An Argumentative Approach for Handling Inconsistency in Prioritized Datalog$^{\pm}$ Ontologies

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Abstract. This is an extended abstract describing the paper "An Argumentative Approach for Handling Inconsistency in Prioritized Datalog$^{\pm}$ Ontologies" published at AI Communications 2022 [9].

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1 Introduction

Prioritized Datalog$^{\pm}$ is a well-studied formalism for modelling ontological knowledge and data, and has a success story in many applications in the (Semantic) Web and in other domains. Since the information content on the Web is both inherently context-dependent and frequently updated, the occurrence of a logical inconsistency is often inevitable. This phenomenon has led the research community to develop various types of inconsistency-tolerant semantics over the last few decades [6, 10, 5, 11, 12]. Although the study of query answering under inconsistency-tolerant semantics is well-understood, the problem of explaining query answering under such semantics took considerably less attention, especially in the scenario where the facts are prioritized (see e.g., [2, 7, 8, 3, 13, 4] and [1] for an overview). However, in the existing approaches, the explanations aspect regarding the conflicting information or the user perspective (e.g., explaining why some answers are (not) accepted under repair semantics) are rather left limited.

To the best of our knowledge, the problem of explaining inconsistency-tolerant query answering in prioritized Datalog$^{\pm}$ KBs has not been yet investigated through the lens of abstract argumentation framework. In this paper, we aim to fill this gap. More specifically, we use Dung's abstract argumentation framework to address the problem of explaining inconsistency-tolerant query answering in Datalog$^{\pm}$ KB where facts are prioritized, or preordered. We clarify the relationship between preferred repair semantics and various notions of extensions for argumentation frameworks. The strength of such argumentation-based approach is the explainability; users can more easily understand why different points of views

are conflicting and why the query answer is entailed (or not) under different semantics. To this end we introduce the formal notion of a dialogical explanation, and show how it can be used to both explain showing why query results hold and not hold according to the known semantics in inconsistent Datalog$^{\pm}$ knowledge bases.

2 Prioritized Argumentation Framework

In this work, we introduce a prioritized argumentation framework (PAF) to address the problem of explaining query answers under preferred repair semantics in prioritized *Datalog*$^{\pm}$ KBs. The main idea is that we translate prioritized KBs into argumentation frameworks. This correspondence enables us to understand explanations based on a form of the arguments and to compute preferred repairs based on the extensions of the argumentation framework. In order to construct dialogical explanations, we introduce the notion of an *argumentation tree*, which is a formal representation of the dialogue within the PAF. That way, we can explain query answer (and no-answers) by using arguments and counter-arguments by graphically representing different points of view, and why they are conflicting or not. Intuitively, it can be seen as a dialogical explanation in the form of a tree of dispute gathering arguments and counter-arguments for and against the query. The dialogical explanation does not only provides the user with the supporting arguments for a query, but also a set of dispute trees rooted in for- and against- arguments for the query. That way, user is not informed only for the accepted answers to the query but also other potentially relevant arguments.

Next, we present one of the main results in the paper, namely the theorem shows that the equivalence between the set of repairs and the set of preferred (resp. stable) extension, and in turn implies the equivalence results for query answering in KB.

Theorem 1. *Given a prioritized Datalog*$^{\pm}$ *KB* $\mathcal{K}$*, and the corresponding PAF* $\mathcal{A}^{\succ}$*, a query* Q*, and* S *being either the stable or the preferred semantics* ($S \in \{stb, prf\}$)*. Then,* $\mathcal{K} \underset{AR_{\geq}}{\models} Q$ *iff* $\mathcal{K} \models^{\succ}_{sc,stb} Q$ *iff* $\mathcal{K} \models^{\succ}_{sc,prf} Q$*.* $\mathcal{K} \underset{BAR_{\geq}}{\models} Q$ *iff* $\mathcal{K} \models^{\succ}_{cr,stb} Q$ *iff* $\mathcal{K} \models^{\succ}_{cr,prf} Q$*.*

3 Conclusion

In this paper, we have investigated the use of argumentation to handle inconsistency in Datalog$^{\pm}$ KBs where facts are ordered representing their reliability, with the aim to improve the explanation techniques under preferred semantics. Based on argumentation-based explanations, the user is provided with a broader explanation regarding the querying process in terms of conflicting information. To the best of our knowledge, this is the first work which studies explanations for query answering in Datalog$^{\pm}$ KB through the lens of argumentation framework. Our work paves the way for the application of certain algorithms to computer-preferred repairs in prioritized Datalog$^{\pm}$ KBs.

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