

Approximate Unification in the Description Logic \mathcal{FL}_0

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Unification in DLs has been introduced as a novel inference service that can be used to detect redundancies in ontologies, by finding out whether two concept descriptions may potentially stand for the same concept. Intuitively, one assumes for this that certain concept names occurring in the concept descriptions stand for concepts that are not yet fully defined, and unification checks whether it is possible to supply definitions for them that make the two concept descriptions equivalent. Unification of concept descriptions was first introduced for the DL \mathcal{FL}_0 in [1], where it was shown to be ExpTime-complete. The ExpTime upper bound was proved by a reduction to solving certain language equations, which in turn were solved using tree automata. In order to increase the recall of this method for finding redundancies, we introduce and investigate the notion of approximate unification. In contrast to exact unification, approximate unification is not required to make the concept descriptions equivalent, but only “similar,” where similarity is formalized using concept distances, i.e., functions that assign non-negative real numbers to pairs of concept descriptions. We show that the approach of [1] for exact unification can be extended to approximate unification. In fact, by linking concept distances with language distances, we can reduce approximate unification in \mathcal{FL}_0 to approximately solving language equations. In order to reduce this problem to a problem for tree automata, we do not employ the original construction of [1], but the more sophisticated one of [2]. We provide procedures for solving the problem w.r.t. two particular language distances. The problem for the first distance translates to a reachability problem in the tree automaton constructed from the language equation. For the second distance, we derive from the tree automaton a system of equations over the real numbers, which can be solved using Linear Programming techniques. For both distances, the complexity of approximate unification is the same as for exact unification.

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References

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