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Automated model selection for simulation based on relevance reasoning. (English)

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Summary: Constructing an appropriate model is a crucial step in performing the reasoning required to successfully answer a query about the behavior of a physical situation. In the compositional modeling approach of Falkenhainer and Forbus, a system is provided with a library of composable pieces of knowledge about the physical world called model fragments. The model construction problem involves selecting appropriate model fragments to describe the situation. Model construction can be considered either for static analysis of a single state or for simulation of dynamic behavior over a sequence of states. The latter is significantly more difficult than the former since one must select model fragments without knowing exactly what will happen in the future states. The model construction problem in general can advantageously be formulated as a problem of reasoning about relevance of knowledge that is available to the system using a general framework for reasoning about relevance described by Levy (1993) and Levy and Sagiv (1993). In this paper, we present a model formulation procedure based on that framework for selecting model fragments efficiently for the case of simulation. For such an algorithm to be useful, the generated model must be adequate for answering the given query and, at the same time, as simple as possible. We define formally the concepts of adequacy and simplicity and show that the algorithm in fact generates an adequate and simplest model.

MSC:

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Keywords:

model formulation; relevance reasoning; qualitative reasoning; simulation

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