

# Roles of Ontologies for Web Intelligence

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**Abstract.** The paper investigates the roles of ontologies for Web intelligence, including issues on presentation, categories, languages, and automatic construction of ontologies. Three ontology categories are suggested, some of the research and development with respect to the three categories is presented, the major ontology languages are surveyed, and a multi-phase process of automatic construction of the *domain-specific* ontologies is discussed.

## 1 Introduction

With the rapid growth of Internet and World Wide Web (WWW), we have now entered into a new information age. The Web has significant impacts on academic research, business, and ordinary everyday life. It revolutionizes the way in which information is gathered, stored, processed, and used. The Web offers new opportunities and challenges for many areas, such as business, commerce, marketing, finance, publishing, education, research and development.

The concept of Web Intelligence (WI for short) was first introduced in our papers and book [23,21,24]. Web Intelligence (WI) exploits Artificial Intelligence (AI) and advanced Information Technology (IT) on the Web and Internet. It is the key and the most urgent research field of IT for business intelligence. Ontologies and agent technology can play a crucial role in Web intelligence by enabling Web-based knowledge processing, sharing, and reuse between applications. Generally defined as shared formal conceptualizations of particular domains, ontologies provide a common understanding of topics that can be communicated between people and agent-based systems.

The paper investigates the roles of ontologies for Web intelligence, including issues on presentation, categories, languages, and automatic construction of ontologies. In Section 2, representation of ontologies is discussed, three ontology categories are suggested, and some of the research and development with respect to the three categories is situated. In Section 3, the roles of ontologies for Web Intelligence are described, and the major ontology languages for Web intelligence are surveyed. In Section 4, a multi-phase process of automatic construction of the *domain-specific* ontology is discussed. Finally, Section 5 gives concluding remarks.

## 2 Representation and Categories of Ontologies

Although many definitions of ontologies have been given in the last decade, the best one that characterizes the essence of an ontology is that *an ontology is a formal, explicit specification of a shared conceptualization* [10,19]. Here, *conceptualization* means modelling some phenomenon in real world to form an abstract model that identifies the relevant concepts of that phenomenon; *formal* refers to the fact that the ontology should be machine readable, that is, an ontology provides a machine-processable semantics of information sources that can be communicated between different agents; *explicit* means that the type of concepts used and the constraints on their use are explicitly defined. In other words, ontologies are content theories about the sorts of objects, properties of objects, and relations between objects that are possible in a specified domain of knowledge [3]. It provides a vocabulary of terms and relations to model the domain and specifies how you view the target world.

An ontology typically contains a network of concepts within a domain and describes each concept's crucial properties through an attribute-value mechanism. Such network is either directed or undirected one. It might also be a special type of network, that is, a concept hierarchy (tree). Further relations between concepts might be described through additional logical sentences.

An ontology can be very high-level, consisting of concepts that organize the upper parts of a knowledge base, or it can be domain-specific such as a chemical ontology. We here suggest three categories of ontologies: *domain-specific*, *task*, and *universal* ones.

A *domain-specific* ontology describes a well-defined technical or business domain.

A *task* ontology might be either a quite domain-specific one, or a set of ontologies with respect to several domains (or their reconstruction for that task), in which relations between ontologies are described for meeting the requirement of that task.

A *universal* ontology describes knowledge at higher levels of generality. It is a more general-purpose ontology (or called a common ontology) that is generated from several domain-specific ontologies. It can serve as a bridge for communication among several domains or tasks.

## 3 Ontologies for Web Intelligence

This section discusses the roles of ontologies and ontology languages for Web intelligence.

### 3.1 The Roles of Ontologies

Generally speaking, a domain-specific (or task) ontology forms the heart of any knowledge information system for that domain (or task). Ontologies will play a major role in supporting information exchange processes in various areas. The roles of ontologies for Web intelligence include: