Integrating heterogeneous clinical knowledge to assist medical decision

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Introduction

The increasingly larger volume of data captured daily in healthcare institutions is opening new and great perspectives about best ways to retool it towards improving clinical practice. The further availability of many scattered information sources that could be used in diagnostic support but are not due to lack of time, availability, tools or knowledge became a research opportunity that has been explored in our research group. We have used data mining and content-based retrieval techniques to automatically lookup and to provide relevant information, such as scientific literature or related clinical cases, which may be of help to a practitioner in the decision making process.

Method

The diversity and amount of information available nowadays are immense, which means that the identification and the recommendation of useful articles and studies are difficult tasks. To overcome this problem we used context information to extract features aiming at improving the precision when finding useful documents that may have relevant clinical information for the diagnostic process. To accomplish that, we designed a recommender system able to generate context-based recommendations to physician during a clinical case analysis, where the context is defined by:

- current study modality;
- image pixel data;
- patient's age and sex;
- similar cases report;
- and other relevant clinical information.

Rare clinical cases are hard to diagnose; even if there are similar cases, it is difficult to identify them. The recommender tool obtains information about the current study and context in order to use it in a context-based recommender engine, which tries to find studies that have similar features to the one being analyzed (Fig. 1). Thus, the system streamlines access to related studies and the physicians do not have to waste time searching for similar cases.

Moreover, the solution uses reports belonging to similar studies to extract sematic information that is used when querying the recommender system for relevant information available in online clinical data sources (Fig. 2).

The resulting system was planned as a component to be integrated in a Web-based DICOM Viewer that is being used in real medical imaging environment.

During the evaluation we implemented a connector for semantically indexing biomedical literature about cardiology available in PubMed. The indexed dataset (Fig. 3) contains near 15,000 documents, which were automatically grouped by semantic categories.

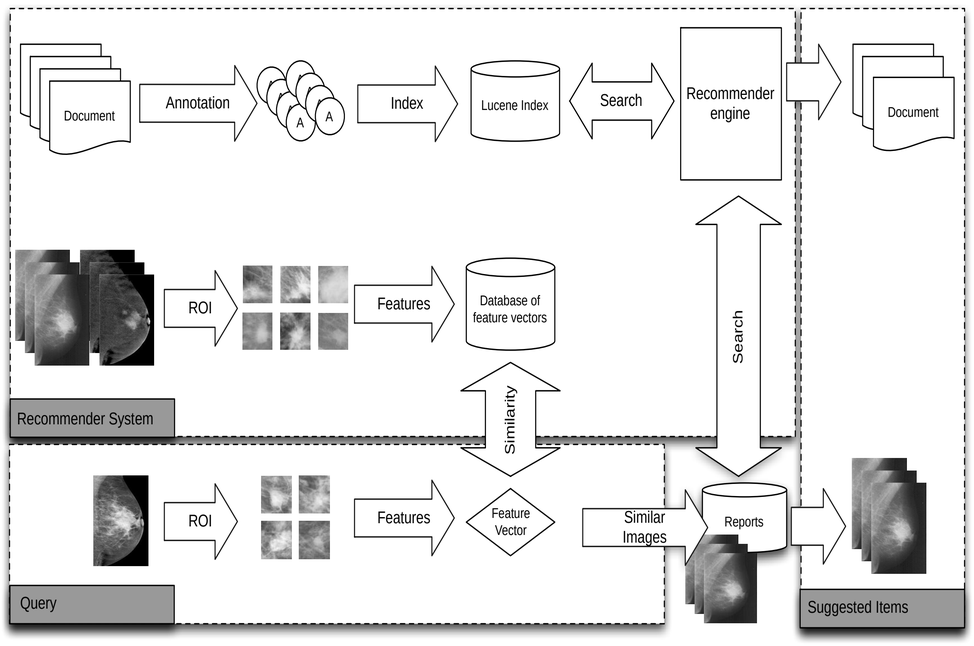

Figure 1. Generating suggestions in a review context.

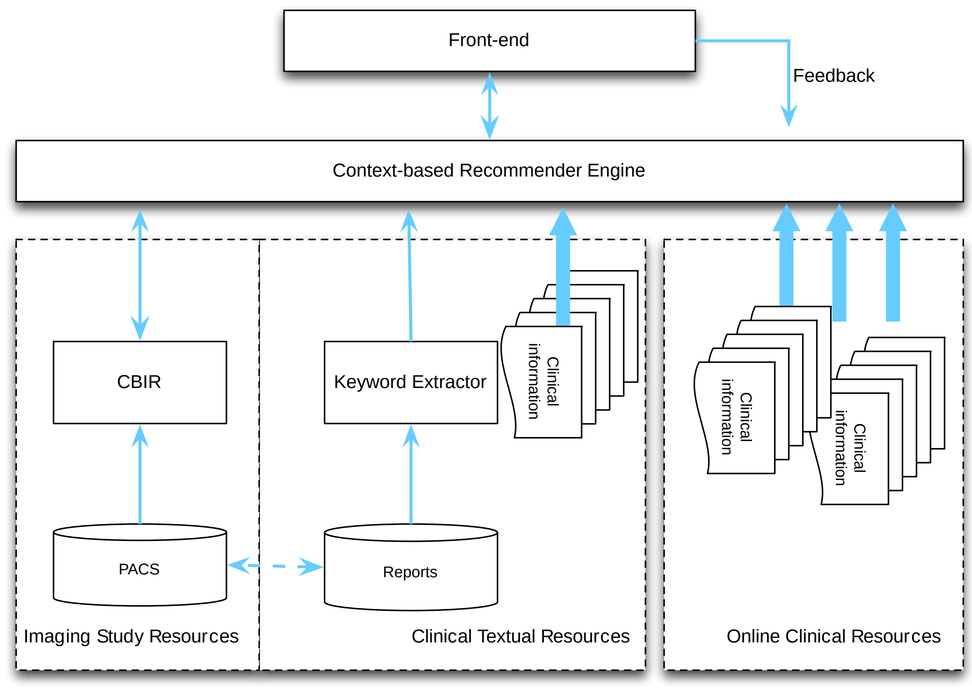

Figure 2. Clinical Recommender System architecture.

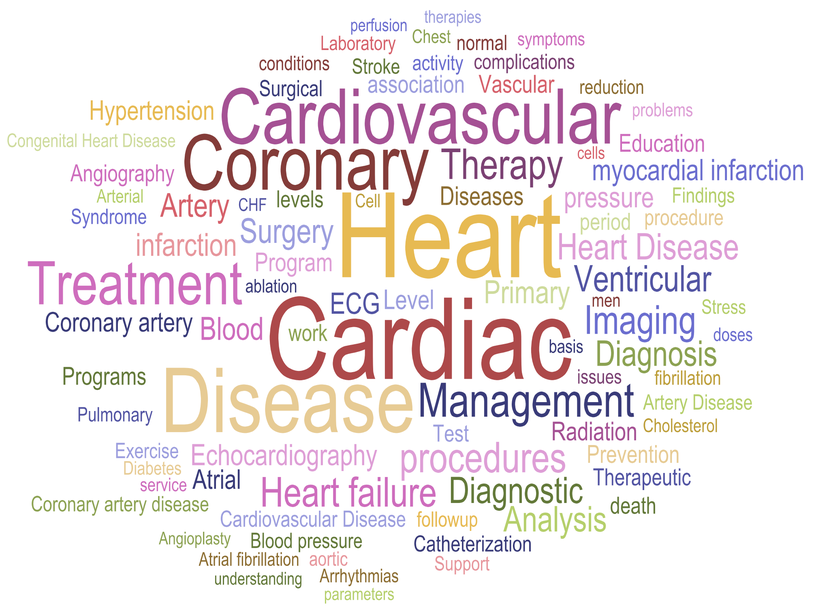

Figure 3. Concepts found in the dataset used in our case study.

Conclusions

The presented solution may increase physicians confidence in the decision-making process by providing them a quick access to important information that may be helpful in their reviewing context. Also, expediting the search for related clinical cases analyzed in the past. The integration of clinical information in a recommender systems for clinical workflow may have an increasing important role to simplify physician's work and also to leverage the quality of the healthcare services. Moreover, It can also be of use as an educative tool. We believe that recommender systems will be a key component and will have wider application in the near future of biomedical informatics.

References

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