ASP for Minimal Entailment in a Rational Extension of $\mathcal{SROEL}$ (Extended Abstract)*

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This work exploits Answer Set Programming (ASP) for reasoning in a rational extension of $\mathcal{SROEL}(\sqcap, \times)$ [5], the low complexity description logic which underlies the OWL EL ontology language. It is based on a preferential approach to defeasible reasoning in description logics (DLs) [2, 3], which has been developed along the lines of the preferential semantics introduced by Kraus, Lehmann and Magidor [4, 6].

Following [3], we have considered an extension of $\mathcal{SROEL}(\sqcap, \times)$ with a typicality operator $\mathbf{T}$, which allows the definition of defeasible inclusions $\mathbf{T}(C) \sqsubseteq D$ ("the typical C elements are Ds"). In this extension, $\mathcal{SROEL}(\sqcap, \times)^{\mathbf{R}}\mathbf{T}$, instance checking under rational entailment has polynomial complexity. We observe that the notion of minimal canonical model introduced in [3] as a semantic characterization of the rational closure for $\mathcal{ALC}$ is not adequate to capture many knowledge bases (KBs) in $\mathcal{SROEL}(\sqcap, \times)^{\mathbf{R}}\mathbf{T}$. In particular, when nominals or the universal role are used, a KB may have no canonical model at all. The $\mathbf{T}$-minimal model semantics is introduced as an alternative to the minimal canonical model semantics. It weakens the canonical model condition in [3], by requiring that only for the concepts C such that $\mathbf{T}(C)$ occurs in the KB (or in the query), an instance of C has to exist in the model, when C is satisfiable wrt the KB. For the KBs having minimal canonical models with the same rank assignment to concepts as in the rational closure, we show that $\mathbf{T}$-minimal models capture the same defeasible inferences as minimal canonical models.

We prove that, for arbitrary $\mathcal{SROEL}(\sqcap, \times)^{\mathbf{R}}\mathbf{T}$ KBs, instance checking under $\mathbf{T}$-minimal entailment is Π_2^P-complete. Based on a Small Model result, where models correspond to answer sets of a suitable ASP encoding, we exploit Answer Set Preferences and the *asprin* framework [1] for reasoning under $\mathbf{T}$-minimal entailment.

References

1. G. Brewka, J. P. Delgrande, J. Romero, and T. Schaub. asprin: Customizing answer set preferences without a headache. In *Proc. AAAI 2015*, pages 1467–1474, 2015.
2. K. Britz, J. Heidema, and T. Meyer. Semantic preferential subsumption. In G. Brewka and J. Lang, editors, *Proc. KR 2008*, pages 476–484, 2008.
3. L. Giordano, V. Gliozzi, N. Olivetti, and G. L. Pozzato. Semantic characterization of rational closure: From propositional logic to description logics. *Artif. Intell.*, 226:1–33, 2015.
4. S. Kraus, D. Lehmann, and M. Magidor. Nonmonotonic reasoning, preferential models and cumulative logics. *Artif. Intell.*, 44(1-2):167–207, 1990.
5. Krötzsch, M.: Efficient Inferencing for OWL EL, *Proc. JELIA 2010*, 2010.
6. D. Lehmann and M. Magidor. What does a conditional knowledge base entail? *Artificial Intelligence*, 55(1):1–60, 1992.

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