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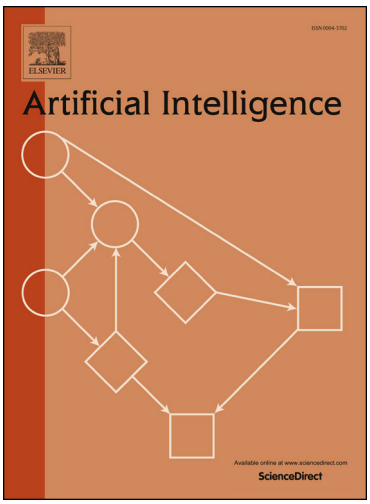

Commonsense reasoning about containers using radically incomplete information

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Commonsense Reasoning about Containers using Radically Incomplete Information

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Abstract

In physical reasoning, humans are often able to carry out useful reasoning based on radically incomplete information. One physical domain that is ubiquitous both in everyday interactions and in many kinds of scientific applications, where reasoning from incomplete information is very common, is the interaction of containers and their contents. We have developed a preliminary knowledge base for qualitative reasoning about containers, expressed in a sorted first-order language of time, geometry, objects, histories, and actions. We have demonstrated that the knowledge suffices to justify a number of commonsense physical inferences, based on very incomplete knowledge.

1. Physical Reasoning Based on Radically Incomplete Information

In physical reasoning, humans, unlike programs for scientific computation, are often able to carry out useful reasoning based on radically incomplete information. If AI systems are to achieve human levels of reasoning, they must likewise have this ability. The challenges of radically incomplete information are often far beyond the scope of existing automated reasoners based on simulation (Davis & Marcus, 2016); rather they require alternative reasoning techniques specifically designed for incomplete information.

As a vivid example, consider the human capacity to reason about containers — boxes, bottles, cups, pails, bags, and so on — and the interactions of containers with their contents. For instance, you can reason that you can carry groceries in a grocery bag and that they will remain in the bag with only very weak specifications of the shape and material of the groceries being carried, the shape and material of the bag, and the trajectory of motion. Containers are ubiquitous in everyday life, and children start to learn how containers work at a very early age (Hespos & Baillargeon, 2001) (figure 1).[1]

[1] Ironically, the working of a baby bottle nipple is beyond the scope of this paper.