HOMEWORK 1 – DATA MINING FOR BUSINESS AND SOCIETY

Group members:

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Part 1 – Search engine evaluation:

- **Number of indexed documents and the number of queries**
  - Cranfield_DATASET:
    - Number of indexed documents: 1401;
    - Number of queries: 223;
  - Time_DATASET:
    - Number of indexed documents: 424;
    - Number of queries: 84.

- **Number of queries in Ground-Truth:**
  - Cranfield : 673
  - Time_DATASET: 322

- **MRR table for each configuration**:

Cranifeld_DATASET

CONFIGURATION	MRR
StemmingAnalyzer() TF_IDF	0.35675324675324677
StemmingAnalyzer() Frequency	0.2777525252525252
StemmingAnalyzer() BM25F	0.4333333333333334
SimpleAnalyzer() TF_IDF	0.1296969696969697
SimpleAnalyzer() Frequency	0.04773629148629149
SimpleAnalyzer() BM25F	0.4038744588744589
StandardAnalyzer() TF_IDF	0.3255811360356815
StandardAnalyzer() Frequency	0.27674242424242423
StandardAnalyzer() BM25F	0.4460606060606062
RegexAnalyzer() TF_IDF	0.1296969696969697
RegexAnalyzer() Frequency	0.04773629148629149
RegexAnalyzer() BM25F	0.4038744588744589
FancyAnalyzer() TF_IDF	0.3301265905811361
FancyAnalyzer() Frequency	0.28128787878787875
FancyAnalyzer() BM25F	0.45363636363636384
NgramAnalyzer(5) TF_IDF	0.2848701298701299
NgramAnalyzer(5) Frequency	0.25056637806637805
NgramAnalyzer(5) BM25F	0.3315656565656567
KeywordAnalyzer() TF_IDF	0.10984848484848485
KeywordAnalyzer() Frequency	0.03838203463203464
KeywordAnalyzer() BM25F	0.390995670995671
LanguageAnalyzer() TF_IDF	0.36357142857142866
LanguageAnalyzer() Frequency	0.30906204906204904
LanguageAnalyzer() BM25F	0.4416017316017317

Time_DATASET

CONFIGURATION	MRR
StemmingAnalyzer() TF_IDF	0.43479166666666663
StemmingAnalyzer() Frequency	0.3785416666666666
StemmingAnalyzer() BM25F	0.6770833333333334
SimpleAnalyzer() TF_IDF	0.20897321428571428
SimpleAnalyzer() Frequency	0.12666666666666665
SimpleAnalyzer() BM25F	0.6264583333333333
StandardAnalyzer() TF_IDF	0.45979166666666665
StandardAnalyzer() Frequency	0.4025
StandardAnalyzer() BM25F	0.6243749999999999
RegexAnalyzer() TF_IDF	0.0
RegexAnalyzer() Frequency	0.0
RegexAnalyzer() BM25F	0.0
FancyAnalyzer() TF_IDF	0.45979166666666665
FancyAnalyzer() Frequency	0.4025
FancyAnalyzer() BM25F	0.6302083333333333
NgramAnalyzer(5) TF_IDF	0.380625
NgramAnalyzer(5) Frequency	0.30124999999999996
NgramAnalyzer(5) BM25F	0.5583333333333333
KeywordAnalyzer() TF_IDF	0.0
KeywordAnalyzer() Frequency	0.0
KeywordAnalyzer() BM25F	0.0
LanguageAnalyzer() TF_IDF	0.49312500000000004
LanguageAnalyzer() Frequency	0.40145833333333336
LanguageAnalyzer() BM25F	0.6900000000000001

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- **A schematic description of all configurations:**

  We created 24 different search engine configurations. We changed these configurations based on different analyzer and different scoring function: We have used eight analyzer (Stemming Analyzer, Simple Analyzer, Standard Analyzer, Regex Analyzer, Fancy Analyzer, Ngram Analyzer, Keyword Analyzer and Language Analyzer). We have combined each analyzer with three different scoring function, that are: Tf_Idf, Bm25f, and Frequency. In the previous table we can see every configuration with its respective mrr score.

- **R-precision distribution table for top five search configurations:**

Cranfield_DATASET

SE conf	mean	min	1quartile	median	3quartile	max
StandardAnalyzer() BM25F	522	0.0	186	0.5	878	1.0
SimpleAnalyzer() BM25F	534	0.0	0.2	0.5	889	1.0
FancyAnalyzer() BM25F	529	0.0	0.2	0.5	889	1.0
StemmingAnalyzer() BM25F	536	0.0	0.2	0.5	865	1.0
LanguageAnalyzer() BM25F	543	0.0	0.2	517	885	1.0

Time_DATASET

SE conf	mean	min	1quartile	median	3quartile	max
SimpleAnalyzer() BM25F	237	0.0	0.0	218	362	1.0
StemmingAnalyzer() BM25F	252	0.0	0.0	244	0.44	1.0
LanguageAnalyzer() BM25F	263	0.0	0.0	0.25	0.5	1.0
StandardAnalyzer() BM25F	256	0.0	0.0	0.25	421	1.0
FancyAnalyzer() BM25F	256	0.0	0.0	0.25	421	1.0

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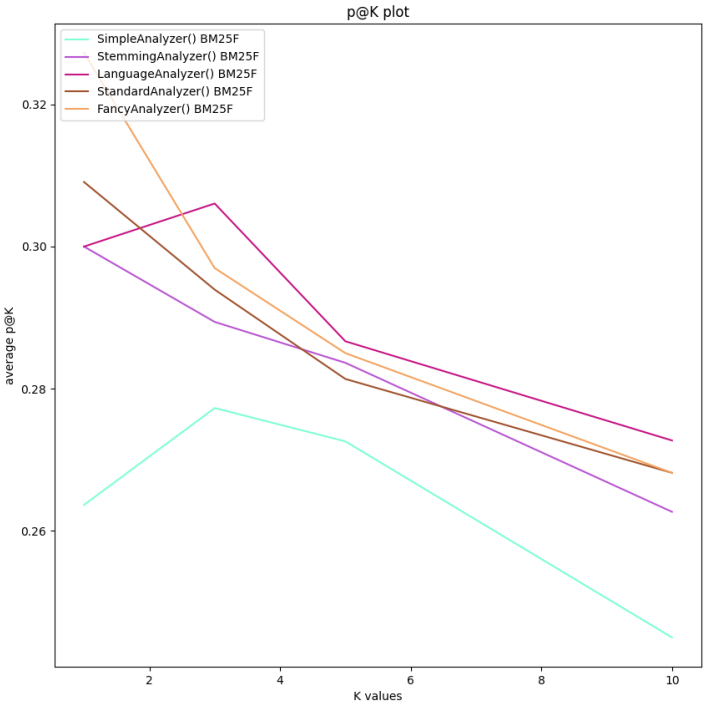
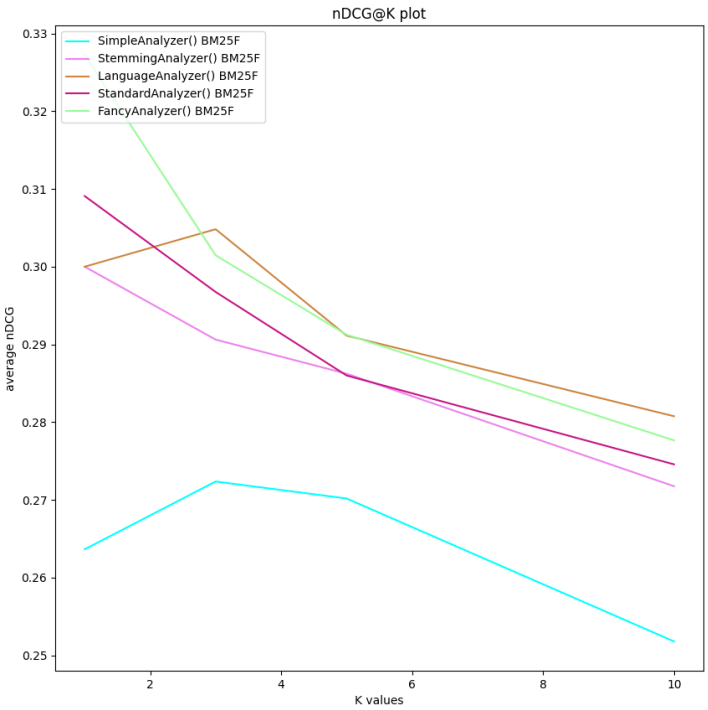
- **p@K plot:**

Cranfield_DATASET

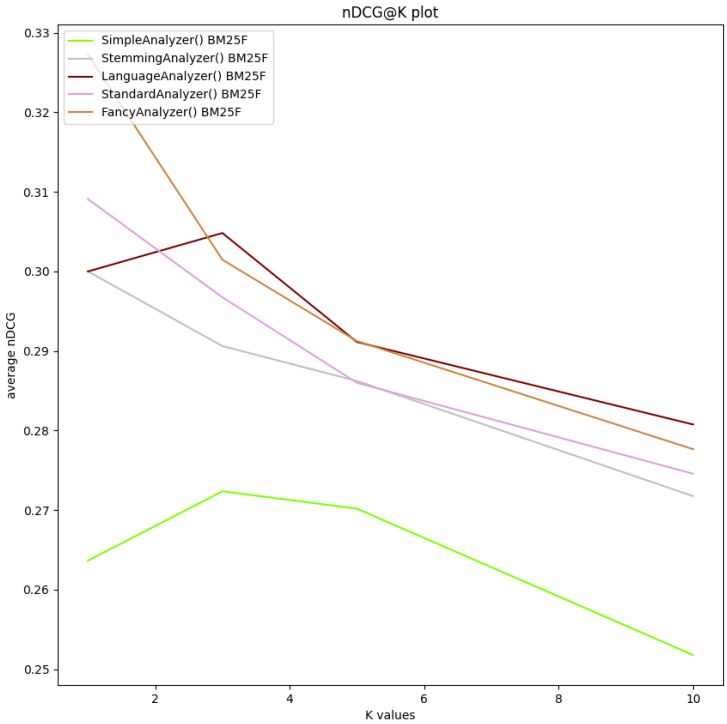


Time_DATASET

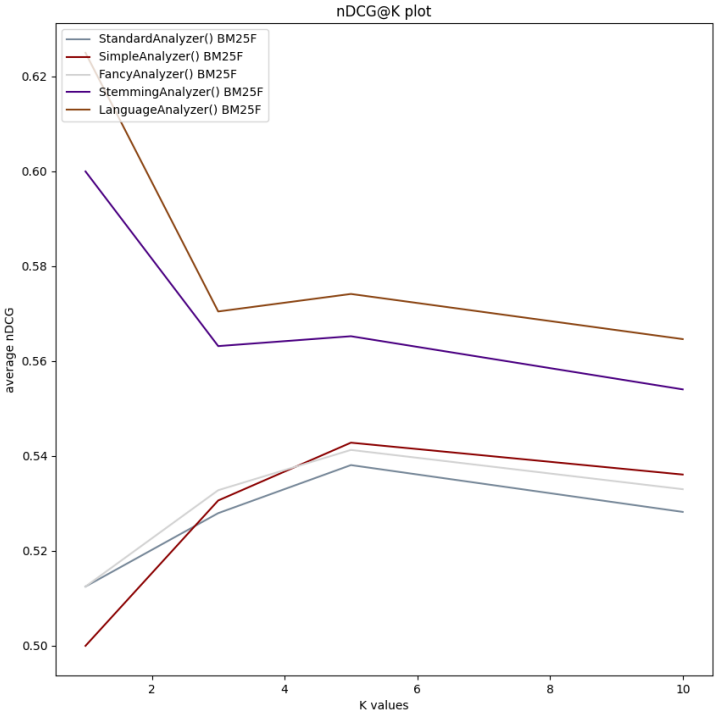


- **nCDG@K plot:**

Cranfield_DATASET



Time_DATASET



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Part 2 – Near-Duplicates-Detection:

- **Number of row and the number of bands that you chose**:
  - R = 5
  - B = 30

- **The probability to have false-Negatives, in the set of candidate pairs, for the following Jaccard values: 0.89, 0.9, 0.95 and 1:**

*P(False negatives) = (1-J**r)**b*

JACCARD VALUE	PRIOBABILITY TO HAVE FN
0.89	2.2423145959674837e^(-11)
0.9	2.33311068949302 4e^(-12)
0.95	4.3239030466373 28e^(-20)
1	0

- **The probability to have false-Positives, in the set of candidate pairs, for the following Jaccard values: 0.85, 0.8, 0.75, 0.7, 0.65, 0.6, 0.55 and 0.5.**

*P(False positives) = 1-(1-J**r)**b*

JACCARD VALUE	PROBABILITY TO HAVE FP
0.85	0.9999999771362545
0.8	0.9999932813669531
0.75	0.9997045171242237
0.7	0.9959949903519956
0.65	0.9752748118175822
0.6	0.9118304460022172
0.55	0.7875762833291795
0.5	0.6142095565052361

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- **How did you reduce the probability to have False-Negatives?**

  It is sure that we will have false positives in our candidates results, based on the values of r and b that we chose. We decided to emphasize on limiting the false negatives for this homework. We could try to increase r and minimize b in order to have smaller false positives, but when we would have bigger false negatives, due to the tradeoff between them. For this specific homework, our conception was to minimize the false negatives. So, to reduce the probability to have FN, we reduced r.

- **The execution time of the Near-Duplicates-Detection tool.**
  - Execution of time: 1 min 33 sec

- **The number of Near-Duplicates couples you found**.
  - Number of near-duplicates: 25276

- **The number of Near-Duplicates couples you found with an approximated Jaccard value at most 0.89, 0.90, 0.91, 0.92, 0.93, 0.94, 0.95, 0.96, 0.97, 0.98, 0.99, 1.**

JACCARD VALUE	NUMBER OF NEAR DUPLICATES
0.89	25276
0.90	24899
0.91	24122
0.92	23848
0.93	23111
0.94	22761
0.95	22164
0.96	21858
0.97	21252
0.98	21060
0.99	20574
1	20478