Hybrid Reasoning with Forest Logic Programs*

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Abstract. Open Answer Set Programming (OASP) is an attractive framework for integrating ontologies and rules. Although several decidable fragments of OASP have been identified, few reasoning procedures exist. In this paper, we provide a sound, complete, and terminating algorithm for satisfiability checking w.r.t. forest logic programs, a fragment where rules have a tree shape and allow for inequality atoms and constants. We further introduce f-hybrid knowledge bases, a hybrid framework where $\mathcal{SHOQ}$ knowledge bases and forest logic programs co-exist, and we show that reasoning with such knowledge bases can be reduced to reasoning with forest logic programs only. We note that f-hybrid knowledge bases do not require the usual (weakly) DL-safety of the rule component, providing thus a genuine alternative approach to hybrid reasoning.

1 Introduction

Integrating Description Logics (DLs) with rules for the Semantic Web has received considerable attention with approaches such as *Description Logic Programs* [7], *DL-safe rules* [18], $\mathcal{DL}$+*log* [20], *dl-programs* [3], *Description Logic Rules* [14], and Open Answer Set Programming (OASP) [12]. OASP combines attractive features from the DL and the Logic Programming (LP) world: an open domain semantics from the DL side allows for stating generic knowledge, without the need to mention actual constants, and a rule-based syntax from the LP side supports nonmonotonic reasoning via *negation as failure*.

Several decidable fragments of OASP were identified by syntactically restricting the shape of logic programs, while carefully safe-guarding enough expressiveness for integrating rule- and ontology-based knowledge. Notable fragments are *Conceptual Logic Programs (CoLPs)* [9] that are able to simulate reasoning in the DL $\mathcal{SHIQ}$ and *Forest Logic Programs (FoLPs)* [10] that are expressive enough to deal with $\mathcal{SHOQ}$. Note that both $\mathcal{SHOQ}$ and $\mathcal{SHIQ}$ are close family of $\mathcal{SHOIN}(\mathbf{D})$, the DL underlying the Web Ontology language OWL-DL [23]. A serious shortcoming of these decidable fragments is their lack of effective reasoning procedures. In [5], we took a first step in mending this by providing a

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