Chapter I

Semantics for the Semantic Web: The Implicit, the Formal, and the Powerful

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Abstract

Enabling applications that exploit heterogeneous data in the Semantic Web will require us to harness a broad variety of semantics. Considering the role of semantics in a number of research areas in computer science, we organize semantics in three forms — implicit, formal, and powerful — and explore their roles in enabling some of the key capabilities related to the Semantic Web. The central message of this article is that building the Semantic Web purely on description logics will artificially limit its potential, and that we will need to both exploit well-known techniques that support implicit semantics, and develop more powerful semantic techniques.
Introduction

Semantics has been a part of several scientific disciplines, both in the realm of computer science and outside of it. Research areas such as information retrieval (IR), information extraction (IE), computational linguistics (CL), knowledge representation (KR), artificial intelligence (AI), and data(base) management (DB) have all addressed issues pertaining to semantics in their own ways. Most of these areas have very different views of what “meaning” is, and these views are all built on some meta-theoretical and epistemological assumptions. These different views imply very different views of cognition, of concepts, and of meaning (Hjorland, 1998). In this chapter, we organize these different views to three forms of semantics: implicit, formal, and powerful (a.k.a. soft). We use these forms to explore the role of semantics that go beyond the narrower interpretation of the Semantic Web (that involve adherence to contemporary Semantic Web standards) and encompass those required for a broad variety of semantic applications. We advocate that for the Semantic Web (SW) to be realized, we must harness the power of a broad variety of semantics encompassing all three forms.

IR, IE, and CL techniques primarily draw upon analysis of unstructured texts in addition to document repositories that have a loosely defined and less formal structure. In these sorts of data sources, the semantics are implicit.

In the fields of KR, AI, and DB, however, the data representation takes a more formal and/or rigid form. Well-defined syntactic structures are used to represent information or knowledge where these structures have definite semantic interpretations associated with them. There are also definite rules of syntax that govern the ways in which syntactic structures can be combined to represent the meaning of complex syntactic structures. In other words, techniques used in these fields rely on formal semantics.

Usually, efforts related to formal semantics have involved limiting expressiveness to allow for acceptable computational characteristics. Since most KR mechanisms and the relational data model are based on set theory, the ability to represent and utilize knowledge that is imprecise, uncertain, partially true, and approximate is lacking, at least in the base/standard models. However, there have been several efforts to extend the base models (e.g., Barbara, Garcia-Molina, & Porter, 1992). Representing and utilizing these types of more powerful knowledge is, in our opinion, critical to the success of the Semantic Web. Soft computing has explored these types of powerful semantics. We deem these powerful (soft) semantics as distinguished, albeit not distinct from or orthogonal to formal and implicit semantics.

More recently, semantics has been driving the next generation of the Web as the Semantic Web, where the focus is on the role of semantics for automated approaches to exploiting Web resources. This involves two well-recognized, critical enabling capabilities — ontology generation (Maedche & Staab, 2001; Omelayenko, 2001)
The Influences and Impacts of Societal Factors on the Adoption of Web Services
www.igi-global.com/chapter/influences-impacts-societal-factors-adoption/35748?camid=4v1a