Information Retrieval, Assignment-2

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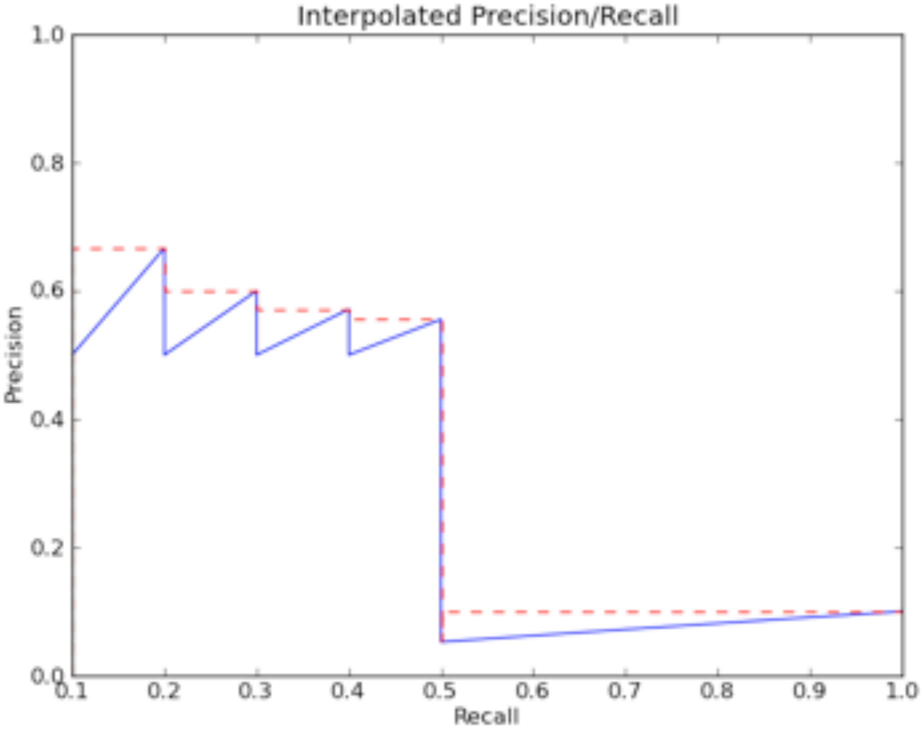
1.A)



11 point interpolated average precision : 0.387

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1.B)

a) Singular values:

26.885, 23.858, 21.677, 3.876, 2.601, 0.805, 0.664, 0.497

Since the last 4 values are comparatively less, I have retained the first 3 values, i.e k = 3

b) Comparing (Xk - X), I could make the following recommendations:

User 5, Song 10 - Score 2.31654664
User 3, Song 8 - Score 2.23019539
User 10, Song 8 - Score 1.98958487

c) Below are vectors for new users:

Recommendation for n1: ***Song 1, Song 8, , Song 10***
[[2.475 -0.248 -0.168 -0.098 -0.163 2.475 -0.168 1.186 -0.141 1.009]]

Recommendation for n2: ***Song 9, Song 10, Song4***
[[-0.22 2.435 -0.019 0.073 2.426 -0.22 -0.019 -0.125 1.221 1.08]]

Recommendation for n3: ***Song 5, Song 2, Song 1,Song 6***
[[0.434 1.146 -0.001 0.037 1.16 0.434 -0.001 0.213 0.572 0.754]]

Recommendation for new user: ***Song 3, Song 5, Song 7***
[[1.027 1.095 1.127 0.599 1.127 1.027 1.127 0.877 0.581 1.002]]

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2 .C)

For the LSI implementation I have used python to code and Scipy library for matrix and SVD calculations.

Term Matrix and SVD

I created the Term-Document matrix [TM] for the corpus of 40 files[same ad previous assignment] and calculated the tfidf weights and store it as a 2 dimensional Scipy array. I now prompt the user for the value of K and then do a SVD of TM to get the singular values. I reduce the concept space by retaining the k greatest singular values to get the reduced Σ matrix.

SVD of TermMatrix C $C = U\Sigma V\ T$

I then get the reduced concept space of TM by the above expres sion and store it as CM[Concept matrix] .

Query vector and cosine similarity:

I tokenize the user input into a set of lower case,non-stop words delimited by space. Any query containing only stop words/ words not present in the corpus will not return any results.

The query token set is converted to a vector representation $\vec{q}$ and cosine similarity is used to calculate the latent semantic relation to each of the document vectors $\vec{d}$ in concept space. using the below expression (referred from Prof. Ginsparg's note on LSI)

$$\text{Similarity}(\vec{q}, \vec{d}_{(j)}) = \cos(\theta) = \frac{\vec{q} \cdot \vec{d}_{(j)}}{|\vec{q}|\,|\vec{d}_{(j)}|} = \frac{\vec{q} \cdot C \cdot \vec{e}_{(j)}}{|\vec{q}|\,|C\vec{e}_{(j)}|}\ .$$

I then list the 4 top results based on greatest values for the similarity vector for each document

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Test Runs

Note: When I retrieve a document with the query term not present, I list the text snippet corresponding to the first word in the term list which matches

1. *Invalid words* :

Words which don't appear in the corpus or which are stop words are removed from the query before processing, hence these are gracefully handled.

```
[zzz: Exit, z: set K Value]
Enter Query:and werwer
No results Found
```

2. *Multiple valid words*

Query vector is constructed with all the terms and similarity is calculated normally

3. *Multiple words with one invalid word:*

I ignore the invalid word and retrieve result for only valid words.

Varying K Value

By reducing the k value we are reducing the input dimension space by reducing noise. Reducing the dimension uncovers hidden or "latent" relations between documents by mapping related concepts.
For example when I searched for house with K = 4, I did not get document 8 as the top result which contains house. This is because "house" was incorrectly mapped into reduced concept space. But with K=8, house as a concept was properly represented and now I got more relevant results.

HOWTO RUN THE PROGRAM

★ **Please Install Scipy package from http://www.scipy.org/Download for the appropriate OS. (*I am not aware of the OS environment it will run on, otherwise I would have included easy_install scripts for easier installation*)**

★ **If the current directory does not have corpus files in folder "./test" it will retrieve the files from the course link**

★ **I am reading the stop list from the file "stopList.txt", please ensure its present in the current directory.**

```
>python LSI.py
```