EIIS:
An Educational Information Intelligent Search Engine Supported by Semantic Services

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ABSTRACT

The semantic web brings a new opportunity for efficient information organization and search. To meet the special requirements of the educational field, this paper proposes an intelligent search engine enabled by educational semantic support service, where three kinds of searches are integrated into Educational Information Intelligent Search (EIIS) framework, and web-based resources and local e-resources are both identically semantically processed. During the design, the EIISReasoning and its relevant rule sets are constructed to automatically reason semantic concepts to diverse levels by a semantic factor and a response time factor. Furthermore, the EIISRanking algorithm applies two-level ranking by a factor of semantic similarity, and the same relevance is differentiated in terms of the educational field’s needs. The experiments show that the EIIS engine with semantic services has a better precision rate and improved ranking performance.

Keywords: Educational Resources, Intelligent Search Engine, Ontology, Semantic Ranking, Semantic Reasoning

INTRODUCTION

The construction of educational information resources is the basis of online education. Recently, with the continuous development of e-learning, online educational resources are increasing rapidly. A variety of online characters bring education more advantages, such as digital and multi-media interface, rich and rapidly updated information, high interactivity and wide coverage, the related applications are open and can be shared over the Internet (Ren, 2009). However, as a result of the absence of resource standards and unified organization...
and management, a large number of education resources are of diverse formats and become isolated island on the Internet. It’s more and more difficult for learners to acquire the very educational resources needed in the information sea. Therefore, for the efficient acquisition of online resources, the study of the related technologies and tools become very urgent.

At present, the most common and convenient way for learners to search online educational resources is the integrated search engines, such as Google, Alta vista, Baidu. These traditional search engines simply snatch at the web pages resources from the Internet with no semantic reorganization and semantic processing, their search mechanisms are mainly based on mechanical match of keywords and they are integrated search engines rather than special one for the education field. So they can not figure out the users’ demands and usually return a huge amount of unrelated information, the search results are far from meeting the learners’ needs. It is necessary to develop intelligent search engine, specifically aiming for education field, which can precisely understand the search intent of learners and return the closely related resources.

The current researches on intelligent search technologies mainly include Intelligent Agent (Kim, 2006), Web Mining (Li et al., 2002), Natural Language Understanding (Kargin & Paramonov, 2005) and so on. The advent of semantic web brings a new opportunity to the formal organization and intelligent search aiming at online educational resources. The semantic web can clearly describe the online resources’ semantic relations and optimize the search mechanism of the traditional search engines. Compared with the traditional search engines that concern with the frequency of word appearance, semantic search engines are more likely to understand the meanings hidden in retrieved documents and users’ queries, by means of adding semantic tags into texts, in order to structuralize and conceptualize the objects within documents (Guha et al., 2003).

However, the current researches on intelligent search based on semantic web technology are still in the initial stage, especially in the education field, a series of key technologies need to be solved, such as the construction of education ontology knowledge base, the semantic annotation of online educational resources, the semantic matching of search keywords, the semantic reasoning of concepts and the semantic ranking of search results. In this paper, on the basis of the in-depth study of the problems mentioned above, we propose a universal intelligent search model for educational resources and implement a prototype system-EIIS (Educational Information Intelligent Search). In EIIS, a semantic reasoning algorithm called EIISReasoning is proposed, then the search concepts can be extended based on ontology knowledge base and the inference rule sets, so that the recall rates can be improved to some extent. Meanwhile, in order to improve the precision rates, we also design a semantic ranking algorithm called EIISRanking in the semantic ranking subsystem, and then the search results will be optimized before being presented to the users.

The remainder of this paper is organized as follows: the related research is analyzed; a universal intelligent search model for educational information is put forward and its design is detailed. The implementation of the system is then described, as well as the related experiment and system performance.

**REVIEW OF RELATED WORKS**

The current researches on semantic search (Guha et al., 2003) are still in the preliminary stage. In the education field, the related literatures are particularly less. In order to make searches rich in semantics and help students to retrieve information more efficiently and conveniently, Gao et al. (2007) designed an intelligent search engine called CASE_Edu based on domain ontology and Cultural Algorithm for network education resources. Pan et al. (2007) presented a personalized search method based on semantic technologies to provide intelligent e-learning services for the learners. Li et al.
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