

A Web Crawler and SPARQL Query Search Agent to Expand and Navigate NPDS Semantic Metadata Records

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Introduction

The Nexus PORTAL-DOORS System (NPDS)¹ manages lexical metadata and semantic descriptions of resources. It has 3 principal components: Nexus diristry, PORTAL registry, and DOORS directory. This project interfaces with the DOORS directory and the semantic metadata stored within it. Semantic metadata descriptions are a prerequisite for many of the goals laid out for NPDS such as automated meta-analysis. However, linked data semantic descriptions are time consuming to manually annotate. Thus, we have developed a system that can extract semantic metadata from a variety of biomedical resources and provide a method of searching through that metadata via a SPARQL query.

Web Crawler and SPARQL Query Engine

The web crawler component retrieves articles and article metadata from DOAJ, Elsevier ScienceDirect, CORE², and PubMed via REST API. The websites' databases are searched through via their inbuilt natural language search functionality. Each article has its title, abstract, DOI (if available), author(s), and publication date returned as basic metadata. From the abstract, triples are extracted and placed in a graph on a document-to-document basis. The in-memory graphs are converted to turtle format. These turtle formatted files are then stored in a DOORS directory via the Scribe API. When a SPARQL query is called the program retrieves the graphs from the database to be queried via the SPARQL query engine.

Triple Extraction Process

The program extracts RDF triples from the unstructured text of the articles' abstracts utilizing NLTK³ and the Stanford Core NLP⁴ modules. First, constituency parsing is performed to create a composition tree from which the subject(s), predicate, and object(s)/adjective(s) are recorded. Then co-reference resolution and pronominal anaphora occurs to recognize unique entities and ensure that their references are consistent throughout the graph. Once entities are identified, named entity extraction is completed by referencing multiple databases (i.e. MeSH and Wikipedia) to label unique entities or jargon. Then, word sense disambiguation is performed on predicates and any remaining subjects to determine the WordNet synset for graph compression.

Conclusion

Here we presented a method for searching through and retrieving semantic metadata from the open web to expand the Nexus PORTAL-DOORS System (NPDS) records. In order to perform this task a pipeline was developed consisting of a web crawler component to retrieve article metadata from external databases, a triple extraction process to derive logical form triples from the unstructured text of each article's abstract, and a SPARQL query engine to facilitate semantic metadata retrieval. These components mesh together to create a system that can furnish large amounts of linked semantic metadata for use by NPDS with relatively low time investment.

References

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