

# Homework mAP (Mean Average Precision) Calculation

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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	0.5	0.6
5	0.57	0.8
6	0.3	0.8
7	0.5	1.0

Ans:  $AP = 0.685$  //

# MAP Homework Key

## Mean Average Precision HL

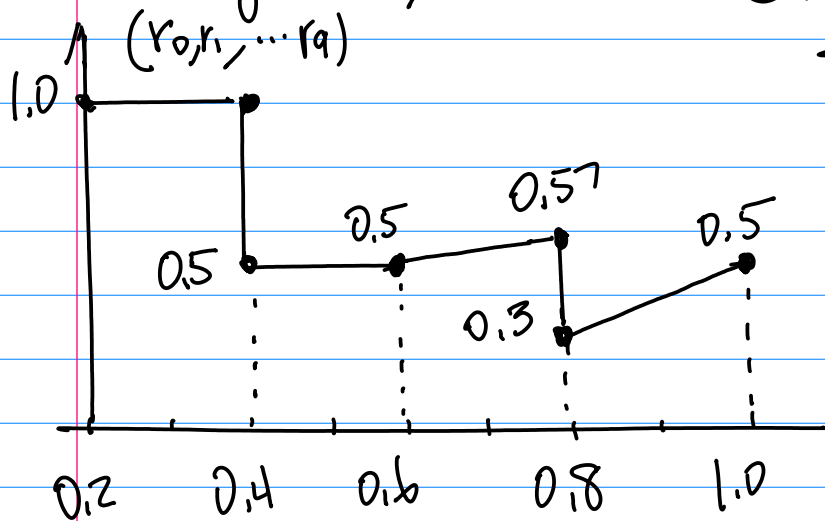
Example: Given the following Data Set, find mAP.

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7	0.5	1.0

$(0.4, 0.5)$ , the min, in the plot, Similarly for  $(0.8, 0.57)$ ,  $(0.8, 0.3)$ , 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,  $N=10$



Note: for  $[0.4, 1.0]$ ,  $[0.4, 0.6]$   $(0.4, 0.5)$ , Choose  $(0.4, 1.0)$  the max, and

Step 2.

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

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

$$AP \approx \frac{1}{10} \sum_{i=0}^9 P(r_i) \dots (1)$$

$$= \frac{1}{10} (P(r_0) + P(r_1) + P(r_2) + \dots + P(r_9))$$

$$= \frac{1}{10} (P(0.2) + P(0.3) + P(0.4) + P(0.5) + P(0.6) + P(0.7) + P(0.8) + P(0.9) + P(1.0)) \dots (2)$$

From the plot,  
 $P(r_0)=1.0, P(r_1)=1.0, P(r_2)=1.0$   
 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  $i=3, r_3=0.5, u=7$

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

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

$$= \max \{ 0.5, \tilde{P}(r_4), \tilde{P}(r_5), \tilde{P}(r_6), 0.5 \}$$

$$= 0.57 \quad \dots (4)$$

Where  $\tilde{P}(r_4), \tilde{P}(r_5), \tilde{P}(r_6) \leq 0.57$

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 <sup>3/3</sup>  
 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  
 into the following Equation

$$AP \approx \frac{1}{10} (\tilde{P}(r_0) + \tilde{P}(r_1) + \dots + \tilde{P}(r_9))$$

$$= \frac{1}{10} (\tilde{P}(r_0) \times 3 + \tilde{P}(r_7) \times 5 + \tilde{P}(r_9) \times 2)$$

$$= \frac{1}{10} (1.0 \times 3 + 0.57 \times 5 + 0.5 \times 2)$$

$$= 6.85/10 = 0.685$$

(END)