Accounting for Assertional Information

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Description logics are specialized languages for the representation and structuring of knowledge, specially tailored to obtain efficient decision methods for different "reasoning tasks." Nowadays, description logics are generally considered to be variations of first-order logic—either restrictions or restrictions plus some added operators. These variations are mainly motivated by the undecidability of the inference problem for first-order logic, but also they are rooted in a desire to preserve the structure of the knowledge being represented, and to understand a finer grained notion of "reasoning." In most description languages the knowledge about a given situation is characterized as either

- *terminological information*: definitions of the basic and derived notions and of how they are interrelated. This information is "generic" or "global," been true in every model of the situation and of every individual in the situation. Or
- *assertional information*: which record "specific" or "local" information, been true of certain particular individuals in the situation.

All known information about a given situation is then modeled as a pair $\langle T, A\rangle$, where T is a set of formulas concerning terminological information (the T-Box) and A is a set of formulas concerning assertional information (the A-Box).

Hybrid languages on the other hand, are extensions of modal languages that use special atomic formulas (called *nominals*) to name states. The first hybrid languages were introduced by Prior [2] in his investigations on tense logic. Basically, the simplest hybrid language is obtained by extending the set of atomic symbols of the modal language with a new sort of nominals. Furthermore, we require that nominals are true at exactly one state in any model. In this way, a nominal "names" a state by being true there and nowhere else.

A wide range of hybrid languages have been studied, including different kinds of sort (paths, intervals), nominal variables which can be bound in different ways, etc., but we will restrict ourselves to very simple hybrid languages like the one described above.

In this talk we explore the connection between Hybrid and Description Languages. It is well known that the description language $\mathcal{ALC}$ (see [4]) is a notational variant of multi-modal logic (see [3]). But this relation only holds at the level of right hand sides of definitions in T-boxes. A full account of definitions is missing and, crucially, in many applications it is often important to perform A-Box (or assertional) reasoning as well — that is, to reason about how concepts apply to particular individuals.

Hybrid Logics help us fill this gap. Building on work done in [1], we will define the appropriate hybrid logics to account for full terminological axioms and assertional information, study notions of bisimulations to characterize the expressive power of some of the most frequent description languages and transfer complexity results.

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References

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