Comparative Analysis of Ontology Ranking Algorithms

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ABSTRACT

Ontologies are the backbone of knowledge representation on Semantic web. Challenges involved in building ontologies are in terms of time, efforts, skill, and domain specific knowledge. In order to minimize these challenges, one of the major advantages of ontologies is its potential of “reuse,” currently supported by various search engines like Swoogle, Ontokhoj. As the number of ontologies that such search engines like Swoogle, OntoKhoj Falcon can find increases, so will the need increase for a proper ranking method to order the returned lists of ontologies in terms of their relevancy to the query which can save a lot of time and effort. This paper deals with analysis of various ontology ranking algorithms. Based on the analysis of different ontology ranking algorithms, a comparative study is done to find out their relative strengths and limitations based on various parameters which provide a significant research direction in ranking of ontologies in semantic web.

Keywords: DARPA Agent Markup Language (DAML), Intelligent Retrieval, Ontologies, Ontology Ranking, Resource Description Framework (RDF), Semantic Search Engine, Semantic Web, Web Ontology Language (OWL)

INTRODUCTION

“The Semantic Web is an extension of the current web in which information is given a well-defined meaning, better enabling computers and people to work in cooperation.” (Berners-Lee, Hendler, & Lassila, 2001)

The Semantic Web (Palmer, 2001) provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. It is an extension of the World Wide Web with new techniques and standards towards interoperation and understanding by computers that includes Resource Description Framework (RDF), Web Ontology Language (OWL), Extensible Markup Language (XML), DAML, N-triples. The Web contains a huge amount of data but computers alone cannot understand or make any decisions with this data. The solution is the Semantic Web. The Semantic Web is not a separate Web but an extension of the World Wide Web, in which information is given well defined meaning, better enabling computers and people to work in cooperation (Berners-Lee et al., 2001).

Ontologies are the most important tool in knowledge representation, as they allow us to logically relate large amount of data (Ding et al., 2005). Ontologies are formal theories supporting knowledge sharing and reuse. They
are used to explicitly represent semantics of semi-structured information. These enable sophisticated automatic support for acquiring, maintaining and accessing information. In the context of knowledge sharing, we use the term ontology to mean a specification of a conceptualization, i.e., Ontology is a description (like a formal specification of a program) of the concepts and relationships that can exist for an agent or a community of agents (Wilson & Matthews, 2006). Ontology is a model of a particular domain, built for a particular purpose. Formally, ontology is the statement of a logical theory. Pragmatically, a common ontology defines the vocabulary with which queries and assertions are exchanged among agents. Ontology (Uschold & Gruninger, 1996) typically consists of a set of classes, properties, and constraints about these classes and properties.

An ontology language provides constructors to construct class and property descriptions based on named classes and properties, as well as some forms of axioms about classes, properties and individuals. The emergence of Ontology engineering is a convenient and effective way to represent domain knowledge and is backbone of Semantic Web. Ontologies are important to many applications such as scientific knowledge portals, information management and integration systems, electronic commerce, and semantic web services. Publically available ontologies are to be reused, modified extended and pruned as required, thereby avoiding huge effort of starting them from scratch (Alani, 2006). As the number of available ontologies on Semantic web is increasing, ontology reuse is in the demand as it is not an easy task to develop an ontology from scratch even with the available tools since it is time consuming, effort requiring, expensive and requires domain knowledge.

The applications of ontology searching and querying have been identified in several areas (Pan, Thomas, & Sleeman, 2006):

1. Information Retrieval,
2. Information Integration,
3. Ontology Management.

Ranking is an important component in most search engines to prioritize search results and to offer the user an immediate list of the most relevant results to a query. Ontology is a highly structured with links to other ontologies based on semantics. Therefore, finding and reusing the existing ontologies are very important and advantageous. Search engines to help finding relevant ontologies have been developed such as Swoogle, as the number of ontologies that such search engines can find increases. Therefore, ranking of ontologies is an important part in designing a Semantic Web search engine (Alani & Brewster, 2005). This ranking system should be capable of analyzing all the available ontologies for a domain based on a certain criteria. Generally, the ontologies are ranked based on various criteria such as page citation count, frequency of occurrence of the keyword given in the query and so on (Sarumathy, Gokulraj, & Selvaperumal, 2012). The existing ranking techniques and algorithms in the Semantic Web which are studied for comparison are Swoogle Ranking, OntoKhoj, AKTiveRank, OntoQA, Onto Search & Ontosearch2, Ontoselect, SemSearch, Recon Rank, and Falcon.

Google is the search engine that order its search results based on page’s “popularity” as computed from the Web’s graph structure. But, Google’s PageRank algorithm, which is based on the “random surfer model,” cannot be directly used in the Semantic Web for several reasons. Moreover, keyword search approaches do not formally capture the clear meaning of a keyword query and fail to address the semantic relationships between keywords. As a result, its recall rate and precision rate are often unsatisfactory, and therefore its ranking algorithms fail to properly reflect the semantic relevance of keywords (Kim & McLeod, 2012). Whereas in Semantic Web, has components that aid in meaning based searches that has various components that helps in concept based search, like URIs mentioned in a RDF/OWL documents are not merely hyperlinks but semantic symbols referencing classes, Semantic Web instances, ontology documents, normal Web resources, etc. Semantic Web surfing is not merely random
Modeling Service Data Objects (SDOs) to the Entity-Relationship (ER) Model
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Context-Aware Recommender Systems in Mobile Scenarios
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