An Ontology Based Framework for Intelligent Web Based e-Learning

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ABSTRACT

E-Learning is a fast, just-in-time, and non-linear learning process, which is now widely applied in distributed and dynamic environments such as the World Wide Web. Ontology plays an important role in capturing and disseminating the real world knowledge for effective human computer interactions. However, engineering of domain ontologies is very labor intensive and time consuming. Some machine learning methods have been explored for automatic or semi-automatic discovery of domain ontologies. Nevertheless, both the accuracy and the computational efficiency of these methods need to be improved. While constructing large scale ontology for real-world applications such as e-learning, the ability to monitor the progress of students’ learning performance is a critical issue. In this paper, a system is proposed for analyzing students’ knowledge level obtained using Kolb’s classification based on the students level of understanding and their learning style using cluster analysis. This system uses fuzzy logic and clustering algorithms to arrange their documents according to the level of their performance. Moreover, a new domain ontology discovery method is proposed uses contextual information of the knowledge sources from the e-Learning domain. This proposed system constructs ontology to provide an effective assistance in e-Learning. The proposed ontology discovery method has been empirically tested in an e-Learning environment for teaching the subject Database Management Systems. The salient contributions of this paper are the use of Jaccard Similarity measure and K-Means clustering algorithm for clustering of learners and the use of ontology for concept understanding and learning style identification. This helps in adaptive e-learning by providing suitable suggestions for decision making and it uses decision rules for providing intelligent e-Learning.

Keywords: Clustering, e-Learning and Concept Extraction, Learning Style, Ontology, Similarity, Threshold,

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1. INTRODUCTION

Electronic learning (e-Learning) is a facility where students learn related course or other types of materials via online computer systems. Moreover, e-learning has proved to be an effective way of delivering materials to unreachable students and the success stories of e-learning conferences and e-learning community speak for the glory. One of the main advantages of e-Learning technology is that it can facilitate adaptive learning. In this scenario, instructors can dynamically revise and deliver instructional materials in accordance with learners’ current progress. Since, adaptive teaching and learning helps to know about learners, a priori or through interactions it helps to alter the learning experience, with the aim of improving learners’ success and satisfaction.

Ontology in e-learning is helpful to create a set of similar group students connected with different types of relations. Each group can include a set of related documents for understanding effectively. Construction of such ontology from a given corpus can be a very time consuming task for the lecturer. In order to get a feeling of what the group in the corpus are, what the relations between topics are and to assign each document to some certain topics. The lecturer has to go through all the documents and process them manually. In order to overcome a new approach is proposed in this paper with special features by building the ontology automatically. Using this system it is possible to visualize similar group of students and to give the material to the student based on this result. So, this work aims at assisting the learners and lecturers in a fast way by automatic construction of the ontology from a large document collection for effective decision making.

Generally, e-Learning technologies can support automatic analysis of learners’ progress in terms of the knowledge structures they have acquired. In this work, a methodology for automatically constructing concept maps on the subject learnt by a student to characterize learners’ understanding for a particular topic has been designed and implemented. Using this system, teacher’s can conduct adaptive teaching and learning based on the learners’ knowledge structures as reflected on the concept maps. In particular, the concept map generation mechanism implemented in this work is underpinned by a context-sensitive text mining method and a fuzzy domain ontology extraction. Concept maps are useful to generate ontology, since ontology provides an effective representation to represent concepts and the semantic relationships among concepts. Moreover, the ontology proposed in this paper facilitates human and computer interactions and it can be easily expressed by using formal semantic markup languages such as RDF and OWL. This system has been implemented using Java, Protégé’s, Wordnet and eclipse.

The two major objectives of this paper are the development of a novel fuzzy domain ontology extraction method as proposed in (Lau et al., 2009) by implementing it for e-learning domain and to provide suitable learning materials and teaching methodologies to each group of students. Although some learning techniques have been proposed in the past for automatic or semiautomatic extraction of domain ontology, those methods did not consider the students level logically and hence enhancement are provided in this work to provide different types of learning contents to different groups of students.

Moreover, this work provides facilities to apply the context-sensitive text mining method and the fuzzy domain ontology extraction algorithm to automatically generate concept maps to reveal the knowledge structures of students who are engaged in e-Learning. As a result, instructors can conduct adaptive teaching and learning based on the information disclosed on the ontology maps.

The performance of the learners in E-learning environments is greatly influenced by the nature of the posted E-learning contents. In such a scenario, the performance of the learners can be enhanced by posting the suitable E-learning contents to the learners based on their learning styles. However, predicting the learning styles needs complete knowledge about the learners
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