Debugging of \( A\mathcal{L}C \)-Ontologies via Minimal Model Generation

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Ontology Debugging

Ontologies are the basis for semantic web and knowledge-based systems

Widely used in practice: BBC, NHS, Klappo, . . .

Ontology debugging aims to guarantee that an ontology

- is coherent
- models properly (implicit) domain knowledge
- keeps these properties over time

Relation between individuals of two models \( I = (\Delta, I) \) and \( I' = (\Delta', I') \) s.t. for any two individuals \( a \) and \( a' \), if \( a S a' \) then the following hold.

- \( V(a) \subseteq V(a') \) (where \( V(a) = \{ A \in N_C \mid a \in A^2 \} \)), and
- if \( r(a, b) \), then there exists a \( b'' \in \Delta' \) such that \( r(a', b') \) and \( b S b'' \).

A model \( I \) of an ontology \( O \) is minimal modulo subset-simulation iff for any model \( I' \) of \( O \), if \( I' \leq I \), then \( I \leq I' \).

Features of the calculus:

- lazy clausification (\((\alpha)\) rule) to reduce the number of inferences
- complement splitting (\((\beta)\) rule) to close “non-minimal” branches as soon as possible
- selection-based resolution to reduce the number of inferences and to close branches
- handling of Boolean ABoxes

The calculus is refutationally sound and complete.

The calculus is minimal model complete.

Subset-simulation test

- If the model extracted from a branch \( B \) subset-simulates a model extracted from a branch \( B' \), then close \( B \).

The test guarantees minimal model soundness. Easily generalisable to cover more expressive logics.

for \( A\mathcal{L}C'\mathcal{H} \)

\[ (H) \quad \frac{r(a, b)}{s(a, b)} \]

Termination via dynamic ancestor equality blocking.

References