Computing Subsumption Justifications of Terminologies – Extended Abstract*

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In this paper, we introduce the notion of *subsumption justification* to capture the subsumption knowledge about a term with respect to all primitive and complex concepts built from terms in a given vocabulary Σ. It extends the notion of classical justification that is a minimal set of axioms needed to preserve the entailment of a particular subsumption $C \sqsubseteq D$. Then we apply this notion to compute *minimal modules* [1], i.e., minimal subsets of an ontology that maintain all subsumptions that are formulated in Σ and entailed by the original ontology.

We provide two dedicated simulation notions to characterise the set of subsumers and the set of subsumees formulated over a target signature Σ for a given signature term X w.r.t. an $\mathcal{ELH}$-terminology $\mathcal{T}$. The simulation notions originate from the proof-theoretic approach from [4] developed for the problem of deciding the logical difference between ontologies [2]. Based on the simulation notions, we devise recursive algorithms for extracting the minimal subsets of axioms that preserve the entailments of all Σ-subsumers and all Σ-subsumees of X w.r.t. $\mathcal{T}$. We show that the respective subsumer and subsumee justifications obtained in this way can then be combined to yield subsumption justifications. Meanwhile, computing minimal modules equals minimising the union of subsumption justifications of all concept names in Σ with respect to the ontology.

We evaluate a prototype implementation for computing subsumption justifications and minimal modules over large biomedical terminologies. The results are encouraging as they show that computing subsumption justifications is indeed feasible in several important practical cases. In particular, minimal modules can be computed faster using subsumption justifications than by using the black-box approach from [1]. The latter is a state-of-the-art approach based on Reiter's Hitting set search algorithm [5] deploying the logical difference tool CEX [3] for determining whether or not axioms belong to a minimal module.

References

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