Evaluation of Ranked Retrieval Models

Evaluation: Ranked Retrieval Models

- Information Retrieval Systems

Evaluation: Ranked Retrieval Models

- Information Retrieval Systems
  - Precision
  - Recall

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Evaluation: Ranked Retrieval Models

- Information Retrieval Systems
  - Precision
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- Works with unranked sets

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Evaluation: Ranked Retrieval Models

- Information Retrieval Systems
  - Precision
  - Recall
- Works with unranked sets
- For ranked sets
  - Precision-Recall curve
  - Mean Average Precision (MAP)

Precision-Recall Curve

Precision-Recall Curve

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y		
2	N		
3	N		
4	Y		
5	Y		
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N		
3	N		
4	Y		
5	Y		
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N	0.1	
3	N		
4	Y		
5	Y		
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N	0.1	
3	N	0.1	
4	Y		
5	Y		
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N	0.1	
3	N	0.1	
4	Y	0.2	
5	Y		
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N	0.1	
3	N	0.1	
4	Y	0.2	
5	Y	0.3	
6	N		
7	Y		
8	N		
9	N		
10	N		

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	
2	N	0.1	
3	N	0.1	
4	Y	0.2	
5	Y	0.3	
6	N	0.3	
7	Y	0.4	
8	N	0.4	
9	N	0.4	
10	N	0.4	

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	1
2	N	0.1	
3	N	0.1	
4	Y	0.2	
5	Y	0.3	
6	N	0.3	
7	Y	0.4	
8	N	0.4	
9	N	0.4	
10	N	0.4	

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	
4	Y	0.2	
5	Y	0.3	
6	N	0.3	
7	Y	0.4	
8	N	0.4	
9	N	0.4	
10	N	0.4	

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	0.33
4	Y	0.2	
5	Y	0.3	
6	N	0.3	
7	Y	0.4	
8	N	0.4	
9	N	0.4	
10	N	0.4	

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	0.33
4	Y	0.2	0.5
5	Y	0.3	
6	N	0.3	
7	Y	0.4	
8	N	0.4	
9	N	0.4	
10	N	0.4	

Total relevant documents = 10

Precision-Recall Curve

# Document	Is_Relevant?	Recall	Precision
1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	0.33
4	Y	0.2	0.5
5	Y	0.3	0.6
6	N	0.3	0.5
7	Y	0.4	0.57
8	N	0.4	0.5
9	N	0.4	0.44
10	N	0.4	0.4

Total relevant documents = 10

Precision-Recall Curve

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1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	0.33
4	Y	0.2	0.5
5	Y	0.3	0.6
6	N	0.3	0.5
7	Y	0.4	0.57
8	N	0.4	0.5
9	N	0.4	0.44
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Total relevant documents = 10

Recall	Interpolated Precision
0.1	
0.2	
0.3	
0.4	

Precision-Recall Curve

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1	Y	0.1	1
2	N	0.1	0.5
3	N	0.1	0.33
4	Y	0.2	0.5
5	Y	0.3	0.6
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0.1	1
0.2	
0.3	
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0.2	0.5
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Total relevant documents = 10

Recall	Interpolated Precision
0.1	1
0.2	0.5
0.3	0.6
0.4	0.57

Mean Average Precision (MAP)

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- Average Precision

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# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
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5	Y	0.6
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7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
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4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

P(k) = Precision at Rank k

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

P(k) = Precision at Rank k

rel(k) = Indication function

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

P(k) = Precision at Rank k

rel(k) = Indication function
rel(k) = 1, if relevant item at rank k
rel(k) = 0, if irrelevant item at rank k

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
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9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP =

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
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4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
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4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0 + 0.33*0

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0 + 0.33*0 + 0.5*1

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0 + 0.33*0 + 0.5*1 + 0.6*1 + 0 + 0.57 + 0 + 0 + 0)

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0 + 0.33*0 + 0.5*1 + 0.6*1 + 0 + 0.57 + 0 + 0 + 0) / 4

Mean Average Precision (MAP)

- Average Precision

# Document	Is_Relevant?	Precision
1	Y	1
2	N	0.5
3	N	0.33
4	Y	0.5
5	Y	0.6
6	N	0.5
7	Y	0.57
8	N	0.5
9	N	0.44
10	N	0.4

$$\text{AveP} = \frac{\sum_{k=1}^{n} (P(k) \times \text{rel}(k))}{\text{number of relevant documents}}$$

AveP = (1*1 + 0.5*0 + 0.33*0 + 0.5*1 + 0.6*1 + 0 + 0.57 + 0 + 0 + 0) / 4

AveP = 0.6675

Mean Average Precision (MAP)

- Average Precision: for single query

Mean Average Precision (MAP)

- Average Precision: for single query
- Mean Average Precision: Mean of Average Precision for set of queries

Mean Average Precision (MAP)

- Average Precision: for single query
- Mean Average Precision: Mean of Average Precision for set of queries

$$\text{MAP} = \frac{\sum_{q=1}^{Q} \text{AveP(q)}}{Q}$$

Thank You

Analytics
Vidhya