Innate Theories as a Basis for Autonomous Mental Development

Thomas C. Henderson
University of Utah

Xiuyi Fan
Australian Centre for Field Robotics

Aniesha Alford
North Carolina A& T

Edward Grant
North Carolina State University

Elaine Cohen
University of Utah

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Abstract

Sloman (in robotics), Chomsky and Pinker (in natural language), and others, e.g., Rosenberg (in human cooperative behavior) have proposed that some abstract theories relevant to cognitive activity are encoded genetically in humans. The biological advantages of this are (1) to reduce the learning time for acquisition of specific contextual models (e.g., from a language community; appropriate physics, etc.), and (2) to allow the determination of true statements about the world beyond those immediately available from direct experience. We believe that this hypothesis is a strong paradigm for the autonomous mental development of artificial cognitive agents and we give specific examples and propose a theoretical and experimental framework for this. In particular, we show that knowledge and exploitation of symmetry can lead to greatly reduced reinforcement learning times on a selected set of problems.