Abstract

In this thesis dissertation we address the problem of semantic heterogeneity in the context of agent communication. We argue that current solutions based on ontologies and ontology matching do not capture completely the complexity of the distributed, dynamic and open-ended nature of multiagent systems, and that they usually do not reckon with the interaction-oriented purpose of communication. Our central thesis is that semantic alignment is also relative to the particular interaction where agents are engaged in, and that in such cases the interaction should be taken into account and brought into the alignment mechanism.

We firstly present a formal model for a semantic alignment procedure that incrementally aligns differing conceptualisations of two or more agents relative to their respective perceptions of the environment or domain where they are acting in. It hence makes the situation in which the alignment occurs explicit in the model. We call this approach Situated Semantic Alignment (or SSA), and we fall back on channel theory, Barwise and Seligman's theory of information flow to carry out the formalisation.

The understanding that semantic alignment is often interaction-dependent is specifically studied in Interaction-Situated Semantic Alignment (I-SSA), which can be seen as a particularisation of the model mentioned above. We also provide a formal foundation for I-SSA, but this time based on a mathematical construct inspired from category theory that we call communication product. In addition, we describe an alignment protocol and a matching mechanism that agents can follow in order to benefit in practice from this approach.

The I-SSA technique is implemented in SICStus Prolog and its viability is proven by means of an exhaustive abstract experimentation and a thorough statistical study through combinations of analyses of variance and Tukey tests. Furthermore, we present a case study about travel reservation that gives us the possibility to put I-SSA within the context of current state-of-the-art techniques. Although a deeper examination is required, this example shows that I-SSA is better suited for semantic alignment when interaction is specially relevant. Also it helps us to highlight the differences between this approach and more standard approaches for semantic alignment.