Neural-Symbolic Methods for Learning and Transforming Embodied Knowledge in Heterogeneous Robotics

Abstract: Effective transfer of embodied knowledge among heterogeneous robots would have significant theoretical value and potentially dramatic practical value as well. It could enable robots to rapidly master skills and adapt to the new surroundings with relatively low computational cost. However, the path to achieving this goal is obstructed by a number of apparent difficulties, related to computational resource limitations, the uncertainty of information acquisition, and the omnipresence of ambient noise. Our research sees to surmount these obstacles via a unique approach to neural-symbolic integration. Our research will employ fixed-parameter complexity and finite model theory as tools, will closely link deep learning and transfer learning, and will utilize the symbolic reasoning power and nonlinear dynamical attention allocation of the OpenCog integrative Artificial General Intelligence architecture. While the formalism, ideas and software developed will largely be generally applicable, the initial target application area will be hand-eye coordination, a topic of significant importance unto itself. The results will be applied to heterogeneous robots carrying out hand-eye coordination in the real world, giving them unprecedented capability for knowledge transformation and associated rapid learning.

Brief Resume： Min JIANG has received the B.Sc and Ph.D. in computer science from Wuhan University, China in 2001 and 2007, respectively. Subsequently as a postdoctoral fellow of Department of Mathematics of Xiamen University, he studied computational epistemic logic and its applications on cognitive robot. Currently he is an associate professor at Department of Cognitive Science and Technology, Xiamen University. His main research interests are computational modal logic, neural network and Neural-Symbolic Integration. A special focuses are software development and basic theories on intelligent robot and Artificial General Intelligence. He is a senior member of the IEEE and Board Member of the Emergent Technologies Technical Committee (ETTC) of the Computational Intelligence Society (CIS) of the IEEE and Board Member of the Theoretical Computer Science Technical Committee (TCSTC) of China Computer Federation (CCF). He is vice chair of the IEEE CIS social media subcommittee and chair of the IEEE CIS Beijing Section Xiamen Chapter.