

MAP Example

Mean Average Precision HL

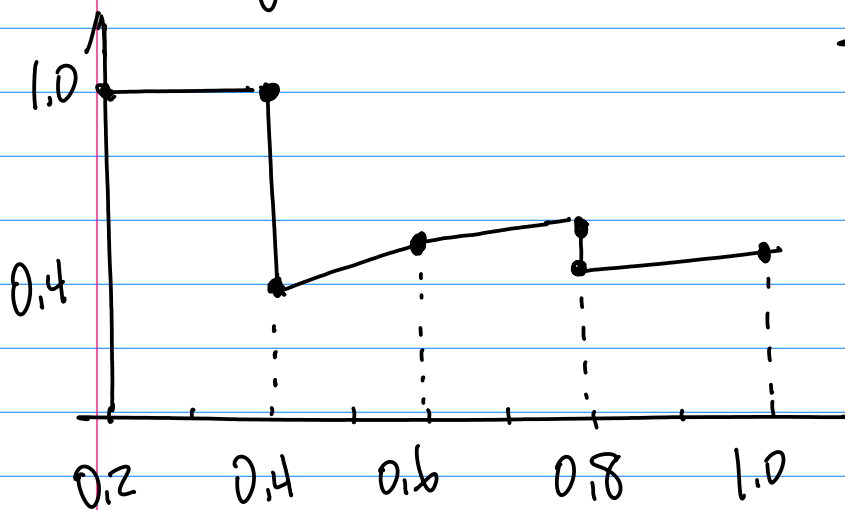
Example: Given the following Data Set, find mAP.

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

$\frac{1}{3}$
 $(0.4, 0.4)$, the min, in the plot, Similarly for $(0.8, 0.57)$, $(0.8, 0.44)$, Choose 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 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

Step 2.

$$\text{Since } AP = \int_0^1 P(r) dr$$

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

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

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

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

From the plot,
 $T(0.2)=1.0, P(0.3)=1.0, T(0.4)=1.0$
 and for Sloped line of P value
 we use

$$\tilde{P}(r_i) = \max_{i \leq k \leq u} \tilde{P}(r_k) \quad \dots (3)$$

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

$$\tilde{P}(r_i) = \tilde{P}(r_3) = \max_{3 \leq k \leq 7} \tilde{P}(r_k)$$

Note the upper bound u

$$\max_{i \leq k \leq u} \{ \tilde{P}(r_k) \}$$

Should be Selected from the Same
 Slopped line Segment

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

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

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

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

$$\tilde{P}(r_7) \leq 0.57 \text{ so}$$

$$\tilde{P}(r_3) = \max \{ 0.4, \tilde{P}(r_4), \tilde{P}(r_5), 0.5, \tilde{P}(r_7), 0.44 \} = \tilde{P}(r_7) = 0.57 \quad \dots (5)$$

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),

$$\tilde{P}(r_8) = \max_{8 \leq k \leq 9} \tilde{P}(r_k)$$

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

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

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

Now, Substitute the Above

From Eqn (2),

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

$$\cong \frac{1}{9} (\tilde{P}(r_0) + \tilde{P}(r_1) + \dots + \tilde{P}(r_8))$$

$$= \frac{1}{9} (\tilde{P}(r_0) + \tilde{P}(r_0) + \tilde{P}(r_0) + \tilde{P}(r_1) + \tilde{P}(r_1) + \tilde{P}(r_1) + \tilde{P}(r_1) + \tilde{P}(r_1) + \tilde{P}(r_1) + \tilde{P}(r_2) + \tilde{P}(r_2) + \tilde{P}(r_2))$$

$$= \frac{1}{9} (3 * \tilde{P}(r_0) + 5 * \tilde{P}(r_1) + 2 * \tilde{P}(r_2))$$

$$= \frac{1}{9} (3 * 1.0 + 5 * 0.57 + 2 * 0.5)$$

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

(END)