

Ackermann-Based Forgetting for Expressive Description Logics (Abstract of Invited Talk)

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Forgetting refers to a non-standard reasoning problem concerned with eliminating terms (i.e., concept and role names) from description logic-based ontologies whilst preserving sufficiently many logical consequences up to the remaining terms. On one hand, it turns out to be a very useful technique in ontology-based information processing, as it allows users to focus on specific parts of ontologies in order to create restricted views or decompositions for in-depth analysis or sharing with other users; forgetting is also useful for information hiding, explanation generation, logical difference computation, and ontology debugging and repair. On the other hand, forgetting is an inherently difficult problem – it is much harder than standard reasoning (satisfiability testing) – and very few logics are known to be complete for forgetting, there has been insufficient research on the topic and very few forgetting tools are available at present.

This work investigates practical methods for semantic forgetting in expressive description logics not considered so far. In particular, we present a practical method for forgetting concept and role names from ontologies expressible in the description logic $\mathcal{ALCOIH}(\nabla, \sqcap)$, i.e., the basic \mathcal{ALC} extended with nominals, inverse roles, role inclusions, the universal role and role conjunctions, and a practical method for forgetting role names from ontologies expressible in the description logic $\mathcal{ALCOQH}(\nabla, \sqcap)$, i.e., $\mathcal{ALCOH}(\nabla, \sqcap)$ additionally extended with qualified number restrictions. Being based on non-trivial generalisations of a monotonicity property called Ackermann’s Lemma, these methods are the first and the only approaches so far that allow for concept and role forgetting in description logics with nominals and that allow role forgetting in description logics with qualified number restrictions. The methods are goal-oriented and incremental. They always terminate and are sound in the sense that the forgetting solution is equivalent to the original ontology up to the interpretations of the forgotten names, possibly with the interpretations of the newly-introduced nominals or concept definers during the forgetting process.

The methods are implemented in Java using the OWL API and the prototypical implementation, namely, FAME, was evaluated on several corpora of publicly accessible biomedical ontologies (in order to verify the practicality of the methods). Despite our methods not being complete, the evaluation results showed that FAME was successful in most test cases (i.e., forgot all concept and role names specified in the forgetting signatures) within a very short period of time.

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