

CE306 or CE706 - Information Retrieval 2022

Assignment 2

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Assessing relevance (Task 1)

Include here your judgments and the reason you make your decision.

| Doc | Judgment | Reason |
|-----|------------|---|
| 1. | Relevant | Under the 'Travel Information' tab, information on car park is provided |
| 2. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 3. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 4. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 5. | Relevant | It does mention the car park information, although I would rank this low as it does not straight up mention the needed information. |
| 6. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 7. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 8. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 9. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |
| 10. | Irrelevant | This page does not say anything about the car park policy information with respect to graduation. |

Pooling (Task 2)

Include here the judgments for each document.

| Doc | Judgment | Doc | Judgment |
|-----|------------|-----|------------|
| 1. | Relevant | 11. | Irrelevant |
| 2. | Irrelevant | 12. | Irrelevant |
| 3. | Relevant | 13. | Relevant |
| 4. | Irrelevant | 14. | Irrelevant |
| 5. | Irrelevant | 15. | Relevant |
| 6. | Irrelevant | 16. | Irrelevant |
| 7. | Relevant | 17. | Relevant |
| 8. | Irrelevant | 18. | Irrelevant |
| 9. | Relevant | 19. | Relevant |
| 10. | Irrelevant | 20. | Irrelevant |

P/R@5 (Task 3)

For each system, compute P/R@5, please include details of the computation.

| Systems | P@5 | R@5 |
|---------|-----|------|
| IR1: | 0.8 | 0.5 |
| IR2: | 0.4 | 0.25 |
| IR3: | 0.4 | 0.25 |

For computing the Precision and Recall at 5 for each of the documents, we compute the precision and recall for first 5 entries for all the documents.

To achieve that, I used MS excel and here is the following table:

The formula behind the Precision and Recall are relevant document/retrieved documents and relevant documents/total relevant documents respectively.

It comes down as $p=4/5$, $r=4/8$; $p=2/5$, $r=2/8$ and $p=2/5$, $r=2/8$ respectively.

IR1

| Precision | Recall |
|-----------|--------|
| 1 | 0.125 |
| 1 | 0.25 |
| 1 | 0.375 |
| 1 | 0.5 |
| 0.8 | 0.5 |

IR2

| Precision | Recall |
|--------------|--------|
| 0 | 0 |
| 0 | 0 |
| 0.3333333333 | 0.125 |
| 0.5 | 0.25 |
| 0.4 | 0.25 |

IR3

| Precision | Recall |
|--------------|--------|
| 0 | 0 |
| 0.5 | 0.125 |
| 0.3333333333 | 0.125 |
| 0.5 | 0.25 |
| 0.4 | 0.25 |

Average Precision (Task 4)

For each system, compute average precision, please include details of the computation.

| Systems | Average Precision |
|---------|-------------------|
| IR1: | 0.83 |
| IR2: | 0.45 |
| IR3: | 0.46 |

To achieve the high precision without needing to set the k value, we use average precision, wherein we go down the ranking, and if the document is relevant, we measure the Precision at that value(k). We do this until we reach the end of the list (or Recall = 1). Once value of recall is 1, we know, we have exhausted the list with all the relevant documents, we then average the precision values calculated above to obtain the average precision value.

Demonstrated below is the table using which the average precision was calculated:

| IR1 | IR2 | IR3 | Recall1 | Precision1 | Recall2 | Precision2 | Recall3 | Precision3 |
|-------------------|-----|-----|---------|-------------|---------|-------------|---------|-------------|
| 1 | 0 | 0 | 0.125 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0.25 | 1 | 0 | 0 | 0.125 | 0.5 |
| 3 | 1 | 1 | 0.375 | 1 | 0.125 | 0.333333333 | 0.125 | 0.333333333 |
| 4 | 2 | 2 | 0.5 | 1 | 0.25 | 0.5 | 0.25 | 0.5 |
| 4 | 2 | 2 | 0.5 | 0.8 | 0.25 | 0.4 | 0.25 | 0.4 |
| 5 | 3 | 3 | 0.625 | 0.833333333 | 0.375 | 0.5 | 0.375 | 0.5 |
| 5 | 4 | 3 | 0.625 | 0.714285714 | 0.5 | 0.571428571 | 0.375 | 0.428571429 |
| 5 | 4 | 4 | 0.625 | 0.625 | 0.5 | 0.5 | 0.5 | 0.5 |
| 6 | 4 | 4 | 0.75 | 0.666666667 | 0.5 | 0.444444444 | 0.5 | 0.444444444 |
| 7 | 4 | 4 | 0.875 | 0.7 | 0.5 | 0.4 | 0.5 | 0.4 |
| 7 | 4 | 4 | 0.875 | 0.636363636 | 0.5 | 0.363636364 | 0.5 | 0.363636364 |
| 7 | 5 | 4 | 0.875 | 0.583333333 | 0.625 | 0.416666667 | 0.5 | 0.333333333 |
| 7 | 6 | 5 | 0.875 | 0.538461538 | 0.75 | 0.461538462 | 0.625 | 0.384615385 |
| 7 | 6 | 5 | 0.875 | 0.5 | 0.75 | 0.428571429 | 0.625 | 0.357142857 |
| 7 | 6 | 6 | 0.875 | 0.466666667 | 0.75 | 0.4 | 0.75 | 0.4 |
| 7 | 6 | 7 | 0.875 | 0.4375 | 0.75 | 0.375 | 0.875 | 0.4375 |
| 8 | 7 | 8 | 1 | 0.470588235 | 0.875 | 0.411764706 | 1 | 0.470588235 |
| 8 | 7 | 8 | 1 | 0.444444444 | 0.875 | 0.388888889 | 1 | 0.444444444 |
| 8 | 8 | 8 | 1 | 0.421052632 | 1 | 0.421052632 | 1 | 0.421052632 |
| 8 | 8 | 8 | 1 | 0.4 | 1 | 0.4 | 1 | 0.4 |
| Average Precision | | | | 0.833823529 | | 0.451973046 | | 0.461587952 |

Discounted Cumulative Gain (Task 5)

For each system, compute discounted cumulative gain, please include details of the computation.

| Systems | Discounted Cumulative Gain |
|---------|----------------------------|
| IR1: | 4.38 |
| IR2: | 2.90 |
| IR3: | 3.24 |

The formula I used to obtain these values here is as follows:

$$DCG_p = rel_1 + \sum_{i=2}^p \frac{rel_i}{\log_2 i}$$

The value of rel is equal to 0 or 1 depending on whether the document is relevant or not and the value for $\log_2 i$ changes as i changes so essentially the non-relevant documents give an output of 0 when put in this formula. This gives us a simpler equation of the summation of the terms in the fashion $1/\log_2 i$. Using the same ideology, we get the equations below:

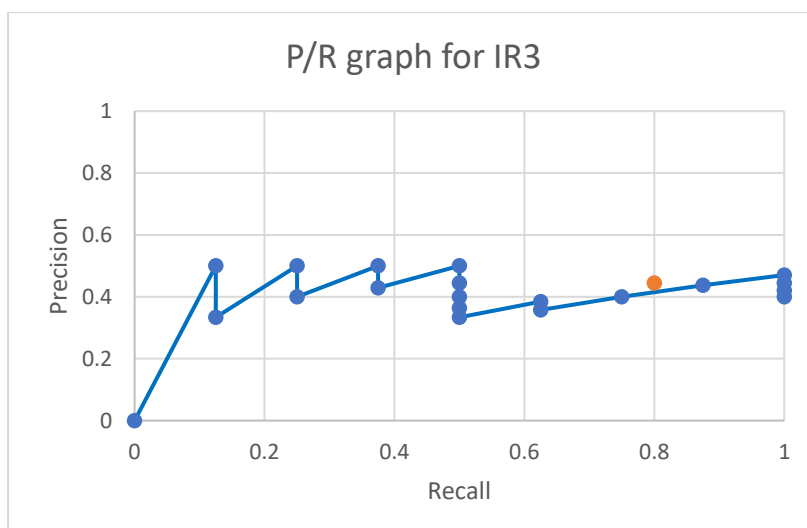
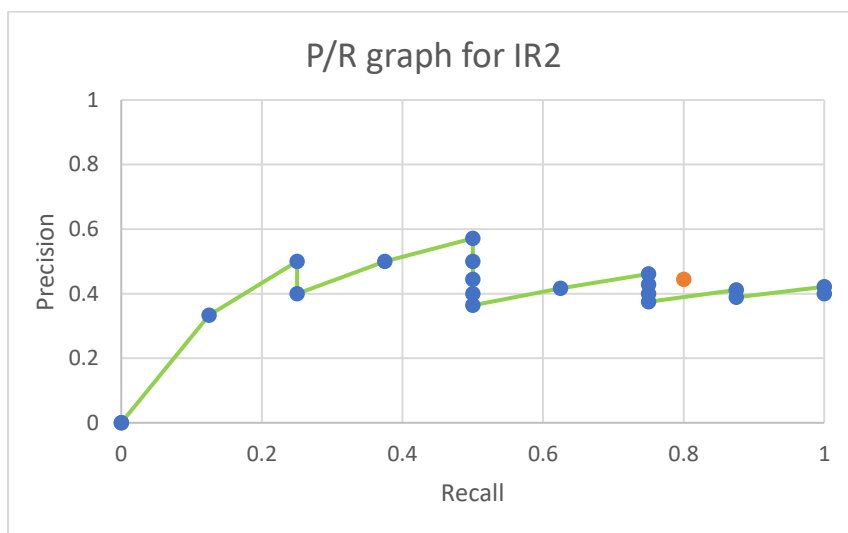
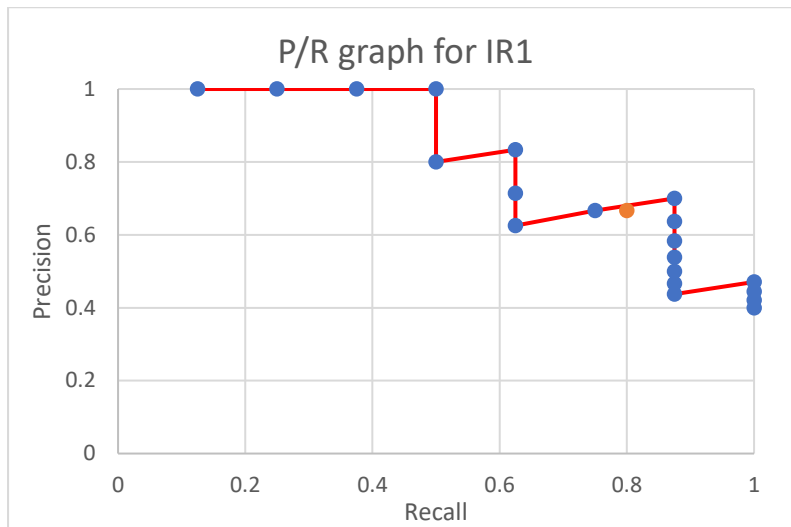
$$IR1 = 1 + 1/\log_2 2 + 1/\log_2 3 + 1/\log_2 4 + 1/\log_2 6 + 1/\log_2 9 + 1/\log_2 10 + 1/\log_2 17 = 4.38$$

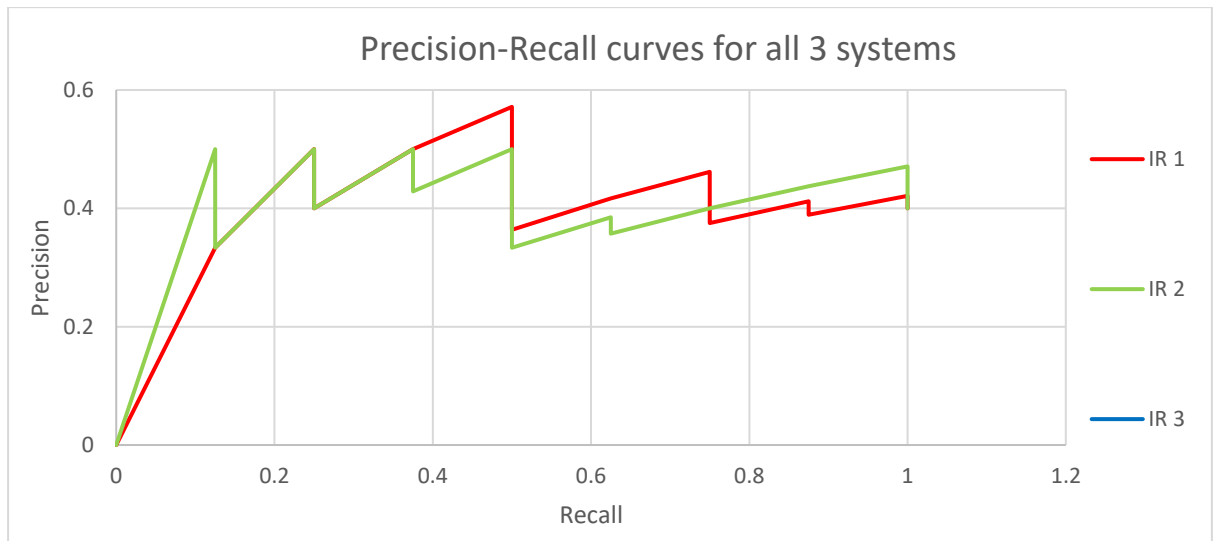
$$IR2 = 1/\log_2 3 + 1/\log_2 4 + 1/\log_2 6 + 1/\log_2 7 + 1/\log_2 12 + 1/\log_2 13 + 1/\log_2 17 + 1/\log_2 19 = 2.90$$

$$IR3 = 1/\log_2 2 + 1/\log_2 4 + 1/\log_2 6 + 1/\log_2 8 + 1/\log_2 13 + 1/\log_2 15 + 1/\log_2 16 + 1/\log_2 17 = 3.24$$

Precision-Recall Curves (Task 6)

For each system, draw the precision-recall curves, and choose your system for the scholar search and explain why.





I would choose the first system named IR1 for the scholar search. The reasoning behind this being that at 80% threshold for Recall, we can observe clearly that IR1 performs the best and give us the maximum precision, i.e., 70 % unlike other two, being 0.41 and 0.43 indicating roughly around 40% precision when at 80% recall which is significantly less than that of the IR1.

High precision means the system is performing better, hence we go with IR1.

Web search (Task 7)

Which system you are going to use for web search? Choose one metric from above to support your decision and explain why you choose this metric.

I would use IR1, as mentioned earlier in this document. The sole reason being that it performs better at ranking the documents and the metrics perform better on it too.

The primary metric I would choose to support my answer would be average precision. I would have gone with Discounted Cumulative Gain or Precision/Recall, but average precision considers most aspects whereas the other metrics don't. For example, choosing just Precision or Recall would be compromising on the other one, so I do not consider that. If F-Score was an option, I would have considered that since it takes into account both Precision and Recall. Now since we are left with Discounted cumulative gain and average precision, we know discounted cumulative gain does not really take into account the lower ranked results, unlike average precision which averages the result for all the relevant documents. Hence In my opinion, average precision would be the right metric and the [table](#) under task 4 suggests that IR1 has an average precision of 0.83 which is quite indicative of its performance.