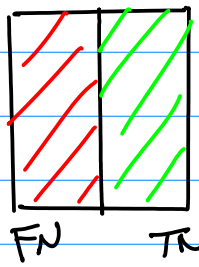
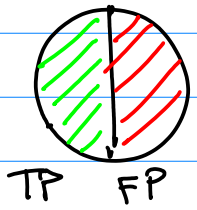
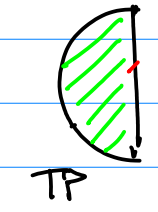
Pie chart Example on mAP (mean Average Precision)

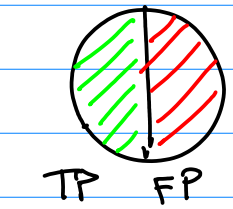


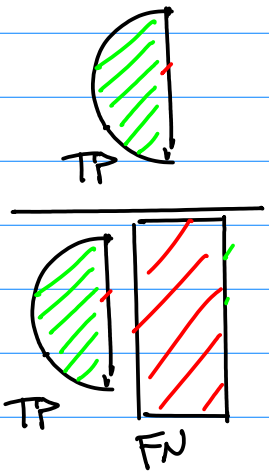
Negative Square
- True Negative (Green)
- False Negative (Red)



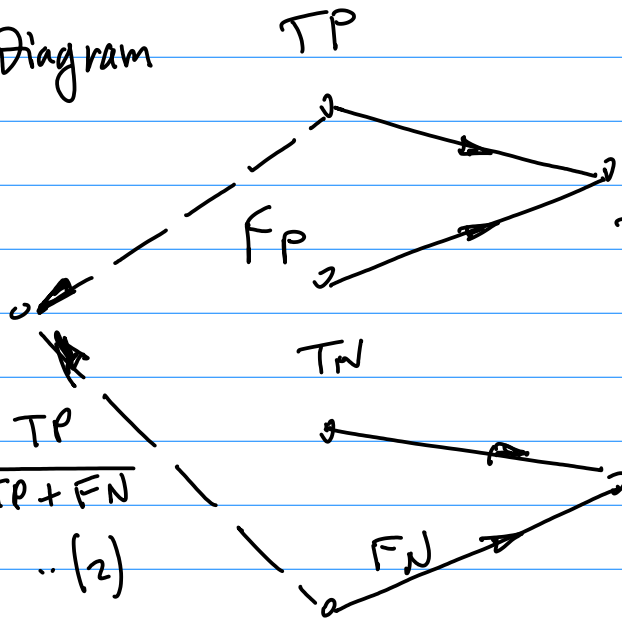
Positive Circle
- True Positive (Green)
- False Positive (Red)







Space Diagram



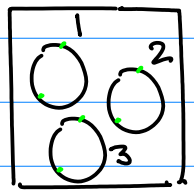
$$\text{Precision} = \frac{TP}{TP+FP} \quad \cdots (1)$$

Positive Circle

$$\text{Recall} = \frac{TP}{TP+FN} \quad \cdots (2)$$

Negative Square

- False Positive ≠ False Negative
- False Positive = False Negative



Predict Ball 1 ! CASE I.
Take a Ball out
B1 : TP
B2 or B3 : TN

IOU ≥ 0.5 TP (True Positive)
< 0.5 FP (False Positive)

Case II : B2 : FP
B1 or B3 : FN

https://jonathan-hui.medium.com/map-mean-average-precision-for-object-detection-45c121a31173

Example on mAP (mean Average Precision)

Example: Suppose Presion (P) and Recall (R) are already Computed. and arranged according to the rank of the Recall as in the following Table

$$Precision = \frac{TP}{TP+FP} \quad \cdots (1)$$

$$Recall = \frac{TP}{TP+FN} \quad \cdots (2)$$

Step 1. Build A Table to Rank Recall values, Suppose for Class C; we have

Rank	Correct?	Precision	Recall
1	True	1.0	0.2
2	True	1.0	0.4
3	False	0.67	0.4
4	False	0.5	0.4
5	False	0.4	0.4
6	True	0.5	0.6
7	True	0.57	0.8
8	False	0.5	0.8
9	False	0.44	0.8
10	True	0.5	1.0

Plot P-R (y-x) chart

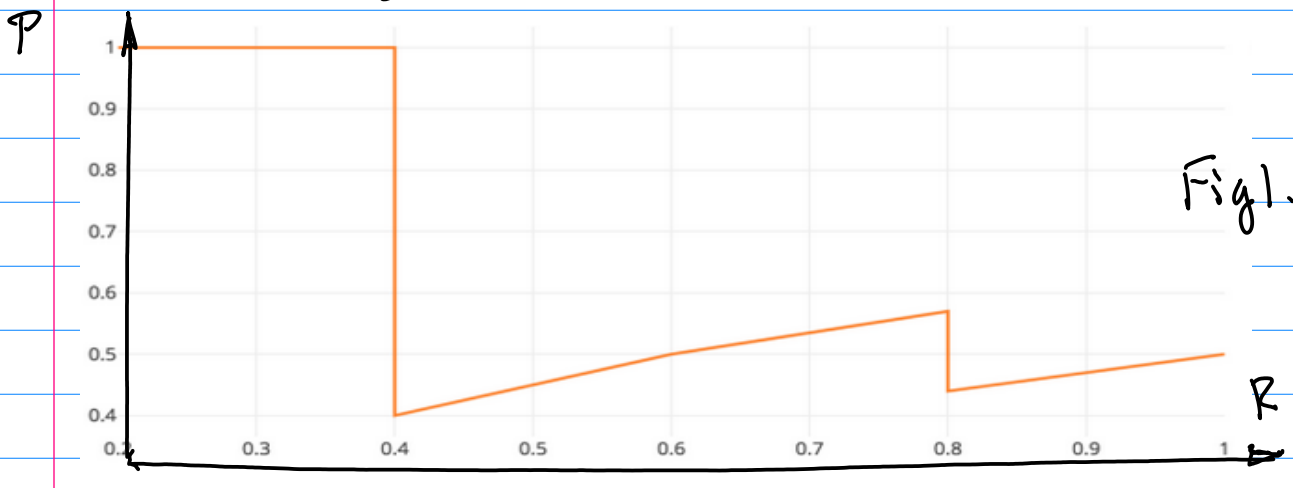
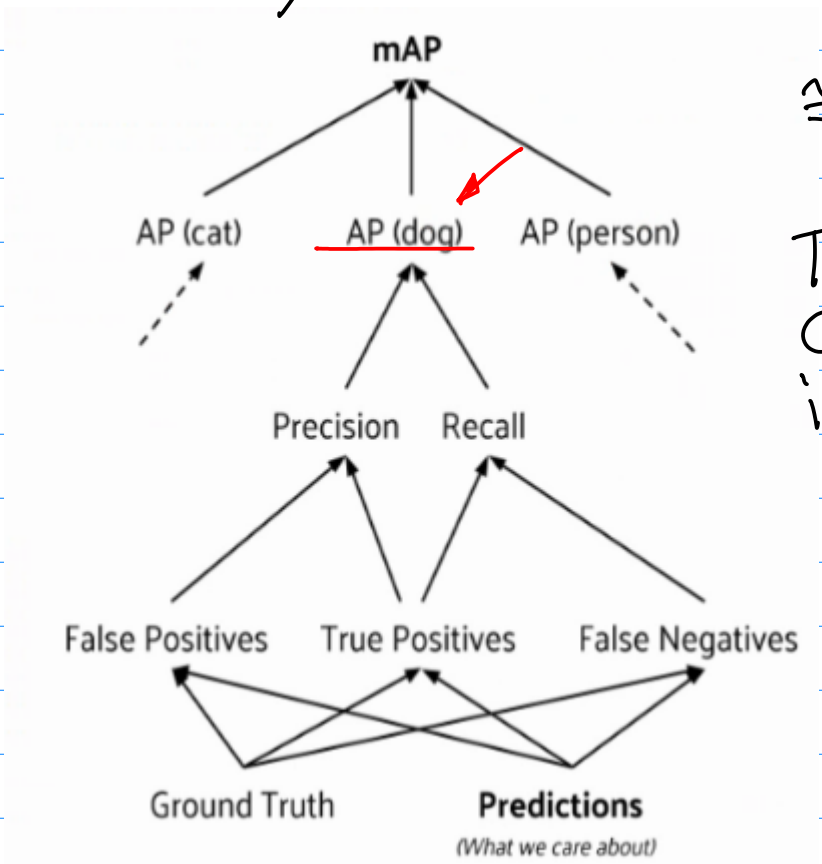


Fig1.

Step 2. Find Average Precission for this Class C_1

$$AP = \int_0^1 P(r)\,dr \quad \cdots (1)$$

$$\approx \sum_{i=0}^{N-1} P(r_i) \quad \cdots (2)$$



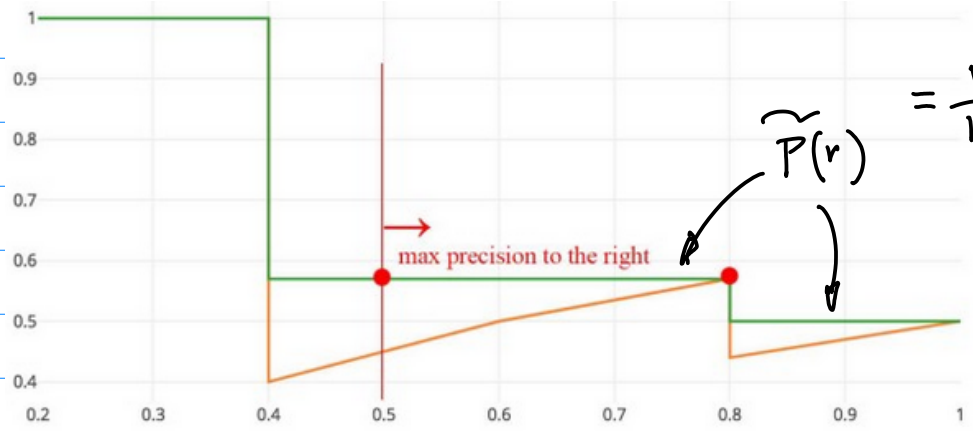
To simplify the computation, use interpolated precision

$$\tilde{P}(r) = \max_{\tilde{r} \geq r_k} P(\tilde{r}) \quad k \leq i \leq N-1 \quad \cdots (3)$$

$$AP = \frac{1}{N} \sum_{i=0}^{N-1} \tilde{P}(r_i)$$

$$= \frac{1}{11} \sum_{i=0}^{10} \tilde{P}(r_i)$$

$$= \frac{1}{11}\left(\tilde{P}(0.2)*1 + \tilde{P}(0.4)*4 + \tilde{P}(0.6)*1 + \tilde{P}(0.8)*3 + \tilde{P}(1.0)*2\right)$$



where

$\tilde{P}(0.2) = P(0.2) = 1.0$

$\tilde{P}(0.4) = P(0.4) = 1.0$, $\tilde{P}(0.6) = 0.57$, $\tilde{P}(0.8) = 0.57$,

$\tilde{P}(1.0) = 0.5$.

Hence, $AP = \frac{1}{11}\left(1.0 + 1.0*4 + 0.57 + 0.57*3 + 0.5*2\right)$

$= \frac{1}{11}\left(1.0*5 + 0.57*4 + 0.5*2\right)$, e.g. for C_1, $AP_1 = AP$

Continue this process for the next class C_2's AP_2.

Suppose $AP_2 = \frac{1}{13}(1.0*6 + 0.52*5 + 0.2*2)$

then $mAP = \frac{1}{2}(AP_1 + AP_2)$

"

(END)