A reasoner for generalized Bayesian dl-programs

Livia Predoiu

Institute of Computer Science, University of Mannheim,
A5,6, 68159 Mannheim, Germany
livia@informatik.uni-mannheim.de

Abstract. In this paper, we describe an ongoing reasoner implementation for reasoning with generalized Bayesian dl-programs and thus for dealing with deterministic ontologies and logic programs and probabilistic (mapping) rules in an integrated framework.

1 Introduction

The Semantic Web has been envisioned to enable software tools or web services, respectively, to process information provided on the Web automatically. For this purpose, the information represented in different ontologies needs to be integrated. More specifically, mappings between the ontologies need to be determined. In our framework, mappings are probabilistic rules. A more detailled discussion on the advantages of using rules for mappings and modelling the uncertainty of mappings with bayesian probabilities can be found in [1–3]). We are using generalized Bayesian dl-programs [3] for representing the deterministic ontologies and the uncertain mapping rules in an integrated logical framework.

2 Generalized Bayesian dl-programs

Generalized Bayesian dl-programs are a slightly extended more general and more formal representation of Bayesian Description Logic Programs as published in [1]. A general Bayesian dl-program is a knowledge base $KB = (L, P, \mu, Comb)$ where L is the knowledge base corresponding to the union of the ontologies to be integrated. L is represented in the description logic programming (DLP) fragment [4]. P is a logic program in Datalog without negation, μ associates with each rule r of $ground(P)$[1] and every truth valuation v of the body atoms of r a probability function $\mu(r, v)$ over all truth valuations of the head atom of r. *Comb* is a *combining rule*, which defines how rules $r \in ground(P)$ with the same head atom can be combined to obtain a single rule. Semantically, a generalized Bayesian dl-program corresponds to a Bayesian Network. Examples and more details can be found in [3].

[1] As usual in the area of logic programming, $ground(P)$ is the set of all ground instances of rules in the logic program P

3 Architecture of the Reasoner

Below, in figure 1, the architecture of our reasoner is depicted. Without loss of generality, two OWL ontologies in the DLP fragment and a user query are the input to our reasoner. We use *dlpConvert* [5] for translating the ontologies into F-Logic for the Ontobroker[2] which is a F-logic programming reasoner. Furthermore, we are using the probabilistic matchers of *oMap* [6] for generating probabilistic level 0 mappings. We translate those mappings and the user query also into F-Logic and feed the translation into a meta reasoner based on the Ontobroker. The user query needs to be translated and fed into the Ontobroker as well before the reasoning process starts. The meta reasoner deduces all atoms needed for the creation of the corresponding Bayesian Network. From the result of the meta reasoner, we can create a Bayesian network which can be dealt with with SamIam[3]. The colored nodes in the architecture below represent knowledge bases or declarative knowledge and the uncolored ones represent tools.

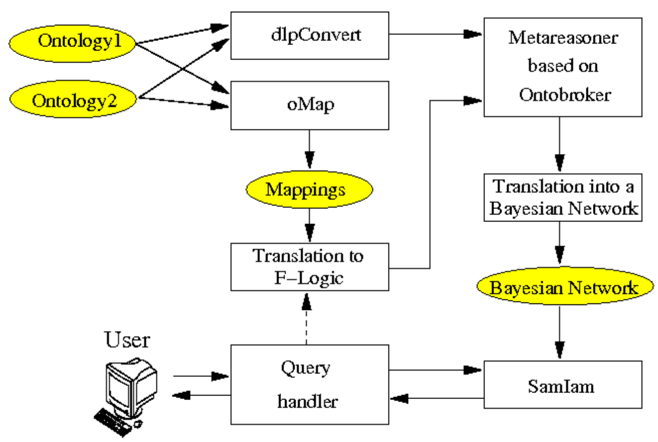

Fig. 1. Architecture of the reasoner

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[2] c.f. http://www.ontoprise.de/
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