

## Chapter 50

# Using a Dialogue Manager to Improve Semantic Web Search

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### ABSTRACT

*Question Answering systems that resort to the Semantic Web as a knowledge base can go well beyond the usual matching words in documents and, preferably, find a precise answer, without requiring user help to interpret the documents returned. In this paper, the authors introduce a Dialogue Manager that, through the analysis of the question and the type of expected answer, provides accurate answers to the questions posed in Natural Language. The Dialogue Manager not only represents the semantics of the questions, but also represents the structure of the discourse, including the user intentions and the questions context, adding the ability to deal with multiple answers and providing justified answers. The authors' system performance is evaluated by comparing with similar question answering systems. Although the test suite is slight dimension, the results obtained are very promising.*

### INTRODUCTION

The Semantic Web (SW), presented by Tim Berners-Lee (2001), has been recognized as the next step in the evolution of the World Wide Web. The inclusion of semantic contents on web pages leads allows machines to process such information and enables users to find, share and combine this information more easily.

Question Answering (QA) systems for Natural Language (NL) on the SW besides establishing the correspondence between words in documents they must also find a precise answer, without users help to interpret the documents returned - they use of knowledge and reasoning to interpret and to obtain the answers (Saint-Dizier & Moens, 2011).

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Consistent with the role of ontologies in structuring and organizing semantic information on the web, QA systems based on ontologies allow exploring the expressive power of ontologies and enriching the queries' interpretation. Ontologies and the SW (Horrocks, 2008) have become formalisms able to represent the conceptual domains of knowledge and promote the capabilities of QA systems based on semantics (Guo & Zhang, 2009).

In this paper, we introduce a Dialogue Manager that, by analysing the NL question (currently, only in English) and the type of expected answer, provides accurate answers. The Dialogue Manager not only represents the semantics of the questions, but also the structure of the discourse that includes the intentions of the user and the questions context, allowing this way to deal with multiple answers and to justify those answers. The Dialogue Manager makes use of a controlled dialogue with the user for clarifying ambiguous situations. The Dialogue Manager resorts to ontologies, OWL2 descriptions and other web resources such as DBpedia (Auer, Bizer, Kobilarov, & Lehmann, 2007) and WordNet (Fellbaum, 1998). Ontologies are used to define, structure and fit the semantic information of the question and its terms, according to search domain, allowing to associate and contextualize terms, improving the question interpretation. Our goal is to provide a tool that is independent of prior knowledge of semantic resources by the user and answer directly and accurately to questions posed in NL.

The remaining paper is organized as follows. First, we present some related work, highlighting the similarities and differences with our proposal. Then, we introduce the proposed Dialogue Manager, highlighting its capabilities. Afterwards, we present a preliminary evaluation which boils down to an experimental set of tests done to the system. Finally, we present our conclusions and elaborate about future work.

## **RELATED WORK**

Cooperative QA systems are automatic systems of question and answer that automatically collaborate with the users, in order to obtain the information and clarification needed to provide the correct answer. These systems provide the user with additional information, intermediate answers, qualified answers and/or alternative questions. An approach for processing cooperatives answers over databases is presented in (Minker, 1998). In (McGuinness, 2004) the author presents a set of techniques that promote the enhancement, its potential and impact on QA systems. Farah Benamara presents several works in this area: in (Benamara, 2004b), presents a logic-based model for accurate generation of intentional answers using a Cooperative QA system; in (Benamara, 2004a), presents a proposal for construction of a Logic-Based QA system, WEBCOOP, that integrates knowledge representation and advanced strategies of reasoning to generate cooperative answers to web queries. More recently, in (Bakhtyar, Dang, Inoue, & Wiese, 2014), the authors present an implementation of conceptual inductive learning operators in a prototype system for cooperative query answering, which can also be used as a usual concept learning mechanism for concepts described in first-order predicate logic.

The system START (Katz, Lin, & Felshin, 2002b; Katz, Borchardt, Felshin, Shen, & Zaccak, 2007) started in 1993 and evolved throughout the years. START is a NLQA system that provides users with appropriate information segments, after parsing the questions, and matches the queries created from the parses trees against its knowledge base. START reformulates user questions into Omnibase (Katz, et al., 2002a) queries, establishing the link between NL and structured databases.

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