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Mobile Information Retrieval in Medicine: A Semantic Approach

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Abstract. Mobile information retrieval is a fast growing research field due to the ever increasing sophistication of mobile devices coupled with the increasing trend that information needs are being satisfied more and more from mobile devices, as opposed to desktop machines. The use of mobile devices for information retrieval is especially interesting for physicians working in hospitals as they have a high level of mobility during a typical shift. In this paper we show the feasibility of mobile retrieval of non-standardized text; this type of text, also known as free text, makes up a significant amount of textual data in medical records. We provide a short description of a proposed architecture and analyze the prospects of using current web technologies in combination with a smart semantic retrieval system to create an application for the mobile end-user. The result is a mobile, web-based retrieval solution with a native look and feel, for use in the medical domain.

Keywords. information retrieval, medicine, mobile solutions, semantics

1. Introduction and Motivation

In health care, physicians and nurses are constantly facing information needs in order to make correct diagnostic and therapeutic decisions. Relevant information for satisfying these needs is often hidden in medical free text. Information retrieval from medical texts faces serious challenges [1]. Simple key word search is not sufficient, and formulating more elaborate queries requires expert knowledge and is not feasible in mobile scenarios. Automated linguistic analysis and semantic representation of free text in combination with medical background knowledge from a large medical ontology enables successful text retrieval with short intuitive queries from mobile devices. This is crucial, as users behave differently when utilizing mobile devices [2].

Mobile information retrieval significantly differs from standard information retrieval; *Context Awareness* and *Content Adaption* are two main differentiations [3]. By exploiting the sensors within a mobile device, *Context Awareness* tries to be aware of the user's situation. In contrast, *Content Adaption* addresses the visualization of the results of an information need. In this paper we describe a proof of concept that demonstrates how different components in an overall architecture can be arranged to enable mobile information retrieval in the medical domain, focusing on free text retrieval.

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2. Architecture and Components

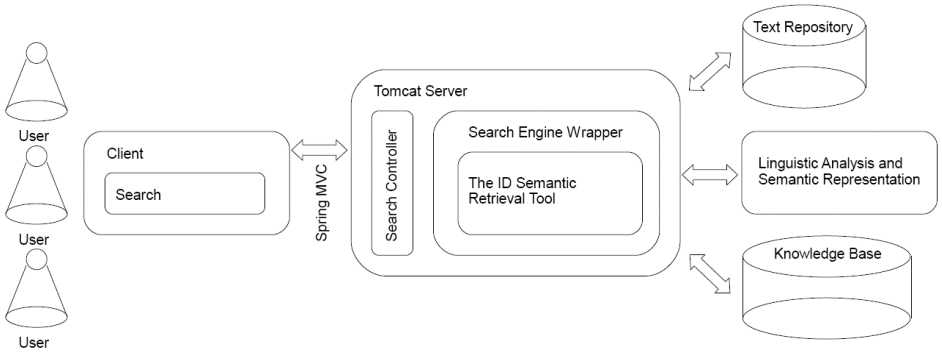

Figure 1. Architecture.

User. A user transforms their information need and into the query language used by the information retrieval tool. An Apple iPhone was used as the input device.

Client/Search. The search-request is sent via an AJAX call to the corresponding controller, residing on a *Tomcat Server*. Communication was realized using the Spring MVC Framework. jQTouch was used for the mobile web interface.

Tomcat Server. The server is running Free BDS on an Intel chipset. The server also hosts the *Text Repository*, the *Linguistic Analysis and Semantic Representation* of the diagnosis texts, and *The ID Semantic Retrieval Tool*.

Search Controller. The Search Controller catches the AJAX search request, which is forwarded to the *Search Engine Wrapper*. The search results from the *Search Engine Wrapper* are sent back in HTML readable form, JSON encoded.

Search Engine Wrapper. The wrapper handles the requests to the *ID Semantic Retrieval Tool*. The retrieval is started via a batch file. The XML results from the retrieval tool are converted into HTML.

Text Repository. The repository is a MySQL database containing a subset of anonymized legacy pathology reports for demonstration purposes. They are all in upper case (7-Bit ASCII Code).

The ID Semantic Retrieval Tool. The semantic retrieval system developed by ID [4] stores *semantic* document representations in a Lucene (http://lucene.apache.org/) text repository. Query expansion using terminological knowledge is used to retrieve not only occurrences of query terms, but of related or more specific terms as well.

Linguistic Analysis and Semantic Representation. We represent documents semantically using a special linguistic processing pipeline for medical texts. It supports morphologic analysis of complex words such as "Ot|o|rhin|o|laryng|o|log|y" [5] and the matching of single or multiword terms to WNC concept identifiers [6].

Knowledge Base. The ontology ID MACS® is a medical semantic network (MSN) of ~90.000 concepts linked by ~300.000 relations. For query expansion we use the taxonomies and the anatomical merology (part/whole relations) of ID MACS®.

3. Results and Conclusion

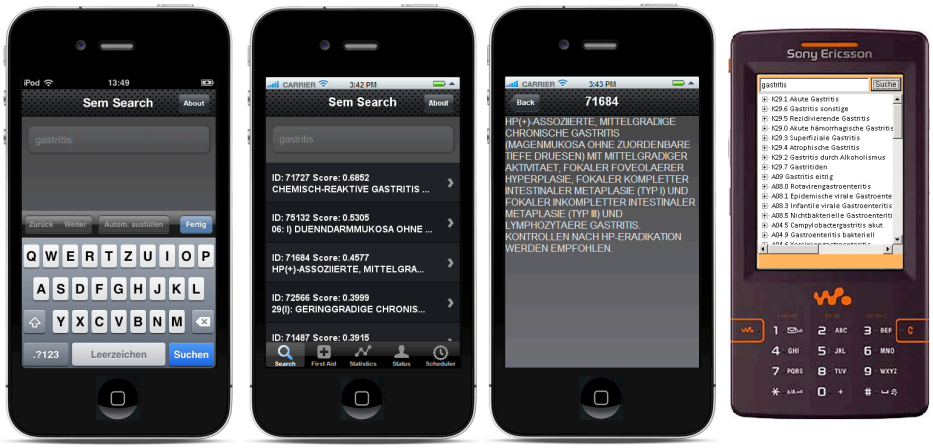

Figure 2. Mobile search interface.

Figure 2 shows the prototype graphical user interface. Each result list item consists of an identifier, a document score, and the first few words of the document. Touching one of the list items shows the document's details. The Tab Bar (second from left) can be used for other possible future functionality; search is only one application of smart phones in the medical domain. Finally, Figure 2 compares a touchscreen interface with an older, keypad-based interface (Sony Ericsson W950i, extreme right). The keypad-based interface makes it difficult to navigate tree-like result list, and it is clumsy to use. Newer technologies enhance the user experience: navigation is more intuitive and search results can be browsed faster and more efficiently. Also, more intuitive interfaces are more likely to be better received by users. Web-based frameworks for mobile devices such as jQuery Mobile, jQTouch, or Sencha Touch, have an advantage in that they support a native look and feel on different mobile devices. Because our retrieval system allows for sophisticated information retrieval using short user input, it seemed ideal for mobile deployment. We made it accessible to users of mobile devices using a web-based interface, optimized for smart phones based on the latest technology. In this paper, we described the overall architecture and each of the project's components.

4. References

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