Semantic Search for Clinical Evidence Using PICO Framework

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Abstract

Evidence based medicine (EBM) aims to apply the best available evidence gained from the scientific method to medical decision making. To make a best practice of EBM, we need to provide users an effective and efficient way to find the useful evidences. In this paper, we describe a PICO framework [1] based semantic search engine for clinical evidences. Our system has three features. Firstly, our search engine supports the searching on specific PICO elements. Secondly, our search engine integrates well defined knowledge in healthcare domain, such as SNOMED CT [2] (Systematized Nomenclature of Medicine - Clinical Terms), such that more complete search results could be returned. Finally, we extract key information of an evidence and display it in search result snippet to assist the critical appraisal phase in EBM. A preliminary evaluation is conducted to demonstrate the effectiveness of our system by comparing it with the keyword search on Cochrane Database.

Keywords:

Evidence-based medicine, SNOMED CT, IR

Method

To enable the PICO-based semantic search on the clinical evidence, we would face three main challenges: (1) How to extract the PICO information from clinical evidences and do semantic annotations; (2) How to expand the extracted information with domain knowledge; (3) How to index the semantic PICO information, and provide efficient search. Figure 1 illustrates the architecture of our system, which contains four main components: (1) **Semantic Information extractor,** which extracts PICO concepts from documents to support PICO based search and critical appraisal; (2) **Semantic Relevance Computer**, which enriches information of the clinical evidence in terms of the domain ontology; (3) **Indexer**, which builds indexes on the extracted semantic information of evidences to support efficient retrieval; (4) **Engine**, which includes the *evaluator* and *ranker*. Given the search query, the evaluator generates the search results using the index files. The ranker computes the score for each result and generates a ranked list. In addition, we need a knowledge base to store the used domain ontologies for expanding information and extraction rules for information extraction.

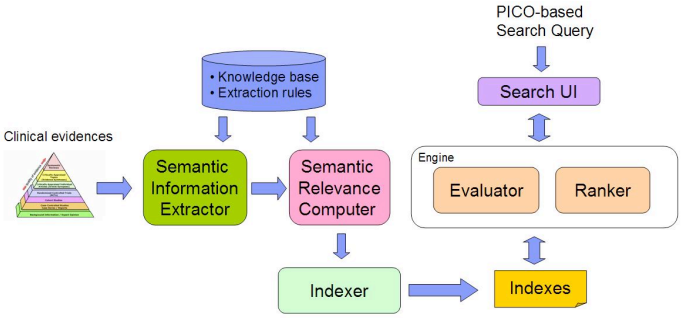

Figure 1- System Architecture

Results

We compare our system with the keyword searching provided by the Cochrane Database . Suppose a doctor has a question "what is the effect of antidementia drug on the dementia". Using the keywords "antidementia drug" and "dementia" in the Cochrane Database, no results are returned. To use our system with "dementia" as the problem and the "antidementia drug" as the intervention, five documents are returned such as a document "Memantine for dementia". It is because by leveraging SNOMED CT to enrich the knowledge of the document, we know that Memantine is one kind of antidemantia drug. As a future work, we plan to conduct more formal comparison with precision and recall on a larger set of clinical evidence documents.

References

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