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SURVEY ON APPLICATIONS OF ONTOLOGY IN VARIOUS DOMAINS

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Abstract— Ontology is a term in philosophy and its meaning is "theory of existence". Ontology is an explicit specification of conceptualization. Ontology is a body of knowledge describing some domain, typically common sense knowledge domain. This paper presents a survey of fifteen papers based on ontology. Discussion is made about ontologies used in web, mining and multi agent systems.

Keywords— ontology, Haptics, service oriented, multiagent, multilingual, web retrieval, mining

INTRODUCTION

After an ontology is developed, it is used, reused, and related to other ontologies, and also needs to be maintained. These tasks may be easier when ontology is designed with these tasks in mind. For example, building ontology on an shared upper ontology and using a modular design usually means easier use and maintenance. In this chapter we describe operations on ontologies, relations between ontologies, and a classification of ontologies.

OPERATIONS ON ONTOLOGIES

It is possible that one application uses multiple ontologies, especially when using modular design of ontologies or when we need to integrate with systems that use other ontologies. In this case, some operations on ontologies may be needed in order to work with all of them. We will summarize some of these operations. The terminology in this areas is still not stable and different authors may use these terms in a bit shifted meaning, and so the terms may overlap, however, all of these operations are important for maintenance and integration of ontologies.

- Merge of ontologies means creation of a new ontology by linking up the existing ones. Conventional requirement is that the new ontology contains all the knowledge from the original ontologies, however, this requirement does not have to be fully satisfied, since the original ontologies may not be together totally consistent. In that case the new ontology imports selected knowledge from the original ontologies so that the result is consistent. The merged ontology may introduce new concepts and relations that serve as a bridge between terms from the original ontologies.
- Mapping from one ontology to another one is expressing of the way how to translate statements from ontology to the other one. Often it means translation between concepts and relations. In the simplest case it is mapping from one concept of the first ontology to one concept of the second ontology. It is not always possible to do such one to one mapping. Some information can be lost in the mapping. This is permissible, however mapping may not introduce any inconsistencies.
- Alignment is a process of mapping between ontologies in both directions whereas it is possible to modify original ontologies so that suitable translation exists (i.e., without losing information during mapping). Thus it is possible to add new concepts and relations to ontologies that would form suitable equivalents for mapping. The specification of alignment is called articulation. Alignment, as well as mapping, may be partial only.
- Refinement is mapping from ontology A to another ontology B so that every concept of ontology A has equivalent in ontology B, however primitive concepts from ontology A may correspond to non-primitive (defined) concepts of ontology B. Refinement defines partial ordering of ontologies.
- Unification is aligning all of the concepts and relations in ontologies so that inference in one ontology can be mapped to inference in other ontology and vice versa. Unification is usually made as refinement of ontologies in both directions.
- Integration is a process of looking for the same parts of two different ontologies A and B while developing new ontology C that allows to translate between ontologies A and B and so allows interoperability between two systems where one uses ontology A and the other uses ontology B. The new ontology C can replace ontologies A and B or can be used as an interlingua for translation between these two ontologies. Depending on the differences between A and B, new ontology C may not be needed and only translation between A and B is the result of integration. In other words, depending on the

number of changes between ontologies A and B during development of ontology C the level of integration can range from alignment to unification.

- Inheritance means that ontology A inherits everything from ontology B. It inherits all concepts, relations and restrictions or axioms and there is no inconsistency introduced by additional knowledge contained in ontology A. This term is important for modular design of ontologies (see later) where an upper ontology describes general knowledge and a lower application ontology adds knowledge needed only for the particular application. Inheritance defines partial ordering between ontologies.

LITERATURE SURVEY

"Applying Evolutionary Computation for Evolving Ontologies"

In this paper [1] introduced a new genetic operator, called repair, which is needed in order to make the offspring viable. Experiments for the generation of user centered automatically generated scenes demonstrate the performance of the proposed approach. However, we consider that a new genetic operator - repair - is needed to making the offspring viable. Otherwise the risk of having no viable individuals after only a few epochs is high. The evolutionary ontologies have been applied for automatically generating scenes. The concept has been applied on a specific ontology built in this scope. The advantage of using scene for researching evolutionary ontologies is that the ontologies as well as the results of the genetic operators have a visual equivalent.

" Focused Crawling with Ontology using Semi- Automatic Tagging for Relevancy"

The process of focused crawling is being enhanced by the semi-automatic tagging done using ontology in this paper [2]. As a result the values of semantic relevance increased for the same search topic with and without semi-automatic tagged resources. Also the harvest rate for the focused crawlers improved over the classical focused crawlers for two different relevance thresholds. The ontology plays an important role in the tagging as well as the crawling process. The process is done on single domain of social bookmarking site but this process can be enhanced to multiple social bookmarking sites to accumulate all the tags from various sites.

"A Graph Derivation Based Approach for Measuring and Comparing Structural Semantics of Ontologies"

Paper [3] have presented a GDR derivation based approach to stably measure and compare ontologies. By theoretical analysis of the properties of GDR, we show that the GDR of an Ontology is semantic-preserving and "unique" in terms of labels, connecting structure and isomorphism, which guarantees stable semantic ontology measurement. We analyze and evaluate the usefulness of our GDR approach and compare our GDR with conventional graph models (GM). We draw two important conclusions. First, the GDR approach Offers stable and reliable semantic measure of ontologies and provides a feasible solution for automated ontology comparison and measurement. Second, the measurement and comparison based on GDRs are more useful and meaningful for the ontologies with a large number of complex concepts. Thus, our GDR based approach can also be used as a complementary mechanism by the existing ontology measurement approaches. Our work on stable and reliable semantic measurements of ontologies continues along three directions. First, the GDR-based ontology comparison assumes that concepts have the same semantics if their names are the same, which is not always true in real life ontology comparison. We will explore comparing the similarity between ontologies with polysemy and toponomy. Second, by the GDR-based ontology comparison, the candidate ontologies that are most similar to a given ontology can be selected from the ontology repositories. The selected ontologies can be further used to help users enrich the ontology design and improve its quality for specific application domain of interest. Three, we can further explore new methods for ontology reuse by utilizing the semantically clean and enriched structures in GDRs.

"A Novel Architecture of Ontology Mapping System for Hidden Web Retrieval"

Paper [4] Choosing the right strategy for Ontology mapping in terms of resource consumptions as well as effectiveness will lead to the conceptualization and implementation of an intelligent Hidden Web Retrieval System. Much concern 67 in any ontology mapping system regarding efficiency is then number of concept-pairs to be matched. Taking efficiency consideration in mind, only relevant concept-pairs has been examined for mapping. Selecting only relevant pairs for mapping, results in higher precision rate as compared to some other prevalent system. Precision in turns offer more accurate results in a more efficient manner. Also there is a scope of dynamically creation of ontology corresponding to a given query interface form. Secondly there should not be a restriction the domain by the proposed model and it should be adaptable to any domain. Dynamic nature of mapping is also required, so that whenever necessary, predefined Ontology database is updated. These additional information are vital in making the mapping process more accurate and efficient.

"Building profiles based on ontology for career recommendation in E-Leaming context."

Paper [5] described a method enabling system to classify students depending on their school levels and also their personal and professional tendencies. This semantic classification integrated within ontology will help the system to build students' profiles. Then, our system will be able to guide them in an optimal and personalized career pathway (CP) and make a decision about interface content recommended to each profile. To evaluate the effectiveness of the proposed approach, an experiment was conducted on students from middle school.

However, simulations of abilities together with a previous preparation become necessary. Although if student decide he have chosen the wrong 'Cpt, he can always switch to a different plan. Indeed, a RCS method based on students' previous school marks (psm) and Holland results is proposed to simulate their abilities. The system will propose the most appropriate career pathway to student and will personalize student's interface with pedagogical content belonging to this same career pathway. The goal is to provide to student the opportunity to be proactive in his choice. Future work involves the prediction of the chosen career pathway depending on student-system interactions.

"SODHO: Service Oriented Development of Haptics Ontology"

Paper [6] look towards the future of Human Computer Interaction, this paper presented an ontology for Haptics. It introduced a design of Haptics Ontology Platform including and illustrated some key concepts. As general conclusions, we can summarize the presented work as follows: The HIS attributes were classified into three categories: Physical, spatial and temporal attributes (for each actuators and sensors). SODHO was developed, using the SUMO model instead of BFO as in HASM ontology, in which the vocabulary that describes human-haptic system interaction was formalized, providing a formal categorization of the haptics domain that can serve users and applications. Second, in adding the "attributes classes" in SODHO, the developed ontology for the haptics will help in designing better software for tactile interfaces, this is due to the fact that, with the proposed unified ontology, we will be working with a global interface that will be the adapter between the soft service layer and the HIS components. This will make easier, the implementation of the service layer. Third, due to SWRL rules, data was inferred and treated. Fourth, by integrating "Actuators" and "Sensors" in one unified ontology, we tried to answer the question of how to integrate the "real world" and computational media, for future Augmented Reality, HAVE and IOT applications.

" Multi-Agent-Based System for Multilingual Ontologies Maintenance"
This workin paper [7] is part of a project where we are developing a framework for semantic manipulation of health and nutrition information. In this paper, we present an automatic ontology maintenance system using multi-agent based approach for multilingual ontologies related to food and health domains. The paper also highlights the challenges and complexities that may occur in multi-agent based systems which are being utilized for the purpose of maintenance of multilingual ontologies.In this paper, we present multi-agent-based system to maintain multilingual ontologies using of Wikipedia and WordNet. The constructed ontology consists of parallel monolingual ontologies and a Language-Agnostic ontology connecting them together. The Language-Agnostic ontology acts as a bridge between the monolingual ontologies. Each monolingual ontology consists of the concepts that exist in that language. The number of concepts differs from each other largely due to the concept diversity in each language. It also reflects the culture for each language based on the available concepts for each language.

" ONTOSSN: Scientific Social Network ONTOlogy"

In this paper [8], the author has proposed a scientific social network ontology which includes definitions of main entities and describes main attributes of : Scientific social network concepts aiming to share common understanding of this domain and to reflect the academic career paths. Social network data currently increasingly emerges everywhere. Particularly, scientific social network which describes the scientific interaction between researchers. After a deep study of ontological modeling of scientific social network, we introduce a new ontology for an enhanced scientific social network representation. Currently, we are studying two main issues: (1) the scrutinize of the impact of the social network evolution on our proposal [5] and (2) the consideration of uncertainty on handling advanced social network mining.

"Detecting and Correlating Video-based Event Patterns: An Ontology driven Approach"

In this paper [9], we have presented an unsupervised trend discovery approach for identifying Temporal and Geographical trends corresponding to an input video. Initially, we are forming the Document Set associated to a video. This facilitates in establishing the complete information that builds around the video. The temporal trend analysis basically identifies the probability distribution of concepts present in Document Set over a given time. To classify the documents, statistical modeling approach is used. To fill the gap between syntactic patterns and semantic meanings, an E-MOWL based ontology has been utilized. A document can then be seen as a probability distribution over concepts. This approach assists in detecting and correlating the event patterns as evolved over time. For geographical trend analysis, initially the geographic named entities are extracted using Stanford NLP Parser. The geographic entities are then mapped onto the geo-ontology concepts to identify the relation between them. This is required for deducing the interrelationships between various geographical locations associated with an event. This further helps in detecting and correlating event patterns showing the relatedness between various locations as associated to an event.

"A Pattern-Based Approach to Semantic Relation Extraction Using a Seed Ontology"

In this paper [10] we presented our experiment on Badea system, which is a system designed to enable the automated enrichment of ontological lexicons. The system uses a pattern based method to extract pairs of words with the antonym semantic relation, and enrich the ontology with newly discovered pairs. The system was evaluated an Arabic seed ontology and two sets of Arabic language corpora. Results from the experiment indicate that the system was useful for extracting useful antonym pairs and yielded a 400% increase in the size of the ontology. Moreover, our experiment also show that even though a large number of patterns were identified (over 900), only 2.7% of these patterns were useful in extracting correct antonym pairs. Although the pattern score computed does indicate the reliability of the pattern, it is not a very good indicator of pattern usefulness or generality, the total number of unique antonyms it retrieves. This implies that another measure should be introduced which is the pattern usefulness or generality score. Our recommendation is that the usefulness score should include the number of unique antonyms retrieved in the pattern.

Shortcomings from this experiment highlight areas for improvement and further work. Results from computing the pattern score highlights an interesting question for further research in this area: what constitutes a good value for the pattern score? Can such measure be computed accurately? What other factors influence the pattern effectiveness in eliciting a semantic relation between words? Another interesting area open for research and exploration is to investigate how to use Badea system to elicit other types of semantic relations between the two extracted words.

"An Ontology-Based Text Mining Method to Develop D-Matrix from Unstructured Text"

A novel ontology-based text mining methodology has been proposed in [11] to construct the D-matrices by automatically mining the unstructured repair verbatim data collected during fault diagnosis. In real-life, the manual construction of a D-matrix diagnostic model corresponding to the complex systems is not practical as it would involve significant effort to integrate the knowledge from SMEs and represent it in a D-matrix. In many cases the SMEs may not even be able to realize all the dependencies between failure modes and symptoms resulting into partial support to perform fault diagnosis. Our approach overcame these limitations where natural language processing algorithms were proposed to automatically develop the D-matrices from the unstructured repair verbatim. We compared the testability and diagnosability metrics of the historical data-driven D-matrix and the text-driven D-matrix.

"An Ontology based Recommendation Mechanism for Lighting System Design"

The proposed method in [12] was constructed with reusable project analysis and term-based ontology analysis. By examining an ontology-based design for lighting control system, designer can observe ranks of and similarities among alternatives by system requirements or system schemas, iteratively select historical project, and adjust system schemas for developing new projects.

This study has described a framework of the reusable project analysis and the term-based ontology analysis for applying to lighting system designs. The proposed ontology based recommendation mechanism can help designer to construct a newly added engineering schematics efficiently from reusing the historical designs. By examining the recommendation mechanism, designer can observe ranks of similarities among alternatives, iteratively select historical projects, and adjust schematic designs for developing new projects. There are still many issues can be studied in this area. The ports of a device provide an interface demarcating devices within a lighting system, and they facilitate the negotiation of interface constraints among different devices. In connections between ports, need to be considered within the context of their attributes.

"An ontology evolution method based on folksonomy"

This paper [13] presented our 3E Steps technique to review and enhance ontologies and our approach to build and use a folksonomies ontology (FO) in this context. A FO is a hybrid entity fusing folksonomies and ontologies. It is a symbiotic combination, taking advantage of both semantic organizations. Ontologies provide a formal semantic basis, which is contextualized by folksonomic data, improving operations over tags based on ontologies. Conversely, the FOs were used as tools to analyze the ontology and to support the process of ontology evolvement, showing the discrepancies between the emergent knowledge of a community and the formal representation of this knowledge in the ontology. In this paper, we described the 3E Steps : Extraction, Enrichment, and Evolution. Extraction is the step where the semantic information is collected from the folksonomies and processed. In the Enrichment step, we combine the two entities, building a third one, with the best of both worlds. Finally, Evolution is the step where the folksonomized ontology is used to support the review and enhancement in the original ontology, closing the circle.

"An Empirical Study of Ontology-Based Multi-Document Summarization in Disaster Management"

In this paper [14], we gave an empirical study on several approaches that utilize the ontology to solve different multidocument summarization problems in disaster management domain. For generic summarization, we employed different vector space models to represent sentences in the document collection, and explored the feasibility of different combinations of the VSMs. Then the centroid-based methods were utilized to cluster the sentence set and the important sentences close to the centroids of the sentence clusters are extracted. The final summary was subsequently generated by reducing information redundancy and ranking sentences. For queryfocused summarization, we delved into the effect of query expansion in summarization tasks. The ontology is rich in conceptual information related to the specific domain. We will keep working on the issue of ontology-based multidocument summarization, particulary, on some other document summarization tasks, i.e., update summarization and comparative summarization.

"Developing a Framework for Ontology Generalization"

In this paper [15], we have developed a framework for ontology generalization that can easily generalize two or more similar type ontologies into one ontology. The proposed system first checks the similarity among the ontologies . It then merges the similar ontologies into one more general ontology. We have tested our developed ontology generalization approach with several ontologies. We have found that our system can perform the generalization of ontologies with a certain level of accuracy. we have developed and implemented an ontology generalization tool that can generalize two ontologies into one. Though our tool is efficient enough to generalize ontologies to a more general one, it only supports ontologies those are written in English. Moreover, current framework just considers the class-subclass relationships for ontology.

CONCLUSION

Different paper based on ontology and its application has been reviewed. Based on this new methods can be proposed or existing methods can be combined

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