ML model, Loss function & Metric

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Computer Vision Model

Object Detection model

Example : Faster R_CNN, Mask R-CNN, and YOLO

Loss function

Loss functions for Object classification and BBox Localization

a combination of two individual loss functions:

bounding Box Regression (Which will measure how well predicted bounding boxes captures ground truth bounding boxes)

Cross Entropy Loss (Which will measure how good a job the detector did in predicting the correct class)

Metric

Average Precision (AP) and mean Average Precision (mAP)

YOLO

Loss function : Coordinate loss + Classification loss + Confidence loss

YOLO uses sum-squared error between the predictions and the ground truth to calculate loss.

The loss function composes of: Classification loss + Localization loss (errors between the predicted boundary box and the ground truth).

Metric : mAP

Object Detection loss function (in detail)

The bounding box is predicted with a loss function that gives the error between the predicted and ground truth bounding box.

L2 loss

IoU loss

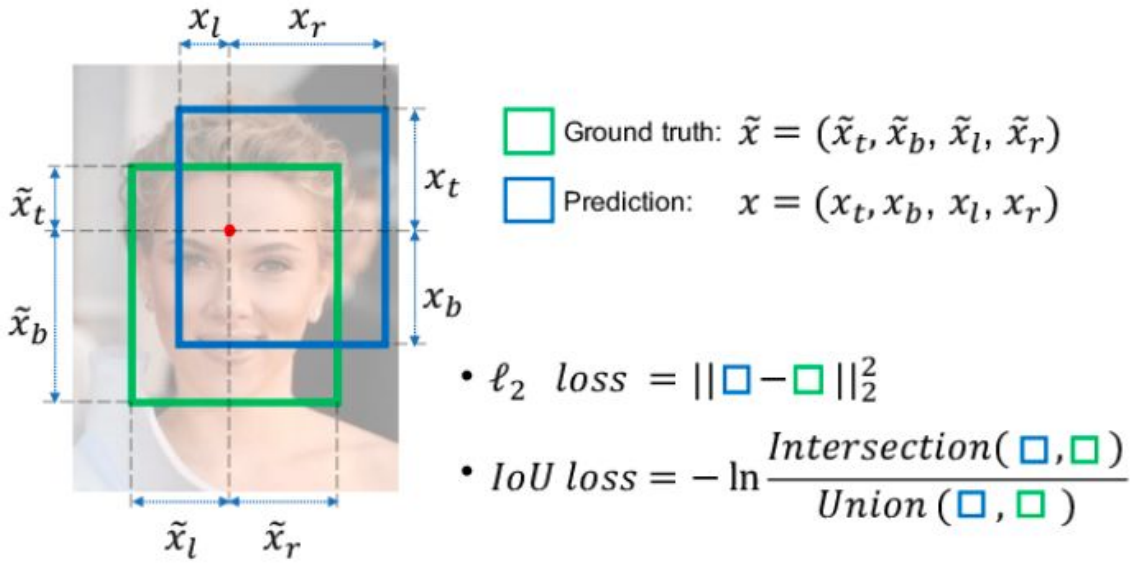
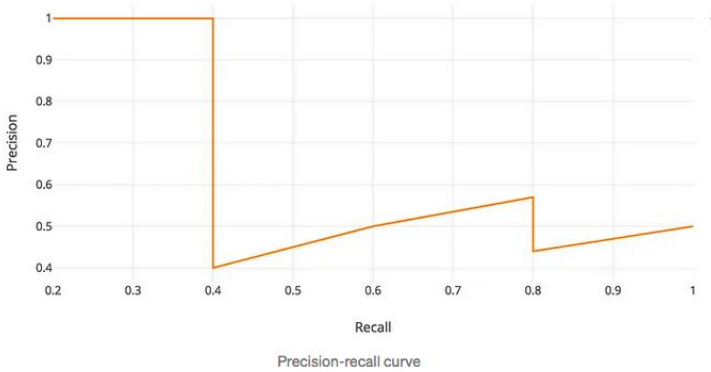


Illustration of IoU loss and 2 loss for pixel-wise bounding box prediction.

Object Detection Model Metric

mAP (Mean Average Precision)



Precision-recall curve

AP (Average Precision) : The area under the precision-recall curve.

mAP (mean average precision) is the average of AP.

In some context, we compute the AP for each class and average them.

The general definition for the Average Precision (AP) is finding the area under the precision-recall curve above.

$$\mathrm{AP} = \int_0^1 p(r)dr$$

But in some context, they mean the same thing. For example, under the COCO context, there is no difference between AP and mAP. Here is the direct quote from COCO:

> *AP is averaged over all categories. Traditionally, this is called "mean average precision" (mAP). We make no distinction between AP and mAP (and likewise AR and mAR) and assume the difference is clear from context*

Semantic Segmentation

Loss function

cross-categorical entropy loss

pixel-wise cross entropy loss

(pixel 별로 class 를 추측하는 것이므로, 일종의 classification 작업이다)

Metric

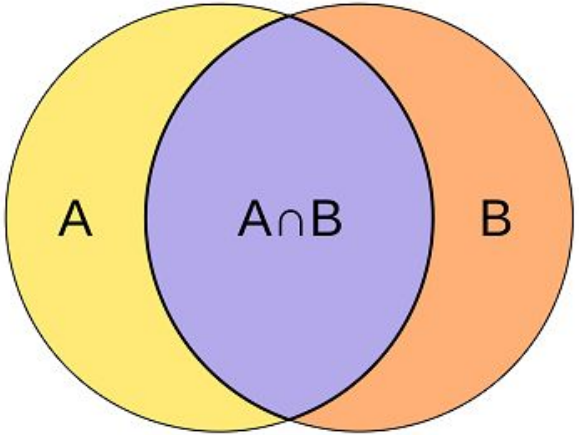
most commonly used metrics are the **IoU** and the **Dice Coefficient**

Dice Coefficient

(Dice Similarity Coefficient)

The DSC measures the spatial overlap between two segmentations, A and B target regions,

and is defined as **DSC(A,B)= 2(A∩B)/(A+B)** where ∩ is the intersection



$$\text{Dice coefficient}(A, B) = \frac{2 \times |A \cap B|}{|A| + |B|}$$

Classification Model

Loss function

Usually Cross-Entropy loss

Binary Cross-Entropy Loss / Log Loss

Metric

The key classification metrics: Accuracy, Recall, Precision, and F1- Score.

Linear Regression Model

Loss function

Mean Square Error (MSE) is the most commonly used regression loss function.

Least Squared Error

Metric

MSE, MAE, R-squared, Adjusted R-squared, and RMSE.

Logistic Regression Model

Loss function

Log loss

$$Cost(h_\theta(x), y) = -ylog(h_\theta(x)) - (1 - y)log(h_\theta(x))$$

Metric (because it is a type of classification)

Accuracy, Precision, Recall, and ROC.