The Use of Structured Text Retrieval to Search for Scientific Publications

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1 Introduction

In modern society searching for information via the Internet and specifically via Google's search engine has become a regular part of day-to-day life. While Google registered 10,000 searches a day in 1998, the same number of queries was sent per second in 2006 [1]. This shows that searching for data becomes more and more important. On a daily basis, new websites are created, articles are written and scientific papers are published. In order to manage this amount of data and to distinguish between relevant and irrelevant sources various search engines are used. Therefore, searches should be simple and precise.

Looking at search engines for scientific publications and research there is a broad selection of possibilities. One of the best-known engines is Google Scholar. It uses a simple input interface and lists the results with regards to their relevance. These listings contain data in various formats from different years covering a variety of topics which do not necessarily reflect the search criteria. However, especially while working on a scientific paper it is vital to obtain precise results.

This paper is concerned with improving the quality of search queries and their results of different scientific publications in the Portable Document Format (PDF). A common problem when searching for a specific author, for example, is that the most popular search engines often do not only list all of the author's articles and books but also sources that cite their publications. The objective of this paper is to provide measures which enhance the stability of the search terms and optimize the usability in order to deliver more concise results. To do so, simple search query structures, an intuitive front end, spell checks and post-processing in the back end will be implemented.

2 Related Work

As stated in the Introduction this master's thesis is concerned with improving the quality of search queries and their results for scientific publications in PDF. According to [3] all academic publications consist of similar structures. These structures are divided into chapters, sections, subsections and so on. The Structured Text Retrieval Model, as proposed in [5], can be perfectly applied to these documents. The model describes the handling of search queries and their corresponding results as well as the post-processing in the back end using structural meta information. In order to sort the documents with regards to their relevance, various ranking strategies such as the Jelenik-Mercer smoothing are used. Through extensions such as the contextualization strategy and aggregation strategy the ranking will be refined further.

To ensure simple and stable search query structures the syntax will be constructed as described in [2]. Thereby the queries consist of multiple terms which are structured according to *label*:*keyword* format. Furthermore, the terms can be prefixed with + to increase their priority. Due to this structure, the user interface will be extended with an advanced search in order to improve usability and therefore create an intuitive front end.

The final usability improvement is achieved through spell checks. These can be implemented as described in [6], where the Levenshtein Distance is used to verify that a word is spelled correctly.

3 Structure

In the first stage the fundamental structure for the project will be implemented. The micro framework Flask requires the front end to be coded in JavaScript and the back end to be in Python. Via simple requests inputs from the user side queries are sent to the server side. There the query is processed and a response is generated. These components form a solid ground work for the Text Retrieval Model.

Python provides a native library to connect to MySQL databases. In the next stage it will be used to generate a database as proposed in [7]. To fill up the database with data a util to classify the document structure, as descripted in [3], is used. Then a ranking system, according to [4, 5] can be implemented.

Thereafter, in order to enhance the usability spell checking of the search terms, as proposed in [6], is applied.

Finally, an advanced search will be added that allows the user to formulate searches without prior knowledge regarding the syntax of the queries, which will result in an intuitive and simple user interface.

4 Outline

1. Introduction
2. Related Work
   a) Unsupervised Document Structure Analysis
   b) Structured Text Retrieval
   c) Structured-Text Retrieval System with an Object-Oriented Database System
   d) Search Queries
   e) Real-Word Error Detection and Correction
3. Implementation
   a) Fundamental Structure
   b) Setup of the Database
   c) User Interface
   d) Satisfaction of Search Queries
   e) Ranking System
   f) Spell Checks

4. Results
5. Conclusion

5 Selected Bibliography

References

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[7] Tak W. Yan and Jurgen Annevelink. Integrating a structured-text retrieval system with an object-oriented database system. In Jorge B. Bocca, Matthias Jarke, and Carlo Zaniolo, editors, *VLDB*, pages 740–749. Morgan Kaufmann, 1994.

6 Schedule

Step	Task in Detail	Deadline
Implementation Process	Creation of the Fundamental Structure	2017-05-31
	Database	2017-06-30
	Import of PDFs via PDF-Extractor	2017-06-30
	Satisfaction of Search Queries	2017-07-31
	Simple Ranking System	2017-07-31
	Improved Ranking System	2017-08-31
	Implement Spell Checks	2017-09-30
	Improve User Interface	2017-10-31
Writing Process	Introduction	2017-10-31
	Related Work	2017-11-30
	Unsupervised Document Structure Analysis	2017-11-30
	Structured Text Retrieval	2017-11-30
	STR with an Object-Oriented Database System	2017-12-31
	Search Queries	2017-12-31
	Spelling Checks	2018-01-31
	Implementation	2018-01-31
	Fundamental Structure	2018-02-28
	Setup of the Database	2018-02-28
	User Interface	2018-03-31
	Satisfaction of Search Queries	2018-03-31
	Ranking System	2018-03-31
	Spell Checks	2018-04-30
	Results	2018-04-30
	Conclusion	2018-04-30
	Correction	2018-05-31