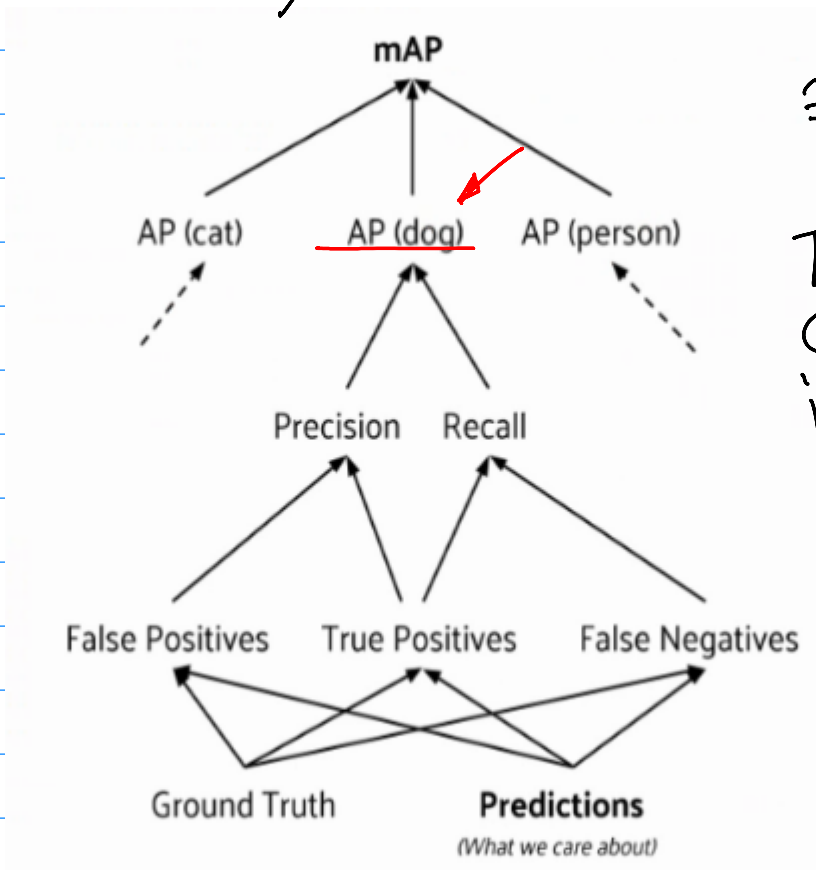
Step 2. Find Average Precission for this Class C_1,

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

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



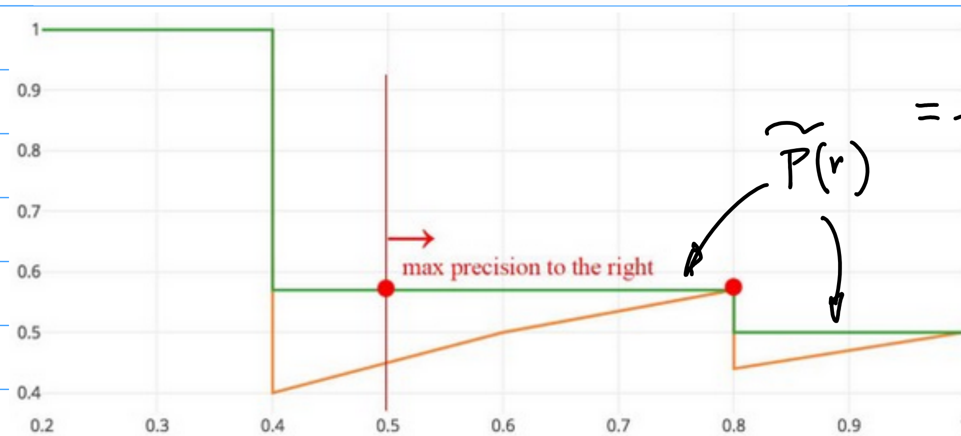
To simplify the Computation, use interpolated precision

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

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

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

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



$\tilde{P}(r)$

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

$= \frac{1}{11}\big(1.0*5 + 0.57*4 + 0.5*2\big)$, 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)

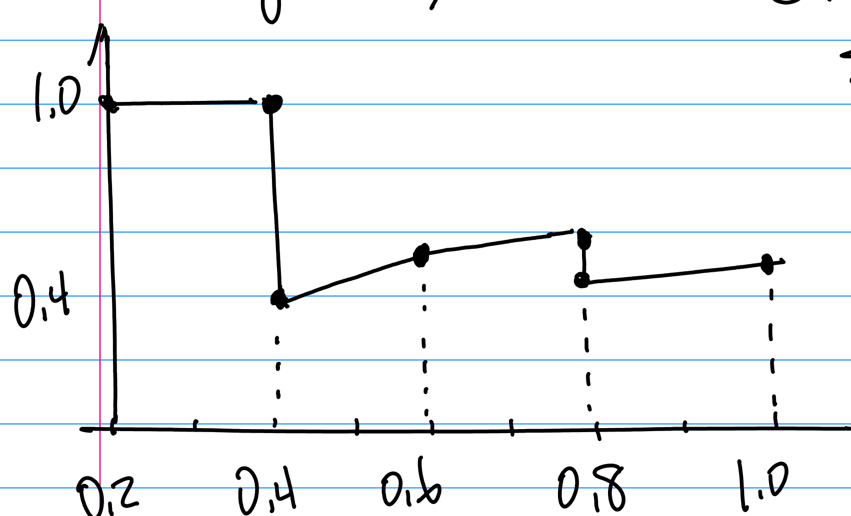
MAP Example
Mean Average Precision

HL

Example: Given the Following Data Set, find MAP.

Rank	P (Precision)	R (Recall)
0	1.0	0.2
1	1.0	0.4
2	0.67	0.4
3	0.5	0.4
4	0.4	0.4
5	0.5	0.6
6	0.57	0.8
7	0.44	0.8
8	0.5	1.0

Step 1. Plot R-P Chart as x-y chart, N=9



Note: for (0.4, 1.0), (0.4, 0.67) (0.4, 0.5), and (0.4, 0.4), Choose (0.4, 1.0) the max, and (0.4, 0.4), the min, in the plot, Similarly for (0.8, 0.57), (0.8, 0.44), Choos the first as max, and the 2nd as min in the plot.

Note: Insert $r_i = 0.3$ between [0.2, 0.4], and $r_i = 0.5$ between [0.4, 0.6], and $r_i = 0.7$ between [0.6, 0.8], as well as 0.9 between [0.8, 1.0].

Step 2.

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

$$\simeq \frac{1}{N}\sum_{i=0}^{N-1} P(r_i) \quad \text{for } N=9$$

$$AP \simeq \frac{1}{9}\sum_{i=0}^{8} P(r_i) \quad \dots (1)$$

$$= \frac{1}{9}\big(P(r_0)+P(r_1)+P(r_2)+\dots + P(r_8)\big)$$

$$= \frac{1}{9}\big(P(0.2)+P(0.3)+P(0.4)+ P(0.5)+P(0.6)+P(0.7)+P(0.8)+ P(0.9)\big) \quad \dots (2)$$

From the plot,

$P(0.2)=1.0,\ P(0.3)=1.0,\ P(0.4)=1.0$

and for Sloped line of P value

we use

$$\tilde{P}(r_i)=\max_{i\le K\le u}\tilde{P}(r_K) \quad \ldots(3)$$

where $i=3,\ r_3=0.4,\ u=7$

$$\tilde{P}(r_i)=\tilde{P}(r_3)=\max_{3\le K\le 7}\tilde{P}(r_K)$$

Note the upper bound u

$$\max_{i\le K\le u}\{\tilde{P}(r_K)\}$$

Should be Selected from the Same Slopped line Segment

$$\tilde{P}(r_3)=\max\{\tilde{P}(r_3),\tilde{P}(r_4),\tilde{P}(r_5),\tilde{P}(r_6),\tilde{P}(r_7)\}$$

$$=\max\{0.4,\tilde{P}(r_4),\tilde{P}(r_5),0.5,\tilde{P}(r_7),0.44\} \quad \ldots(4)$$

Where $\tilde{P}(r_4),\tilde{P}(r_5)\le 0.5$, and

$\tilde{P}(r_7)\le 0.57$ So

$$\tilde{P}(r_3)=\max\{0.4,\tilde{P}(r_4),\tilde{P}(r_5),0.5,\tilde{P}(r_7),0.44\}=\tilde{P}(r_7)$$

$$=0.57 \quad \ldots(5)$$

Similarly, On the Same Slopped line Segment

$\tilde{P}(r_4)=\tilde{P}(r_7)$

$\tilde{P}(r_5)=\tilde{P}(r_7)$

$\tilde{P}(r_6)=\tilde{P}(r_7)$

Now, for $\tilde{P}(r_8),\tilde{P}(r_9)$, we are on A New Slopped Line Segment, from Eqn(3),

$$\tilde{P}(r_8)=\max_{8\le K\le 9}\tilde{P}(r_K)$$

$$=\max\{\tilde{P}(r_8),\tilde{P}(r_9)\}$$

from the line segment, $\tilde{P}(r_8)\le\tilde{P}(r_9)$

So, $\tilde{P}(r_8)=\tilde{P}(r_9)=0.5$

Now, Substitute the Above

From Eqn (2),

$$AP = \frac{1}{9}\left(P(r_0)+P(r_1)+P(r_2)+\cdots+P(r_8)\right)$$

$$\doteqdot \frac{1}{9}\left(\tilde{P}(r_0)+\tilde{P}(r_1)+\cdots\tilde{P}(r_8)\right)$$

$$= \frac{1}{9}\left(\tilde{P}(r_0)+\tilde{P}(r_0)+\tilde{P}(r_0)+\tilde{P}(r_7)+\tilde{P}(r_7)\right.$$

$$\left.+\tilde{P}(r_7)+\tilde{P}(r_7)+\tilde{P}(r_7)+\tilde{P}(r_9)+\tilde{P}(r_9)\right)$$

$$= \frac{1}{9}\left(3*\tilde{P}(r_0)+5*\tilde{P}(r_7)+2*\tilde{P}(r_9)\right)$$

$$= \frac{1}{9}\left(3*1.0+5\times0.57+2*0.5\right)$$

$$= \frac{1}{9}(3+2.85+1.) = 6.85/9 = 0.7611$$ //

(END)