Abstract

Formal ontologies are nowadays widely considered a standard tool for knowledge representation and reasoning in the Semantic Web. In this context, they are expected to play an important role in helping automated processes to access information. Namely: they are expected to provide a formal structure able to explicate the relationships between different concepts/terms, thus allowing intelligent agents to interpret, correctly, the semantics of the web resources improving the performances of the search technologies.

Here we take into account a problem regarding Knowledge Representation in general, and ontology based representations in particular; namely: the fact that knowledge modeling seems to be constrained between conflicting requirements, such as compositionality, on the one hand and the need to represent prototypical information on the other. In particular, most common sense concepts seem not to be captured by the stringent semantics expressed by such formalisms as, for example, *Description Logics* (which are the formalisms on which the ontology languages have been built). The aim of this work is to analyse this problem, suggesting a possible solution suitable for formal ontologies and semantic web representations.

The questions guiding this research, in fact, have been: is it possible to provide a formal representational framework which, for the same concept, combines both the classical modelling view (accounting for compositional information) and defeasible, prototypical knowledge ? Is it possible to propose a modelling architecture able to provide different type of reasoning (e.g. classical deductive reasoning for the compositional component and a non monotonic reasoning for the prototypical one)?

We suggest a possible answer to these questions proposing a modelling framework able to represent, within the semantic web languages, a multilevel representation of conceptual information, integrating both classical and non classical (typicality based) information. Within this framework we hypothesise, at least in principle, the co-existence of multiple reasoning processes involving the different levels of representation.

This works is organized as follows: in chapter 1 the semantic web languages and the description logics formalisms on which they are based are briefly presented. Then, in chapter 2, the problem on which this work is focused (e.g. conceptual representation) is illustrated and the general idea of the proposed multi-layer framework is sketched. In chapter 3 the psychological theories about concepts based on prototypes and exemplars are surveyed. In this chapter we argue that such distinction can be useful in our approach because it allows (i) to have a more complete representation of the concepts and (ii) to hypothesise different types of non monotonic reasoning processes (e.g. non

monotonic categorization). In chapter 4 the proposed modeling architecture is presented and, in chapter 5, it is evaluated on particular information retrieval tasks. The chapter 6 is dedicated to the conclusions.