TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science Institute of Theoretical Computer Science, Chair of Automata Theory

Description Logics

Exercise Sheet 12

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Exercise 1

We call the composition of features feature paths. Let $f_1, \dots f_m$ and $g_1 \dots g_n$ be (not necessarily distinct) features. The concept constructor *feature path agreement* $(f_1 \circ f_2 \circ \dots f_m) \downarrow (g_1 \circ g_2 \circ \dots g_n)$ has the semantics

$$(f_1 \circ f_2 \circ \dots f_m) \downarrow (g_1 \circ g_2 \circ \dots g_n)^{\mathcal{I}} = \{d \in \Delta^{\mathcal{I}} \mid f_m^{\mathcal{I}}(\cdots f_2^{\mathcal{I}}(f_1^{\mathcal{I}}(a) = g_n^{\mathcal{I}}(\cdots g_2^{\mathcal{I}}(g_1^{\mathcal{I}}(a)\}.$$

Show that for the DL that extends $\mathcal{ALC}$with feature path agreements, satisfiability w.r.t. general TBoxes is undecidable.

Exercise 2

If $\mathcal{D}$ is a concrete domain, we use $\mathcal{ALC}(\mathcal{D})$ to denote the extension of $\mathcal{ALC}$ with the concrete domain $\mathcal{D}$. Show the following:

a) If f is an abstract feature, then $\exists f.C$ is equivalent to $\exists f.\top \sqcap \forall f.C$.

b) Let $\mathcal{D}$ be a concrete domain with only unary predicates. Let $\mathcal{ALC}(\mathcal{D})^-$ be obtained from $\mathcal{ALC}(\mathcal{D})$ by allowing only concrete features instead of feature chains inside the concrete domain restictions. Prove that for every $\mathcal{ALC}(\mathcal{D})$-concept, there is an equivalent $\mathcal{ALC}(\mathcal{D})^-$-concept.