A Survey on Ontology Creation Methodologies

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ABSTRACT

In the current literature of knowledge management and artificial intelligence, several different approaches to the problem have been carried out of developing domain ontologies from scratch. All these approaches deal fundamentally with three problems: (1) providing a collection of general terms describing classes and relations to be employed in the description of the domain itself; (2) organizing the terms into a taxonomy of the classes by the ISA relation; and (3) expressing in an explicit way the constraints that make the ISA pairs meaningful. Though a number of such approaches can be found, no systematic analysis of them exists which can be used to understand the inspiring motivation, the applicability context, and the structure of the approaches. In this paper, we provide a framework for analyzing the existing methodologies that compares them to a set of general criteria. In particular, we obtain a classification based upon the direction of ontology construction; bottom-up are those methodologies that start with some descriptions of the domain and obtain a classification, while top-down ones start with an abstract view of the domain itself, which is given a priori. The resulting classification is useful not only for theoretical purposes but also in the practice of deployment of ontologies in Information Systems, since it provides a framework for choosing the right methodology to be applied in the specific context, depending also on the needs of the application itself.

Keywords: knowledge engineer; ontologies; semantic models

INTRODUCTION

In the recent past, complex markets have been characterized by a huge specialization of work, a high level of outsourcing processes, and a more open Porter’s chain that develop and increase the needs of intra- and interorganizational networks. Both intraorganizational networks among strategic units, divisions, groups, and other even smaller substructures and interorganizational networks, such as industrial districts and knowledge networks (Hamel & Prahalad, 1990) are
composed of a constellation of specialized units (Ashby; 1956; Numagami, Ohta & Nonaka, 1989), which might not be controlled totally by a unique subject and might grow and differentiate their activities, their system of artifacts, and their view of the world in an autonomous way. Although every unit uses a different view of the world (i.e., different conceptualizations), they should coexist as in a biofunctional system (Maturana & Varela, 1980) and communicate, coordinate, and share knowledge in a networked environment. Furthermore, this continuous and unpredictable encountering of different views might enable the creation of an unexpected and innovative combination of processes and products (Chandler, 1962).

Most of these processes are based nowadays on the Web, and in this scenario, tools and technologies that sustain knowledge telecommunication, coordination, and sharing are increasing their importance. Therefore, both the scientific community on computer science and industries are interested in what is called the Semantic Web. The Semantic Web community has grown in terms of dimension and specialization, and different viewpoints of creating and managing semantic tools have been taken on the nature of the Web. In studies, an excellent role is being assumed by disciplines about development of systems and methodology that allow the combination of several different views (expressed through taxonomies, classifications, contexts, and ontologies) of the world. In particular, ontology can be considered as the boundary topic between the Semantic Web research and Information Systems that mostly deserves special attention to the methodological aspects. This is the argument that urged researchers all over the world to create outstanding projects that involve methodological research, and that urged industries to create ontology-based applications that express the units’ points of view and, at the same time, allow knowledge exchange among different units and their perspectives (Bonifacio, Bouquet & Cuel, 2002). In this work, we are interested especially in ontology, because that it is one of the most important systems and methods that allows an explicit representation of knowledge and expresses itself a view of the world. Even if implicitly, each organization, unit, or employee interconnected in a networked system uses a personal conceptual schema that could be shared or at least understood among them. Therefore, developing a good ontology seems to be one of the critical issues in this area. For this reason, this paper focuses on the methodologies in literature that provide frameworks for developing Formal Ontologies. Frameworks are provided by ontology creation tools, which explicitly or implicitly endow a series of steps that the developer should follow. For instance, some ontology development tools make available documentation that describe the better way in which an ontology developer might create an ontology; other ontology development tools implicitly force the developer to follow some specific steps during the process of ontology creation.

**BACKGROUND THEORIES**

It is quite well established in recent investigations on Information Systems, that
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