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Query Answering over Contextualized RDF/OWL Knowledge with Forall-Existential Bridge Rules: Attaining Decidability Using Acyclicity

Abstract

The recent outburst of context-dependent knowledge on the Semantic Web (SW) has led to the realization of the importance of the quads in the SW community. Quads, which extend a standard RDF triple, by adding a new parameter of the 'context' of an RDF triple, thus informs a reasoner to distinguish between the knowledge in various contexts. Although this distinction separates the triples in an RDF graph into various contexts, and allows the reasoning to be decoupled across various contexts, bridge rules need to be provided for inter-operating the knowledge across these contexts. We call a set of quads together with the bridge rules, a quad-system. In this paper, we discuss the problem of query answering over quad-systems with expressive forall-existential bridge rules. It turns out the query answering over quad-systems is undecidable, in general. We derive a decidable class of quad-systems, namely *context-acyclic* quad-systems, for which query answering can be done using forward chaining. Tight bounds for data and combined complexity of query entailment has been established for the derived class.

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Query Answering over Contextualized RDF/OWL Knowledge with Forall-Existential Bridge Rules: Attaining Decidability Using Acyclicity

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Abstract. The recent outburst of context-dependent knowledge on the Semantic Web (SW) has led to the realization of the importance of the quads in the SW community. Quads, which extend a standard RDF triple, by adding a new parameter of the 'context' of an RDF triple, thus informs a reasoner to distinguish between the knowledge in various contexts. Although this distinction separates the triples in an RDF graph into various contexts, and allows the reasoning to be decoupled across various contexts, bridge rules need to be provided for inter-operating the knowledge across these contexts. We call a set of quads together with the bridge rules, a quad-system. In this paper, we discuss the problem of query answering over quad-systems with expressive forall-existential bridge rules. It turns out the query answering over quad-systems is undecidable, in general. We derive a decidable class of quad-systems, namely *context-acyclic* quad-systems, for which query answering can be done using forward chaining. Tight bounds for data and combined complexity of query entailment has been established for the derived class.

Keywords: Contextualized RDF/OWL knowledge, Contextualized Query Answering, Quads, Forall-Existential Rules, Semantic Web, Knowledge Representation.

1 Introduction

One of the major recent changes in the SW community is the transformation from a *triple* to a *quad* as its primary knowledge carrier. As a consequence, more and more triple stores are becoming *quad* stores. Some of the popular quad-stores are 4store[1], Openlink Virtuoso[2], and some of the current popular triple stores like Sesame[3] internally keep track of the context by storing arrays of four names (c, s, p, o) (further denoted as $c : (s, p, o)$), where c is an identifier that stands for the context of the triple (s, p, o). Some of the recent initiatives in this direction have also extended existing formats like N-Triples to N-Quads. The latest Billion triples challenge datasets (BTC 2012) have all been released in the N-Quads format.

[1] http://4store.org
[2] http://virtuoso.openlinksw.com/rdf-quad-store/
[3] http://www.openrdf.org/

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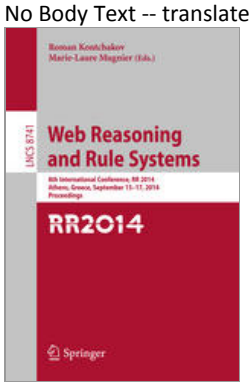

Chapter Metrics

Citations

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