Inline Evaluation of Hybrid Knowledge Bases

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Motivation
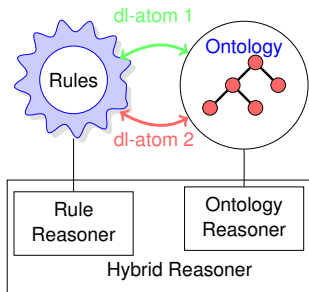
Hybrid Knowledge Bases

- ▶ combining KBs in different formalisms
- ▶ Ontologies + Rules
- ▶ Ontology $Father \equiv Man \sqcap \exists hasChild.Human$
- ▶ Rule $fly(X) \leftarrow bird(X), not\ penguin(X).$

Combination Approaches

- ▶ Loose Coupling Approaches: DL-Programs, F-Logic# KBs
- ▶ Tight Coupling Approaches: SWRL, r-Hybrid KBs, ELP
- ▶ Embedding Approaches: MKNF KBs, Open ASP, g-Hybrid KBs

Aim of this work
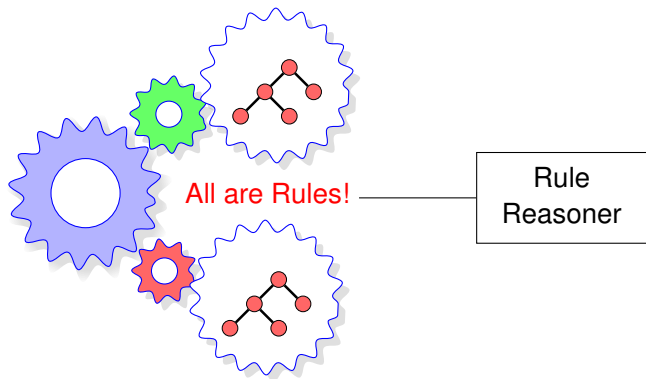improve the efficiency of reasoning over DL-Programs

DL-Program $KB = (\Sigma, P)$

$\Sigma = \{\ C \sqsubseteq D\ \}$

$P = \{\ p(a).\quad s(a).\quad s(b).$

$\qquad q \leftarrow DL[C \uplus s; D](a),$

$\qquad not\ DL[C \uplus p; D](b).\ \}$

dl-atom 1

Ontology

Rules

dl-atom 2

Rule Reasoner

Ontology Reasoner

Hybrid Reasoner

Issues

- overhead of multi calls to external reasoners
- costly exchange of the entailments

Inline Evaluation

All are Rules! — Rule Reasoner

Effects

- hybrid KB $\Rightarrow$ single rule formalism
- only rule reasoner is needed — the ontology part is "inlined"
- improved efficiency

Contributions & Future Work

Contributions

- ▶ Notion of datalog-rewritable DLs
- ▶ A general framework for inline evaluation of DL-Programs
- ▶ A Datalog rewritable DL: $\mathcal{LDL}^+$
- ▶ A prototype implementation: DReW
- ▶ Promising evaluation results

Future Work

- ▶ Inline Evaluation of DL-Programs over OWL 2 Fragments
- ▶ ... over Horn DLs
- ▶ Optimization of rewriting
- ▶ More benchmark tests
- ▶ Apply this idea to other hybrid KBs

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Go raibh mile maith agaibh!
Thanks!