CSE 435/535 Information Retrieval (Fall 2016)

Project 3: Evaluation of IR models

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Project Report

Overview of the project:

The goal of this project is to implement various IR models, evaluate the IR system and improve the search result based on the understanding of the models, the implementation and the evaluation.

- **Strategies followed:** The initial task we performed was to generate the MAP value . The MAP values obtained through default similarity classes for bm25,vsm and dfr are 0.6575, 0.6418 and 0.6554.

BM25 default:

```
map                     all     0.6575
gm_map                  all     0.5829
Rprec                   all     0.6388
bpref                   all     0.6725
```

VSM default:

```
map                     all     0.6418
gm_map                  all     0.5708
Rprec                   all     0.6367
bpref                   all     0.6510
```

DFR default:

```
map                     all     0.6554
gm_map                  all     0.5807
Rprec                   all     0.6402
bpref                   all     0.6698
```

Measure/Model	VSM	BM25	DFR
MAP	0.6418	0.6575	0.6554

Experiments made as a part of improving the MAP value:

Experiment 1:

A document can be classified as relevant when the information need of the user is satisfied to a maximum extent.

To increase, the number of relevant documents returned, we tried to translate the given query to all three languages.

For the training query 1,

- When the query=Russia's intervention in Syria

```
map                     001     0.3418
recall_5                001     0.2000
recall_10               001     0.3500
recall_15               001     0.3500
recall_20               001     0.4000
```

- When the query=Russia's intervention in Syria or Russlands Intervention in Syrien

```
map                     001     0.3383
recall_5                001     0.2000
recall_10               001     0.3500
recall_15               001     0.3500
recall_20               001     0.4000
```

Experiment 2:

Improving the IR system:

1.Tuning Parameters:

The first task was improving the MAP value using Parameter tuning.
Parameter tuning can be done only for BM25 and DFR models.

BM25 Model:

The parameters k1 and b can be tuned for BM25 model where as the parameters Basic model, after effect and normalization can be modified for DFR model. We changed the values of k1 between 0.0 and 4.0 in increments of 0.1 and b between 0 and 1 in increments of 0.1.

Some of the experiments we did are:

k1	**b**	**MAP**
0.4	0.0	0.6790
0.35	0.3	0.656

DFR Model:

The different values of the DFR model that can be modified are
Basic Mode

After Effect
Second Normalization

The values change and the corresponding MAP values observed have been tabulated below.
DFR MODEL:

Basic Model	After Effect	Second Normalization	MAP
I(F)	L	H3	0.6656
G	B	H2	0.6554
D	B	H2	0.6579
I(F)	B	H3	0.6518
I(n)	B	H2	0.6608

2. Adding synonyms relevant to the queries:
As a part of optimising the MAP value in order to improve the precision and recall, we added synonyms related to the queries and the addition of relevant synonyms have boosted the score by a considerable value.

```
map                     all     0.6819
gm_map                  all     0.6373
Rprec                   all     0.6632
bpref                   all     0.6933
```

3. Addition of stopwords:
Addition of language specific stopwords to be handled by the query parser has improved the MAP value.
4. Stemming:
<filter class="solr.KStemFilterFactory"/>
Addition of this line to managed-schema file has showed not a very siginificant change under all the circumstances but has boosted the score by a marginal value.

```
map                     all     0.6986
gm_map                  all     0.6537
Rprec                   all     0.6980
bpref                   all     0.7155
```

5. Using Query Handlers:

The use of query handlers like dismax and edismax in the python file to generate scores have not
improved the score of relevant documents.

The final values observed for different values are:

BM25 modified:

map	all	0.6995
gm_map	all	0.6516
Rprec	all	0.6909
bpref	all	0.7146

VSM modified:

map	all	0.6858
gm_map	all	0.6350
Rprec	all	0.6807
bpref	all	0.6973

DFR modified:

map	all	0.7043
gm_map	all	0.6589
Rprec	all	0.6925
bpref	all	0.7316