Extending Defeasible Reasoning Beyond Rational Closure

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Abstract. The KLM framework is a well known extension of classical logic for incorporating defeasible reasoning. Central to the KLM framework is rational closure, recognized as the most conservative approach to defeasible reasoning. Rational closure operates through two complementary paradigms: model-theoretic and formula-theoretic. This paper concentrates on the model-theoretic dimension, known as minimal ranked entailment. Unfortunately, the practical implementation of minimal ranked entailment remains largely impractical due to high computational and storage demands. To address this, we present reduced minimal ranked entailment, an optimization that employs reduced ordered binary decision diagrams to eliminate redundant information, thereby enhancing computational efficiency and reducing memory requirements. We further demonstrate that this optimized approach significantly facilitates the practical application and development of model-theoretic extensions of rational closure. This is illustrated through our own Bayesian refinement of minimal ranked entailment, which conceptualizes defeasible entailment as a form of conditional probability.

Keywords: knowledge representation and reasoning · defeasible reasoning · rational closure · bayesian reasoning