The Relevance of Formal Logics for Cognitive Logics, and Vice Versa

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Abstract

Classical logics like propositional or predicate logic have been considered as the gold standard for rational human reasoning, and hence as a solid, desirable norm on which all human knowledge and decision making should be based, ideally. For instance, Boolean logic was set up as kind of an algebraic framework that should help make rational reasoning computable in an objective way, similar to the arithmetics of numbers. Computer scientists adopted this view to (literally) implement objective knowledge and rational deduction, in particular for AI applications. Psychologists have used classical logics as norms to assess the rationality of human commonsense reasoning. However, both disciplines could not ignore the severe limitations of classical logics, e.g., computational complexity and undecidedness, failures of logic-based AI systems in practice, and lots of psychological paradoxes. Many of these problems are caused by the inability of classical logics to deal with uncertainty in an adequate way. Both disciplines have used probabilities as a way out of this dilemma, hoping that numbers and the Kolmogoroff axioms can do the job (somehow). However, psychologists have been observing also lots of paradoxes here (maybe even more). So then, are humans hopelessly irrational? Is human reasoning incompatible with formal, axiomatic logics? In the end, should computer-based knowledge and information processing be considered as superior in terms of objectivity and rationality? Cognitive logics aim at overcoming the limitations of classical logics and resolving the observed paradoxes by proposing logic-based approaches that can model human reasoning consistently and coherently in benchmark examples. The basic idea is to reverse the normative way of assessing human reasoning in terms of logics resp. probabilities, and to use typical human reasoning patterns as norms for assessing the cognitive quality of logics. Cognitive logics explore the broad field of logic-based approaches between the extreme points marked by classical logics and probability theory with the goal to find more suitable logics for AI applications, on the one hand, and to gain more insights into the structures of human rationality, on the other. In particular, the talk features conditionals and preferential nonmonotonic reasoning as a powerful framework to explore characteristics of human rational reasoning.

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