



Logic-Based Ontology Engineering

Summer Semester 2018

Exercise Sheet 4

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Exercise 4.1 Bring your Sushi ontology (crafted since the last exercise session), show it in Protégé and explain how it can be used to answer the competency questions.

Exercise 4.2 For a tree model \mathcal{I} , we denote by $\mathcal{I}|_n$ the interpretation obtained from \mathcal{I} by restricting the domain to all elements of depth $\leq n$ in the tree.

Prove the following: If C is a concept of role depth n and $\mathcal{I}, \mathcal{I}'$ are two tree models such that $\mathcal{I}|_n = \mathcal{I}'|_n$ has root d_0 , then $d_0 \in C^{\mathcal{I}}$ iff $d_0 \in C^{\mathcal{I}'}$.

Exercise 4.3 Show the remaining cases (negated concept names and value restrictions) for the induction proof of weak completeness of the operator ρ_B (slide 68 in part 2): "For all concepts C and all $B \in \mathbf{C}$ with $B \sqcap C \not\sqsubseteq_{\mathcal{O}} \perp$, we have $\top \rightarrow_{\rho_B}^* E$ for some concept E with $B \sqcap E \equiv_{\mathcal{O}} B \sqcap C$."

Exercise 4.4 We consider the following ontology:

$$\begin{aligned} \mathcal{T} = \{ & \textit{Female} \sqsubseteq \textit{Person}, \\ & \textit{Male} \sqsubseteq \textit{Person}, \\ & \textit{Father} \sqsubseteq \textit{Male}, \\ & \textit{Male} \sqsubseteq \neg \textit{Female} \} \end{aligned} \quad \mathcal{R} = \{ \textit{dom}(\textit{hasChild} \textit{ Person}), \\ \textit{ran}(\textit{hasChild} \textit{ Person}) \}$$

$$\begin{aligned} \mathcal{A} = \{ & \textit{Female}(\textit{anna}), \textit{hasChild}(\textit{anna}, \textit{heinz}), \\ & \textit{Male}(\textit{heinz}), \\ & \textit{Male}(\textit{markus}), \textit{Father}(\textit{markus}), \textit{hasChild}(\textit{markus}, \textit{anna}), \\ & \textit{Male}(\textit{martin}), \textit{Father}(\textit{martin}), \textit{hasChild}(\textit{martin}, \textit{heinz}), \\ & \textit{Female}(\textit{michelle}), \\ & \textit{Father}(\textit{stefan}), \textit{Male}(\textit{stefan}), \textit{hasChild}(\textit{stefan}, \textit{markus}) \} \end{aligned}$$

- (a) Starting from \mathcal{T} , which concepts of maximal size 4 are generated by the refinement operator ρ_c using the ontology $\mathcal{O} = (\mathcal{A}, \mathcal{T}, \mathcal{R})$?
- (b) What are the accuracy and the score for each concept from (a)?

“DL-Learner” is a tool for concept learning. Download the Protégé plugin for DL-Learner and install it (since it is incompatible with the VOWL plugin, you may have to remove VOWL from Protégé’s plug-in folder first).

- (c) Load the ontology `father_oe.owl` (from the lecture’s web page) in Protégé.
- (d) Navigate to the concept *Father* in Protégé, and add a new equivalence axiom for it. In the dialog window, find the “DL-Learner” tab, and let it suggest definitions for *Father*.
- (e) Speculate why the accuracy scores from (d) are different to the results of (b).