Chapter 7
Semi-Automatic Ontology Design for Educational Purposes

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ABSTRACT

In this paper, we present a (semi) automatic framework that aims to produce a domain concept from text and to derive domain ontology from this concept. This paper details the steps that transform textual resources (and particularly textual learning objects) into a domain concept and explains how this abstract structure is transformed into more formal domain ontology. This methodology targets particularly the educational field because of the need of such structures (Ontologies and Knowledge Management). The paper also shows how these structures make it possible to bridge the gap between core concepts and Formal ontology.

INTRODUCTION

Ontology defines a common vocabulary for researchers who need to share information in a domain (Noy & McGuinness, 2000). The proposed method is to build a semi automatic ontology for educational data for various topics. Ontology can be treated as set of topics connected with different types of relations. Each topic includes a set of related documents. Construction of such ontology from a given corpus can be a very time consuming task for the user. In order to get a feeling on what the topics in the corpus are, what the relations between topics are and, at the end, to assign each document to some certain topics, the user has to go through all the documents. The proposed method will overcome this by building a semi automated ontology which helps the user by suggesting the possible new topics and visualizing the topic ontology created. The Semi-Automatic ontology building starts from small core ontology constructed by

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domain experts and learn the new concepts and relationships between concepts. The proposed method aims at assisting the user in a fast semi-automatic construction of the ontology from a large document collection of educational data.

Introduction to Ontology

Ontology has been attracting a lot of attention recently since it has emerged as a very important discipline in the areas of knowledge representation (Sowa, 2000). Ontology refers to the shared understanding of a domain of interest and is represented by a set of domain relevant concepts, the relationships among the concepts, functions and instances (Bhowmick et al, 2010).Ontology is used for representing the knowledge of a domain in a formal and machine understandable form in areas like intelligent information processing. Thus it provides the platform for effective extraction of information and many other applications (Choudhary & Roy, 2012). It is very useful for expressing and sharing the knowledge of semantic web (Tiwari & Thakur, 2012). There exist many definitions of ontology in different areas by different people. In philosophy, Ontology means theory of existence. It tries to explain what is being and how the world is configured by introducing a system of critical categories to account things and their intrinsic relations.

One scenario of ontology is in Artificial Intelligence, where it is defined as *Ontology is a formal, explicit specification of shared conceptualization*. This definition is given by Gruber (Gruber, 1993) which is most commonly used by knowledge engineering community. Here Conceptualization is a *world view* that often present as a set of concepts and their relations. It is the abstract representation of a real world entity (view) with the help of domain relevant concepts (Bhowmick et al, 2010).Since the ontologist has huge amount of knowledge which is unstructured and it should be organized. Conceptualization helps to organize and structures the acquired knowledge using external representations that are independent of the implementation languages and environments (Aguado et al, 1998). Another scenario from compositional view of ontology is *Ontology is a hierarchical organization of concepts along with relationship between them*. From knowledge-based systems point of view, ontology is defined as *a theory (system) of concepts/vocabulary used as building blocks of an information processing system* by R. Mizoguchi (Mizoguchi, 1995). One thing that we should understand about ontology is Semantic web which requires semantic interoperability among metadata in which ontology is expected to fill the semantic gap between metadata (Mizoguchi, 1995). Ontologies act as a conceptual backbone for semantic document access by providing a common understanding and conceptualization of a domain (Kietz,2001).

Though essentially different, ontologies are closely related to knowledge bases and database schemas. An ontology can be distinguished from a knowledge base in the fact that it is a conceptual structure of a domain while a knowledge base is a particular state of domain. An ontology also separates itself from a database schema in that an ontology is sharable and reusable while a database schema tends to be specific to the domain and is context-dependent; therefore is unlikely to be shareable and reusable. For instance, an OWL DL ontology is essentially equal to a description logic knowledge base which contains both a TBox (elements of which constitute an ontology), and an ABox (which comprises instances of the ontology).