Demo: Using Qualitative Reasoning in Natural Language Question-Answering

Kenneth D. Forbus, Maxwell Crouse, Clifton McFate

Qualitative Reasoning Group, Northwestern University, Evanston, IL, 60201 USA
forbus@northwestern.edu

Abstract

One of the goals of qualitative reasoning is to capture aspects of human commonsense reasoning, a sizeable portion of which involves reasoning about continuous processes. Commonsense models of these processes provide the grounding for learning more sophisticated models in school, and this is particularly important in science. Learning and applying said models requires integrating qualitative reasoning with other cognitive capabilities, including natural language understanding. This demonstration will show how QP theory is being used in the Companion cognitive architecture in learning by reading and in answering science test questions posed in simplified English.

Introduction

Understanding the nature of human commonsense reasoning is one of the central problems of cognitive science, and replicating these abilities in software remains a major challenge for artificial intelligence. Qualitative reasoning has been proposed as a key component of commonsense knowledge, because it provides symbolic representations of continuous entities, properties, and processes that make up much of the everyday physical and social worlds, and perhaps our mental world as well. For most of its history, QR research has focused on developing sets of representations and algorithms to perform various types of qualitative reasoning. This has often been in isolation, e.g. stand-alone QR systems such as QSIM (Kuipers, 1994) or GARP3 (Bredweg et al. 2009). Now, however, with an increasing focus on larger-scale intelligent systems, the time seems right to pay more attention to integrating qualitative representations and reasoning with other aspects of cognition. This demonstration will illustrate how qualitative reasoning is being used in the Companion cognitive architecture (Forbus & Hinrichs, in press) to both extract qualitative models from English text, and to use qualitative reasoning in natural language question-answering. Potentially, such techniques can be used in future intelligent assistant programs and in larger-scale models of human cognition.

What the demo will include

We will demonstrate two capabilities. The first is learning qualitative models by reading natural language text (McFate & Forbus, 2016). The processes of parsing, disambiguation, semantic interpretation, and extracting qualitative models will be demonstrated via examples. The second capability is solving elementary school science problems (e.g. Crouse & Forbus, 2016), but posed using natural language text. Again, the process of understanding the question, formulating the reasoning query, and performing the qualitative reasoning will be demonstrated.

Acknowledgements

References

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