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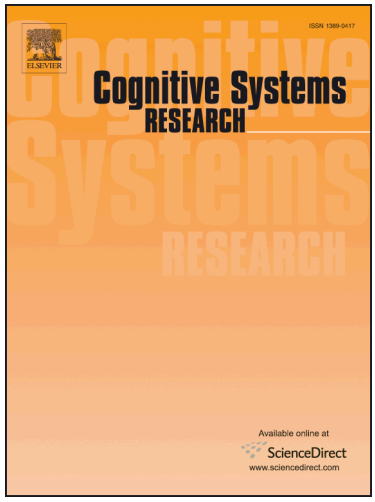

Value Systems for Developmental Cognitive Robotics: A Survey

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Value Systems for Developmental Cognitive Robotics: A Survey

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ABSTRACT: This paper surveys value systems for developmental cognitive robotics. A value system permits a biological brain to increase the likelihood of neural responses to selected external phenomena. Many machine learning algorithms capture the essence of this learning process. However, computational value systems aim not only to support learning, but also autonomous attention focus to direct learning. This combination of unsupervised attention focus and learning aims to address the grand challenge of autonomous mental development for machines. This survey examines existing value systems for developmental cognitive robotics in this context. We examine the definitions of value used—including recent pioneering work in intrinsic motivation as value—as well as initialisation strategies for innate values, update strategies for acquired value and the data structures used for storing value. We examine the extent to which existing value systems support attention focus, learning and prediction in an unsupervised setting. The types of robots and applications in which these value systems are used are also examined, as well as the ways that these applications are evaluated. Finally, we study the strengths and limitations of current value systems for developmental cognitive robots and conclude with a set of research challenges for this field.

Keywords: robotics, cognition, developmental systems, value systems, intrinsic motivation

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