Volume 4, Issue 12, December 2014 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Extended Data Mining Technique for Ontology Learning to Present Multi-Media Learning Contents

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Abstract— Due to the enormous availability of the learning resources in the internet/ intranet, we need to have a system which picks the relevant resources to the students or teachers to improvise the learning. To achieve this we need a system which captures the learners activity, their preference of learning, teaching mode and also the spatial relationship between the resources available in the learning system This is achieved by building a system which could build a relationship between ontological artefacts, resource availability, learners preference and so on. To build a ontological relationship between the multi-dimensional data, the pre-processing technique is used to remove the noise from the knowledge based system. Removing the noise in the sense of removing the unnecessary or irrelevant documents to the current temporal situations. We have used existing clustering techniques to remove the noise or outliers from the knowledge base and build a ontological representation in the form of XML. In the existing system ontological structure is build and it wouldn't take the temporal changes of the resources into consideration. In our proposed system, we have build a dynamic ontological system which would take the temporal properties of the system which the dynamic user's preference, dynamic KB updates and any change in learning methodology change. And also we have proposed a learning system which uses clustering techniques to determine the outliers, ontology to determine the relationship between the resources available in the system and these documents categorized and given a weitage based on the resource quality and the dynamic preference of the users.

Keywords— Ontology, Learning management system, clustering, learning, XML

I. INTRODUCTION

Ontologies [1] constitute a formal conceptualization of a particular domain of interest that is shared by a group of people. When building ontologies into information systems, it is possible to modularize many software aspects mostly related to the domain (e.g., taxonomic structures) from ones mostly related to the processing (e.g., querying) and visualization (e.g., layouting) of data. One could argue that the drawback one encounters there is that such information systems software cannot be built with an implicit understanding of the domain, but rather it is necessary to make conceptualizations of the domain explicit — which may be a difficult task, resulting in a well-known knowledge engineering bottleneck. While one answer to this argument, also found in software engineering, certainly is: you should make your structures explicit in order to be able to adapt and extend them easily, the quest for faster and cheaper ontology engineering remains. Though ontology engineering tools have matured over the last decade, the manual building of ontologies still remains a tedious, cumbersome task.

Adaptive learning is a computer-based and/or online educational system that modifies the presentation of material in response to student performance. Best-of-breed systems capture fine-grained data and use learning analytics to enable human tailoring of responses. The associated learning management systems (LMS) provide comprehensive administration, documentation, tracking and reporting progress, and user management.

Advances in adaptive learning systems and platforms with their powerful feedback loops are used in blended learning environments for greater personalization. The ability for students to track their own learning means that they can develop valuable self-monitoring skills, and engage in their personal learning progress. • In recent world, the availability of learning contents and resources are enormous. This creates a problem to find the right resources for appropriate learners since there is a need to find relationship among the learning contents and present to learners which enables self learning.

There is also a need to represent the meta-data about resources which has been represented as text format. And also there is a need to find irrelevant learning contents before the system analyze learning contents. Ontology has been used to represent the data and he relationship amongst data in various applications like data mining, data migration. Several algorithms are used to cluster the data but fuzzy clustering helps us to cluster the data and associate the cluster to different data points based on the weightage.

II. LITERATURE SURVEY

Ontology is used to identify and overcome the knowledge sharing barriers. Ontology provides a shared vocabulary, which can be used to model a domain and support reasoning about concepts. The use of ontology is a possible approach to overcome the problem of semantic heterogeneity. Ontology is proposed as a way to overcome the obstacles of

knowledge integration. It is used to unify Databases, Data Warehouses, knowledge bases vocabularies and even to maintain consistency in updating Corporate Memories used in knowledge management in modern enterprises [2].

In recent years, several approaches have been proposed to solve the problem of ontology learning. These approaches include: ontology pruning [8], conceptual grouping [7], formal concept analysis (FCA) [5], association rules [6], pattern extraction [3] and conceptual learning [4]. However, these approaches do not consider all available information to make a realistic decision. They are often focused on limited types and neglect others.

2.1 Types of Learning

There are seven types of learning which categorizes the learner and learning behavior [13].

- Inquiry Based Learning
- Problem Based Learning
- Discovery Learning
- Cooperative learning
- Authentic Learning
- Project Based Learning
- Situated Learning

2.1.1 Inquiry Based Learning

This is a learning process that is based on inquiry or asking questions. Through asking challenging questions learners get intrinsically motivated to start delving deeper to find answers for these questions and in doing so they are exploring new avenues of knowledge and insight. As you can see in the graphic below inquiry-based learning is a cyclical learning process composed of many different t stages starting with asking questions and results in asking more questions. Inquiry based learning is not just asking questions, but it is a way of converting data and information into useful knowledge. A useful application of inquiry based learning involves many different factors, which are, a different level of questions, a focus for questions, a framework for questions, and a context for questions.

2.1.2 Problem Based Learning

In a problem-based learning (PBL) model, students engage complex, challenging problems and collaboratively work toward their resolution. PBL is about students connecting disciplinary knowledge to real-world problems—the motivation to solve a problem becomes the motivation to learn.

2.1.3 Discovery Learning

Discovery learning is a kind of teaching that is based on the student finding things out for themselves, looking into problems, and asking questions. Essentially, it's all about students coming to their own conclusions and asking about things in their course that might not make particular sense. Obviously, as soon as enquiries are made, they can learn new things and hence will have become part of an innovative, thought-provoking and interesting educational journey. Top psychologists in the country have promoted this kind of learning.

2.1.4 Cooperative Learning

Several definitions of cooperative learning have been formulated. The one most widely used in higher education is probably that of David and Roger Johnson of the University of Minnesota. According to the Johnson & Johnson model, cooperative learning is instruction that involves students working in teams to accomplish a common goal, under conditions that include the following elements (7):

1. Positive interdependence. Team members are obliged to rely on one another to achieve the goal. If any team members fail to do their part, everyone suffers consequences.

2. Individual accountability. All students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned.

3. Face-to-face promotive interaction. Although some of the group work may be parcelled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another.

4. Appropriate use of collaborative skills. Students are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills.

5. Group processing. Team members set group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future. Cooperative learning is not simply a synonym for students working in groups. A learning exercise only qualifies as cooperative learning to the extent that the five listed elements are present.

2.1.5 Authentic Learning

Authentic learning typically focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice. The learning environments are inherently multidisciplinary. They are "not constructed in order to teach geometry or to teach philosophy. A learning environment is similar to some 'real world' application or discipline: managing a city, building a house, flying an airplane, setting a budget, solving a crime.

2.1.6 Project Based Learning

These activities are designed to answer a question or solve a problem and generally reflect the types of learning and work people do in the everyday world outside the classroom."

2.1.7 Situated Learning

Situated learning is a type of learning that involves learning materials within the context of how the information or skills are actually used and applied. It is typically associated with social learning and though it was initially recognized in regard to adult education, some of its practices have been extended to youth education as well. With this type of learning, communities of practice are established in which individuals learn and build mutual meaning through active processes that imbue context and purpose into what is learned. Situated learning does not typically involve a particular pedagogical approach, but instead seeks to understand how learning relates to daily practices and social interactions.

2.2 Adaptive Systems and Learning Systems

The need of the adaptive systems has been increasing every day. Hence e-learning systems must be capable of providing adaptive contents to the user. Many students fail to learn due to the full freedom in many learning systems. There is also a lack of guidance provided to the students when they deviate from the normal learning path. The individual differences in the students learning play a vital role in developing such adaptive learning systems [9]. People generally have different cognitive styles and different capabilities of learning [9].

Hence any while building any such adaptive systems we must address the different styles of learning. The student's interaction with the system could impact the learning behavior. Hence obtrusively asking the students might not motivate the students to use the system for a longer time [10].

In [12] discuss about the impact of the learner's attributes such as gender, ethnicity and task specific attributes. Adaptive learning may be defined as ''the process of generating a unique learning experience for each learner based on the learner's personality, interests and performance in order to achieve goals such as learner academic improvement, learner satisfaction, effective learning process and so forth" [11].

Adaptive Hypermedia Systems (AHS) are systems that use user and concept models to provide a personalized version of the information for the end user. Adaptive Educational Hypermedia Systems (AEHS) are those that create a unique learning experience for each learner based on learner's knowledge-base, goals, learning style and so forth [13].

2.3. Existing Approaches

2.3.1. A new Data Mining System for ontology learning Using Dynamic Time Warping alignment as a case

In this paper ontology they have proposed a semi-automatic approach that uses the variables selection and clustering to find the candidate changes. In order to identify the correspondence between the ontological artifacts and candidate changes, we used an alignment process. This paper also exploits natural language processing, indexation and machine learning techniques to increase the productivity of ontology engineering task during the enrichment of conceptual model.

2.3.2. Learning Management Systems Meet Adaptive Learning Environments, Intelligent and Adaptive

In this paper, new system GRAPPLE has been defined and the users are presented with dynamic contents. They have created an architecture which ensures the systematic interaction for the teachers, learners and the system. They have provided a system with a nice interface but there is a lack of adaptive content presentation to the user. This adaptation is in the user interface level which lacks the adaptation when the new contents are dynamically added in to the system.

2.3.3. A strategy to join adaptive and reputation-based social-collaborative e-learning, through the zone of proximal development

This system provides a way for identification of a strong need for adaptation of the learning activities, both traditional classroom and modern e-learning ones, to the present state of learner's knowledge and abilities. Furthermore, Vygotskij's educational model includes a strong bent towards social and collaborative learning. The joint answer to these two trends can be concretely implemented through a tight integration between personalized learning paths and collaborative learning activities. Along this line, the authors designed the combination of the functions of two pre-existing prototypes of web-based systems, to investigate how the above integration can merge adaptive and social e-learning. LECOMPS is a web-based e-learning environment for the automated construction of adaptive learning paths. SOCIALX is a web-based system for shared e-learning activities, which implements a reputation system to provide feedback to its participants.

2.3.4. Ontology-Driven Relation Extraction by Pattern Discovery

This paper describes an ontology-driven system that performs relation extraction over textual data. The system exploits expert knowledge of the domain, including lexical resources, in the form of an ontology to drive the extraction of patterns using manually annotated texts. Such patterns are then applied in order to identify candidates for relation extraction. Paired with basic, reliable named-entity-level text annotation, this results in the discovery of relations among entities in Italian newspaper articles. This paper also describes the system and measure its performance.

III. EXISTING AND PROPOSED SYSTEM

3.1 Existing System

Ontology is used in various applications but ontology is not used to represent the learning contents meta-data in the learning management system. Several learning management systems are there but learner's likeliness are not captured much. Ontology is used in various applications like data mining, migration, networking but the ontology is not used much in learning management systems. Due to the enormous availability of resources there is a need to find the outliers and eliminate the resources before presenting it. And also clustering improvises the time and gives us exact resources to

the learning groups. There is a lack of standards in representing the resources which could create multiple problems during implementation.

Existing systems did not create dynamic adaptation when the resources are added or deleted or modified in the system.

And existing system didn't consider the user preference dynamicity; this may vary from time to time. Since there are possibility for the user to change his/her preference.

3.1.1. Disadvantages

There is no standard to represent the resources which couldn't produce a stable dynamic system. We address by providing a standard representation by using the XML and creating the xml based ontological tree.

In the existing system, there is no dynamic nature of the adaptive nature of the system which we are addressing when the user preference or the contents changes in the system.

Existing system didn't consider the users preference in learning environment and the type of learning. We propose a system where the user can enter into various types of learning methodology and the contents may vary accordingly.

Elimination of the outliers is not considered in the existing systems because irrelevant data may irritate the user some times which reduces the learning capacity.

3.2 Proposed System

We are proposing a learning management system for the students based on the several attributes like user likeliness, resource availability and other parameters. In this learning management system resources are categorized into various types and the relationship between the resources are represented using ontological tree which will be implemented in the form of XML and stored in the database.

And due to the enormous amount of data, there is a need to find the irrelevant resources from the system and remove it before presenting it to the user. Along with this students and resources are clustered and based on the clusters appropriate resources are presented to the learners. This enables the learning capacity, motivation to learn and dynamic nature creates the interest towards the system.

In our proposed system, there are various types of resources that a user can view in the learning system. And also user can set their preference because some of the users are interested in videos and some may interested in presentation so we have a option where the user can enter and save his/her preference.

This preference is stored in the system and based on the preference ontological tree is created and the unwanted resources are eliminated using outlier detection which gives only the appropriate resources to the system.

Based on the ontology tree, fuzzy clustering is applied to cluster the resources by which various resources and users are clustered and if the user is in particular cluster appropriate resources are presented to the user based on the preference, learning resources availability.

3.2.1. Architecture of Proposed System

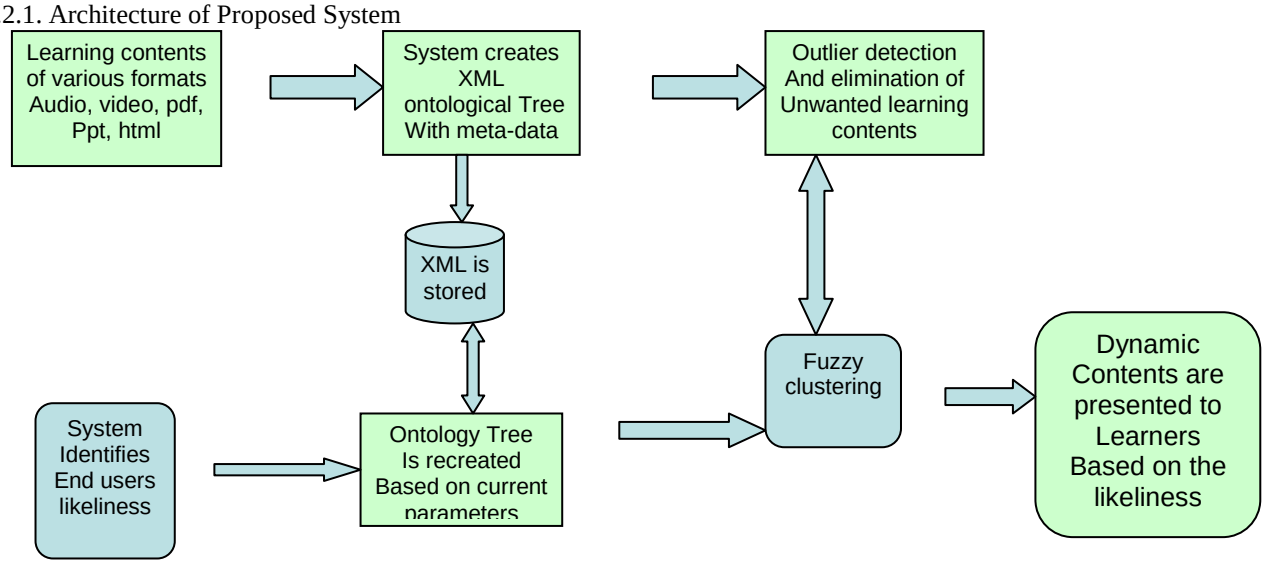

Fig. 1. Architecture of Learning Management System

The ontology tree and clustering happens on the below parameters:

Resource category

Identification of the resources category based on the different projects and objectives. These projects and objectives are identified by the tutors and are created in the system. Teachers/trainers can add various resources based on the project and objectives.

Preferences

Preferences are categorized into subject level and resource category level.

This subject level preference is used to present the contents for the learners of different skill set.

Based on the skill set of the users which are initially received from the user for the particular subject, our proposed system presents the resources to the learners.

3.2.1. Advantages of the proposed System

- Dynamic Ontology creation which enables more levels of abstraction
- Outlier elimination which gives only related information to user which improvises user learning satisfaction
- Dynamic adaptation to the user whenever the content changes
- Dynamic adaptation to the whenever the user preference changes
- Dynamic content presentation based on the skill set of the user

3.2.3. Different modules of Proposed System

1. **Tutor module** – which enables to create various modules/ subjects and provides and interface to add the resources
2. **Ontology Structuring** – which creates the representation for the resources in the form of xml
3. **Outlier Detection and Elimination** – which determines the outliers and eliminates the outliers based on the current properties
4. **Clustering module** – creates the clusters of resources and associates the learners to the particular clusters
5. **Learner module** – which creates an interface to enroll into particular subject/ module and set/change the preference of the learning methodology
6. **Presentation Module** – which creates the user interface for the learners and dynamic contents are presented accordingly

IV. CONCLUSIONS

To implement the Learning management system for different learning groups which should enable the motivation for learning and the satisfaction towards learning. This is done by collecting various resources like audio, video, pdf, ppt, html and so on and presenting it to appropriate learning groups based on the likeliness. This will be implemented using the ontology tree which is represented in XML format and determining and eliminating the outliers. All the resources are clustered and will be presented to learning groups appropriately.

Advantages

- Resources are represented in the form of Ontology which gives the metadata and the relationship between the resources
- Since outliers are eliminated in prior to clustering which could provide the efficient clustering approach
- Our System would increase the learning capacity of the learners
- Dynamic contents are presented in a very efficient way
- Learners would be very much interested to learn more using our systems
- Performance of the learners in the particular subject is increased and we will make a comparatively analysis with and without the system.

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