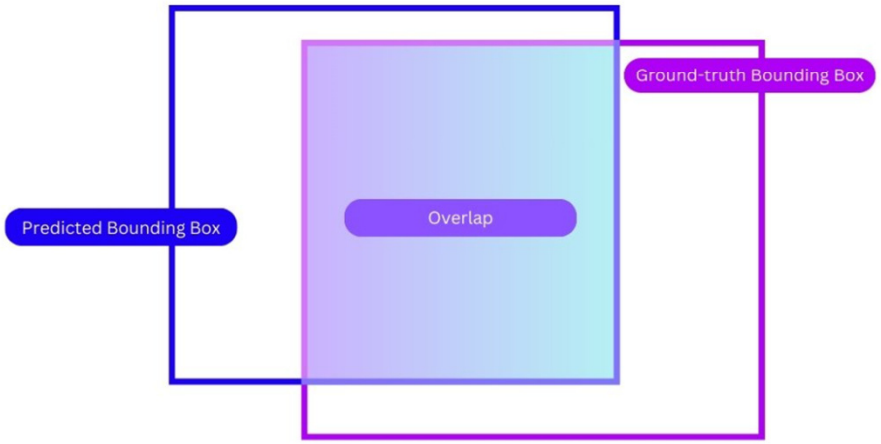
IoU = 0.971



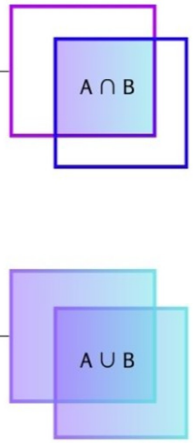
IoU = 0.772



IoU = 0.324



$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}}$$



IOU to determine TP and FP

True Positive

IoU = 0.922

The model predicted correctly

False Positive

IoU = 0.258

IoU Threshold = 0.5

The model predicted wrongly.

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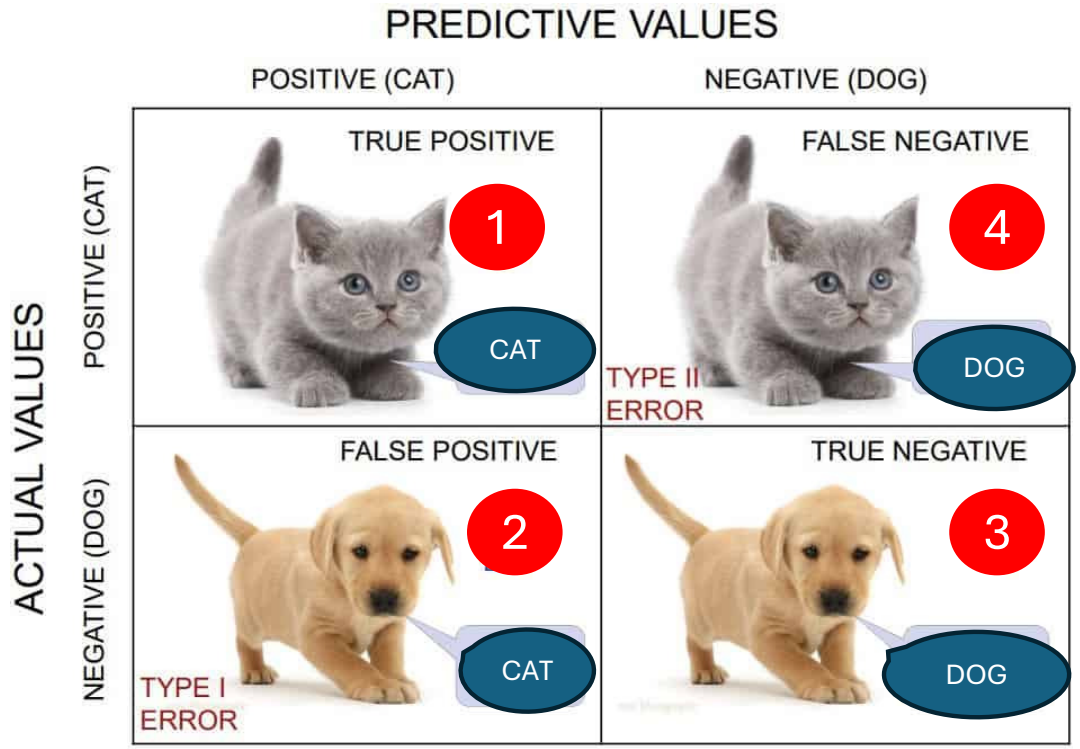
Confusion Matrix

- **Confusion matrix** is a simple table used to measure how well a classification model is performing.
- **True Positive (TP):** The model correctly predicted a positive outcome i.e the actual outcome was positive.
- **True Negative (TN):** The model correctly predicted a negative outcome i.e the actual outcome was negative.
- **False Positive (FP):** The model incorrectly predicted a positive outcome i.e the actual outcome was negative. It is also known as a Type I error.
- **False Negative (FN):** The model incorrectly predicted a negative outcome i.e the actual outcome was positive. It is also known as a Type II error.

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
Actual Negative	False Positive (FP)	True Negative (TN)

Example of Confusion Matrix

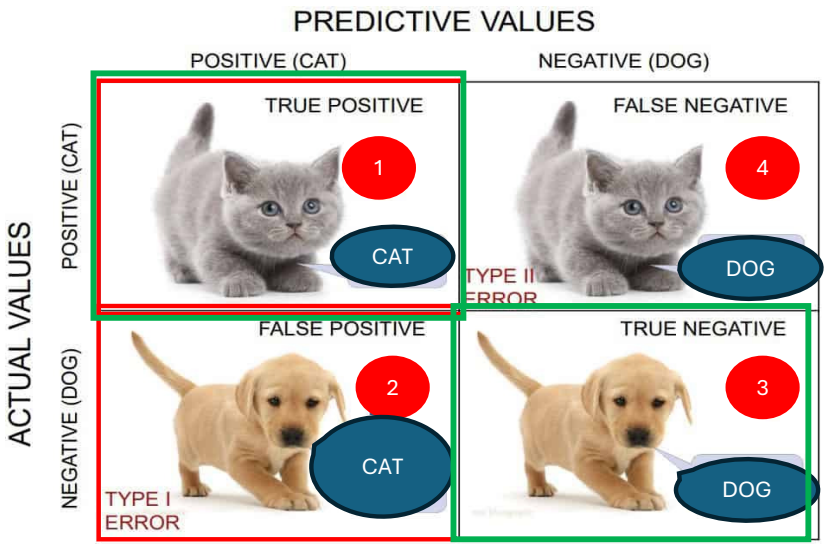


1. **True Positive (TP):** Correctly predicted a positive outcome (cat) and the actual outcome was positive (cat)
2. **False Positive (FP):** Incorrectly predicted a positive outcome (cat) and the actual outcome was negative (dog)
3. **True Negative (TN):** Correctly predicted a negative outcome (dog) and the actual outcome was negative (dog)
4. **False Negative (FN):** Incorrectly predicted a negative outcome (dog) and the actual outcome (cat) was positive.

Precision and Recall

- **P (Precision)**: The accuracy of the detected objects, indicating how many detections were correct. Refers to accuracy of the model's positive predictions.

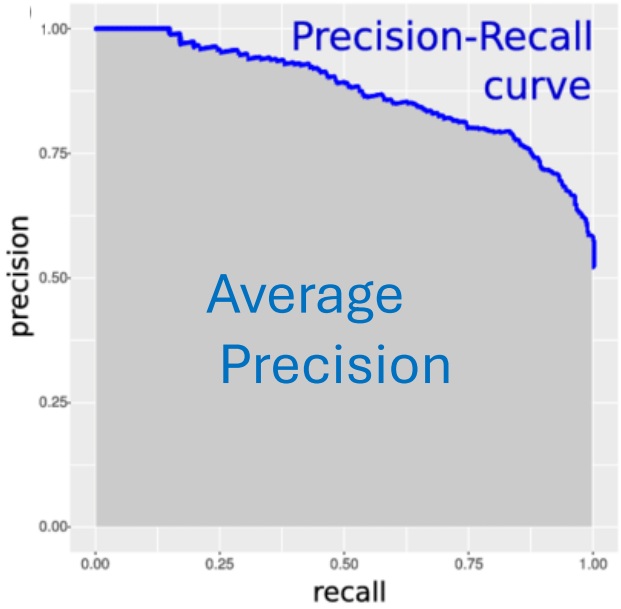
$$\text{Precision (P)} = \frac{\text{TP}}{\text{TP} + \text{FP}}$$



- **R (Recall)**: The ability of the model to identify all **relevant** instances of objects in the images. (True positives are correctly identified cancerous cells, and false negatives are cancerous cells that the model missed.)

$$\text{Recall (R)} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

- Average precision (AP) is the area under the precision-recall curve (PR curve). A higher AP indicates better performance



Mean Average Precision (mAP)

- **Mean Average Precision**
  - The **average of AP** calculated across all classes in an object detection task
- **mAP50 (easy detection)**:
  - Mean average precision calculated at an intersection over union (IoU) **threshold of 0.50** across all classes.
- **mAP50-95 (more accurate)**
  - The average of the mean average precision calculated at varying IoU thresholds, ranging from **0.50 to 0.95** across all classes.
  - The thresholds are typically incremented by 0.05 and mAP is calculated for each IoU.

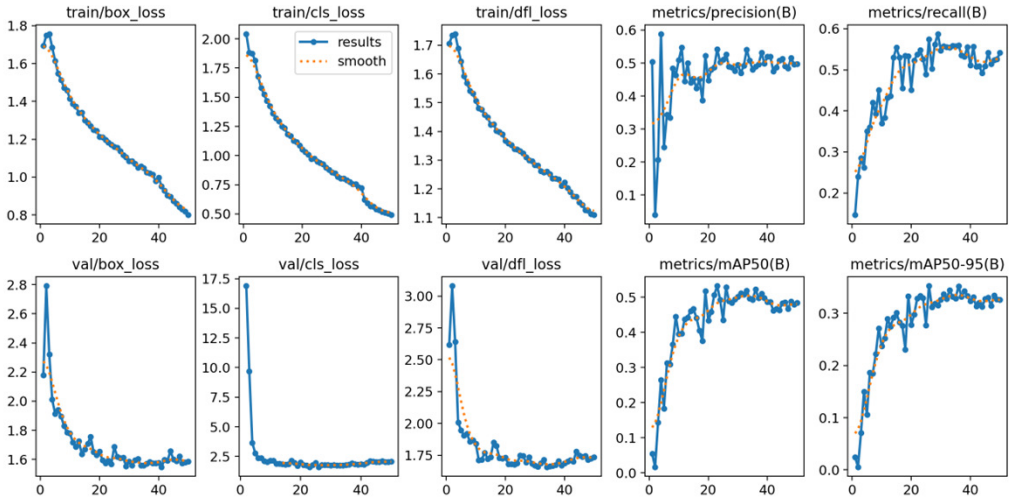
$$\text{mAP} = \frac{1}{N}\sum_{i=1}^{N} \text{AP}_{\text{IoU(k)}}$$

$\text{AP}_{\text{IoU(k)}}$ is the Average Precision at the (k)-th IoU threshold and N is the number of class.

Precision vs Recall

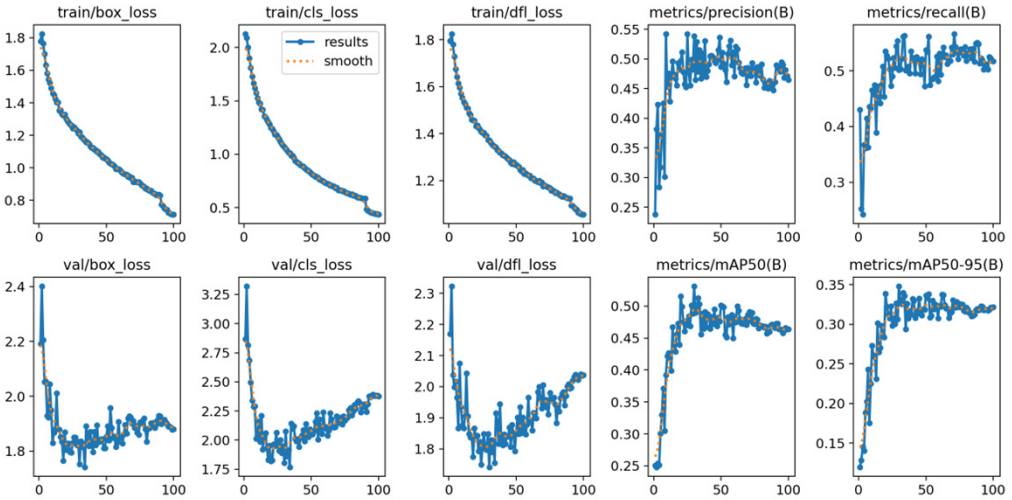
- Epoch50, batch16, yolov8l.pt

Class	Images	Instances	Box(P	R	mAP50	mAP50-95):
all	244	726	0.511	0.595	0.521	0.35
corner-cast	190	399	0.207	0.206	0.0934	0.0386
roof	154	202	0.654	0.698	0.634	0.394
shipping-container	28	125	0.672	0.88	0.836	0.616



- Epoch100, batch16, yolov8l.pt

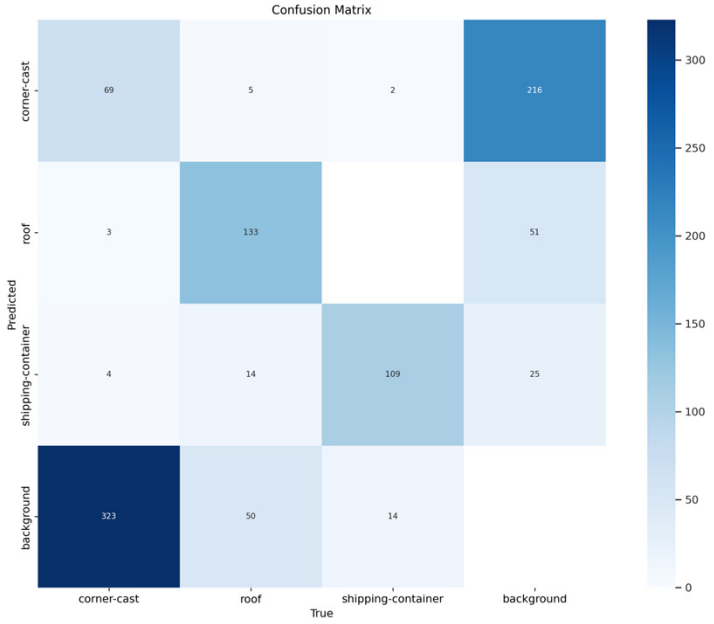
Class	Images	Instances	Box(P	R	mAP50	mAP50-95)
all	244	726	0.539	0.502	0.531	0.348
corner-cast	190	399	0.204	0.138	0.119	0.0467
roof	154	202	0.761	0.504	0.664	0.413
shipping-container	28	125	0.651	0.864	0.809	0.584

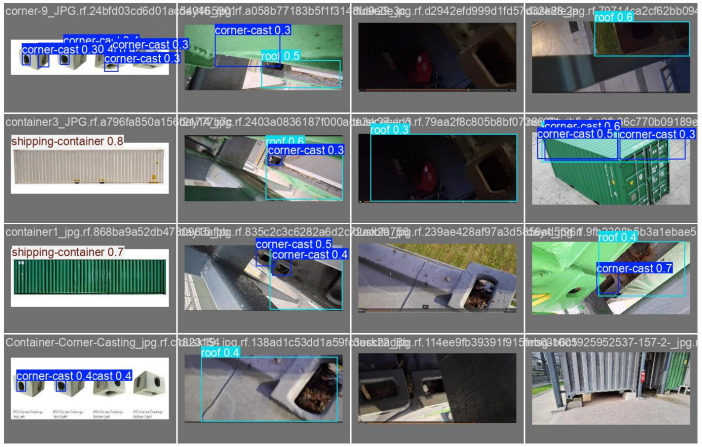


DFL Loss

Confusion Matrix

- Epoch50, batch16, yolov8l.pt





- Epoch100, batch16, yolov8l.pt