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COM 3110 Semester 1 Project Report

Implementation

All three schemes are performed through the forQuery of the **Retrieve** class. A **Retrieve** object is constructed from the variable **index** and the variable **termWeighting**. The variable **index** is a dictionary where each key is a word and each value is a dictionary. In each of the sub-dictionaries, each key is a docid from documents.txt and each value is the frequency of the word in the document with said docid. The variable **termWeighting** determines whether binary, tf or tfidf is used.

All three schemes use the variable **query**, which is a dictionary where the keys are strings. First they filter out the sub-dictionaries in index that have a word in the current query. Then they calculate the scores of each word for different docids, the calculation is different depending on the scheme used. The scores are summed up according the docid. The docids are then sorted by highest to lowest score and returned.

Binary

Increment the document's score if the word is in it.

Term Frequency (tf)

Words that appear frequently in one document score higher. To calculate this, we first calculate the number of distinct words for each document by looping through the sub-dictionaries in the **index** variable and incrementing the word count for a document every time its docid appears as a key.

Term Frequency Inverse Document Frequency (tfidf)

Just like in **tf**, terms that appear frequently in one document score higher. Unlike **tf**, these are also multiplied by the Inverse Document Frequency (**idf**) which is given by the formula:

Where t is the term and D is the set of all documents. [1]

$$\operatorname{idf}(t, D) = \ln \frac{|D|}{|\{d \in D : t \in d\}|}$$

This is so that words that appear in many documents score lower.

Performance

I've timed each run three times on my own laptop (Time1) and Diamond PCs (Time2), measured in minutes and seconds.

binary	nsns	nsws	wsns	wsws
Time1	8.0677347183227 54	5.6350028514862 06	4.8804974555969 24	3.2782843112945 557
Time2	7.3701531887054 44	4.6051862239837 65	4.5701844692230 225	3.1341757774353 027
Rel_Retr	84	91	107	116
Precision	0.13	0.14	0.17	0.18
Recall	0.11	0.11	0.13	0.15
F-measure	0.12	0.13	0.15	0.16

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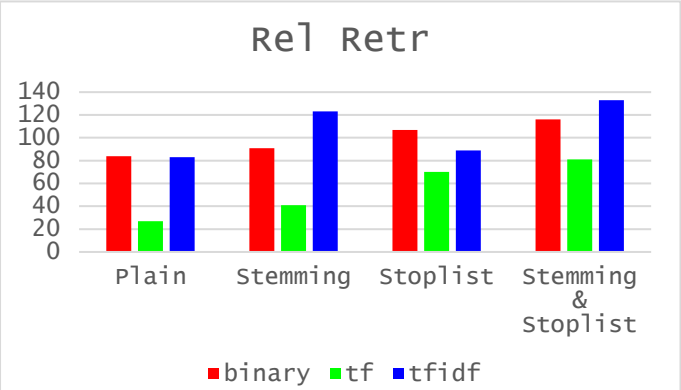
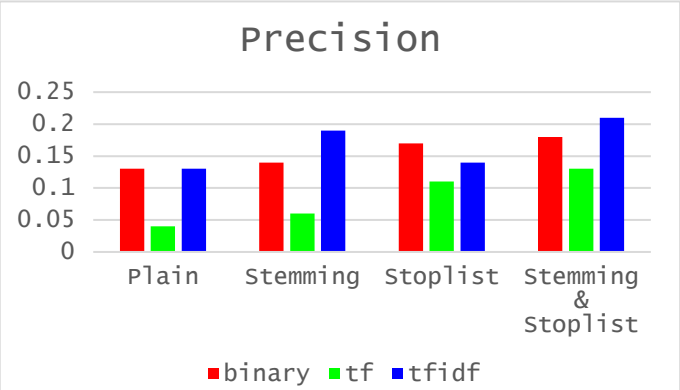
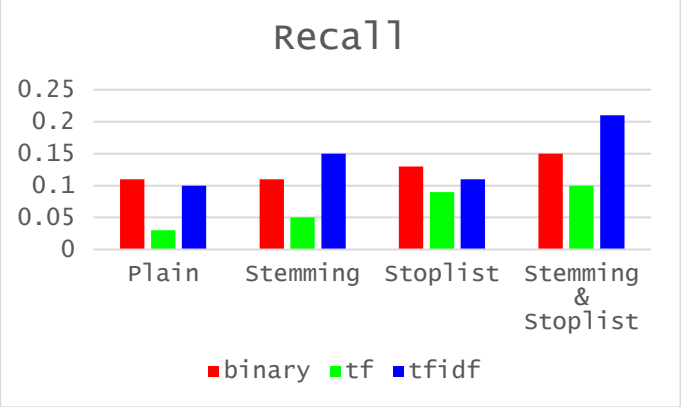
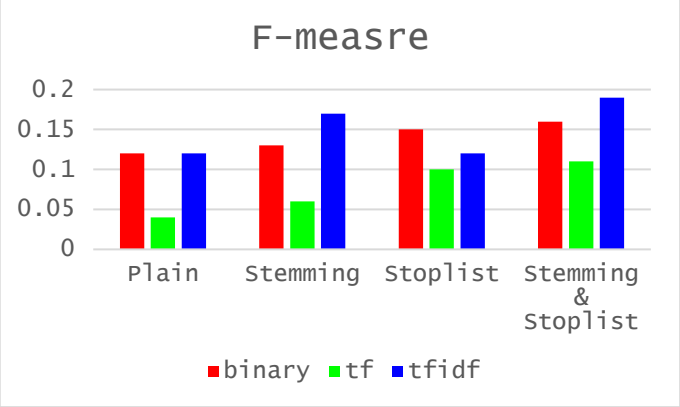
tf	nsns	nsws	wsns	wsws
Time1	09:48.214860916 1377	10:59.052261114 1205	49.985572814941 406	01:49.941136598 58704
Time2	6:20.1829800605 774	7:06.8623325824 7375	32.817876577377 32	70.189223289489 75
Rel_Retr	27	41	70	81
Precision	0.04	0.06	0.11	0.13
Recall	0.03	0.05	0.09	0.10
F-measure	0.04	0.06	0.10	0.11

tfidf	nsns	nsws	wsns	wsws
Time1	09:39.910022020 34	10:52.137382745 7428	49.847440242767 334	01:48.464047670 36438
Time2	06:11.560946941 37573	06:57.807318925 85754	33.019713163375 854	01:09.038710832 59583
Rel_Retr	83	123	89	133
Precision	0.13	0.19	0.14	0.21
Recall	0.10	0.15	0.11	0.17
F-measure	0.12	0.17	0.12	0.19









Binary is the fastest whereas tfidf is slowest. Tf is the worst performing. Binary has the best performance when there isn't stemming or a stoplist but with those options, especially stemming, it is possible for tfidf to perform better. Having a stoplist and stemming can improve performance.

References

[1] P. Senin, "Term Frequency - Inverse Document Frequency statistics," 27 10 2016. [Online]. Available: https://jmotif.github.io/sax-vsm_site/morea/algorithm/TFIDF.html. [Accessed 06 11 2017].