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A computational model of belief

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Abstract

We propose a logic of belief in which the expansion of beliefs beyond what has been explicitly learned is modeled as a finite computational process. The logic does not impose a particular computational mechanism; rather, the mechanism is a parameter of the logic, and we show that as long as the mechanism meets a particular set of constraints, the resulting logic has certain desirable properties. Chief among these is the property that one can reason soundly about another agent's beliefs by simulating its computational mechanism with one's own. We also give a detailed comparison of our model with Konolige's deduction model, another model of belief in which the believer's reasoning mechanism is a parameter. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

If an observer sees dark clouds and hears thunder, it might cause him to believe that it will rain soon. Similarly, if the observer knows that Mary sees clouds and hears thunder, he might conclude that she believes it will rain. The observer draws this conclusion by drawing an analogy between Mary's mental processes and his own: by observing how his own beliefs work, he sees that if he were in her position, he would believe rain was coming.

This kind of reasoning, called *simulative reasoning*, has been explored in the AI literature (e.g., [2,3]), but with the exception of [17], which we discuss below, the treatments have lacked precise descriptions of conditions under which simulative reasoning yields all and only correct conclusions.

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