An Extended Value-Based Argumentation Framework for Ontology Mapping with Confidence Degrees

Cássia Trojahn¹, Paulo Quaresma¹, and Renata Vieira²

¹ Departamento de Informática, Universidade de Évora, Portugal
² Pós-Graduação em Computação Aplicada, Universidade do Vale do Rio dos Sinos, Brazil
cassia@di.uevora.pt, pq@di.uevora.pt, renatav@unisinos.br

Abstract. Heuristics to combine different approaches for ontology mapping have been proposed in the literature. This paper proposes to use abstract argumentation frameworks to combine such approaches. We extend the Value-based Argumentation Framework (VAF)[2], in order to represent arguments with confidence degrees. Our agents apply individual mapping algorithms and cooperate in order to exchange their local results (arguments). Next, based on their preferences and confidence of the arguments, the agents compute their preferred mapping sets. The arguments in such preferred sets are viewed as the set of globally acceptable arguments.

1 Introduction

Ontology mapping is the process of linking corresponding terms from different ontologies. The mapping result can be used for ontology merging, agent communication, query answering, or for navigation on the Semantic Web.

Well-known approaches to the problem can be grouped into lexical, semantic, and structural ones, as terms may be mapped by a measure of lexical similarity, or they can be evaluated semantically, usually on the basis of semantic oriented linguistic resources, or considering the term positions in the ontology hierarchy. It is assumed that the approaches are complementary to each other and combining different ones reflect better solutions when compared to the solutions of the individual approaches. Heuristics to combine such approaches have been proposed [18] [14] [9] [15].

This paper proposes to use abstract argumentation frameworks [6] to combine approaches for ontology mapping. We extend a state of art argumentation framework, namely Value-based Argumentation Framework (VAF)[2], in order to represent arguments with confidence degrees. The VAF allows to determine which arguments are acceptable, with respect to the different audiences represented by different agents. We then associate to each argument a confidence degree, representing how confident an agent is in the similarity of two ontology terms.
Our agents apply different mapping approaches and cooperate in order to exchange their local results (arguments). Next, based on their preferences and confidence of the arguments, the agents compute their preferred mapping sets. The arguments in such preferred sets are viewed as the set of globally acceptable arguments. Our approach is able to give a formal motivation for the composite mapping approaches.

This paper is structured as follows. Section 2 comments on argumentation framework. Section 3 introduces the ontology mapping approaches. Section 4 presents our agent argumentation model. Section 5 presents a walk through example. Section 6 comments on related work. Finally, section 7 presents the final remarks and the future work.

2 Argumentation Framework

Our argumentation model is based on the Value-based Argumentation Frameworks (VAF)\[2\], a development of the classical argument system of Dung \[6\]. First, we present the Dung’s framework, upon which the VAF rely. Next, we present the VAF and our extended framework.

2.1 Classical Argumentation Framework

Dung \[6\] defines an argumentation framework as follows.

Definition 2.1.1. An Argumentation Framework is a pair $AF = (AR, attacks)$, where $AR$ is a set of arguments and $attacks$ is a binary relation on $AR$, i.e., $attacks \subseteq AR \times AR$. An attack$(A,B)$ means that the argument $A$ attacks the argument $B$. A set of arguments $S$ attacks an argument $B$ if $B$ is attacked by an argument in $S$.

The key question about the framework is whether a given argument $A$, $A \in AR$, should be accepted. One reasonable view is that an argument should be accepted only if every attack on it is rebutted by an accepted argument \[6\]. This notion produces the following definitions:

Definition 2.1.2. An argument $A \in AR$ is acceptable with respect to set arguments $S(acceptable(A,S))$, if $(\forall x)(x \in AR) \not\in (attacks(x,A)) 
\rightarrow (\exists y)(y \in S) \not\in attacks(y,x)$

Definition 2.1.3. A set $S$ of arguments is conflict-free if $\neg (\exists x)(\exists y)((x \in S) \not\in (y \in S) \not\in attacks(x,y))$

Definition 2.1.4. A conflict-free set of arguments $S$ is admissible if $(\forall x)(x \in S) 
\rightarrow acceptable(x,S)$

Definition 2.1.5. A set of arguments $S$ is a preferred extension if it is a maximal (with respect to inclusion set) admissible set of $AR$. 