Benchmark on Logic-Based Argumentation Framework with $Datalog^{\pm}$

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Abstract

In this paper, we propose a practically-oriented benchmark on logic-based argumentation framework instantiated from inconsistent knowledge bases expressed using $Datalog^{\pm}$, a language widely used in Semantic Web. We outline how the set of instances was generated and provide several structural properties on the argumentation graphs.

1 Introduction

We place ourselves in the setting of logic-based argumentation where arguments and attacks in an abstract argumentation graphs [1] are built using the data from inconsistent knowledge bases. The notion of logic-based argumentation was thoroughly studied in the literature with several frameworks proposed such as: assumption-based argumentation frameworks (ABA) [2], DeLP [3], deductive argumentation [4] or ASPIC/ASPIC+ [5, 6].

In this paper, we propose a benchmark of 134 argumentation graphs (108 small instances and 26 large) built upon knowledge bases expressed in the $Datalog^{\pm}$ language [7]. This language is a formalism that extends plain Datalog with existential quantifiers, equalities, and falsum in rule heads and is widely used for its practical applicability and generality with respect to other Semantic Web languages [7, 8]. As for the choice of the argumentation framework, none of the aforementioned frameworks are directly and straightforwardly applicable in the context of the $Datalog^{\pm}$ language. In the case of ASPIC+, we cannot instantiate it because the definition of the contrariness relation is not general enough to account for $Datalog^{\pm}$ negative constraints. In the case of ABA, it needs a contrariness function that returns a single contrary sentence for each formula of the language which is a problem in the case where a fact appears in multiple conflicts since the language does not allow for the disjunction. In the case of DELP, we cannot instantiate it since the original work only consider ground rules which cannot encompass existential rules. Last not but least, the approach of [9] cannot be used as it is defined for classical propositional or full first order logic [4]. Thus, we use the specifically crafted instantiation for $Datalog^{\pm}$ [10, 11] where arguments are based on a hypothesis and a conclusion (á la Besnard and Hunter). This specific instantiation has been proven to respect rationality desiderata [12, 13] and to output a set of extensions equivalent to the set of repairs [14, 15] of the knowledge base (i.e. the maximum consistent sets of facts with respect to inclusion).

2 Benchmark Generation

We used the set of knowledge bases extracted from the study of Yun et al. [10, 16]. These inconsistent knowledge bases are composed of two main sets:

- A set of A composed of 108 knowledge bases. This dataset is further split into three smaller set of knowledge bases:
  - A set of A_1 of 31 knowledge bases without rules, two to seven facts, and one to three negative constraints.

  - A set A_2 of 51 knowledge bases generated by fixing the size of the set of facts and successively adding negative constraints until saturation.
  - A set A_3 of 26 knowledge bases with only ternary negative constraints, three to four facts and one to three rules.

- A set B of 26 knowledge bases with eight facts, six rules and one or two negative constraints. This set contains more free-facts than the knowledge bases in set A.

Using the generator of Yun et al. [17], we obtained two sets of argumentation graphs: (1) A set of 108 small argumentation graphs (from the sets of knowledge bases A_1, A_2 and A_3) with a median number of arguments and attacks of 26 and 296 respectively. (2) A set of 26 large argumentation graphs (from the set of knowledge base B) with a median number of arguments and attacks of 5967 and 11,542,272 respectively.

All argumentation graphs are available online in the ASPARTIX format at: https://gite.lirmm.fr/yun/iccma-2019.

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