
Advanced Robotics Call for Papers

Special Issue on World Models and Predictive Coding in Robotics

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Scope:

Developing autonomous cognitive-developmental robots is one of the dreams of robotics. An autonomous cognitive system should be able to adapt to its environment through interactions. Importantly, the experience is based on its sensor-motor systems. Creating cognitive dynamics that allow a robot to develop and learn based on the robot's own action and perception is a critical challenge in cognitive and developmental robotics. It also supports the development of social capabilities necessary for adaptive collaborative robots. The autonomous learning process is also referred to as lifelong learning.

Based on outstanding success in deep learning and probabilistic generative models in the 2010s, world models are attracting attention in artificial intelligence. A world model allows a cognitive system (e.g., an agent) to predict its future sensory observations and to optimize its controller (i.e., behavior) based on the prediction. The idea is closely related to predictive coding that has been studied in neurorobotics to develop neuro-dynamics realizing adaptive behaviors and social perception. Predictive coding and world models also share the same fundamental idea with the free-energy principle which is an influential theory in neuroscience nowadays.

Although the world model-based approach is promising in robotics, the many applications and studies of world models are still limited to simulation studies. Application to real robots should be studied. The problems and challenges of developing autonomous cognitive-developmental robots

based on world models, predictive coding, and free-energy principle have not been fully explored. These approaches are based on a generative view of cognition. In studies about cognitive development and symbol emergence in robotics, many computational cognitive models based on probabilistic generative models have been developed.

Therefore, this special issue focuses on the new frontiers in robotics, emphasizing world models, predictive coding, probabilistic generative models and the free-energy principle. Papers on recent achievements in cognitive robotics are welcome. We also welcome surveys and short papers that clarify current essential topics in symbol emergence in robotics, cognitive robotics, and artificial intelligence. Prospective contributed papers are invited to cover, but are not limited to, the following topics:

- World models for robotics
- Predictive coding
- A free-energy principle in robotics
- Probabilistic generative models for robotics
- Reinforcement learning with partial observations
- Representation learning for robotics
- Active inference and exploration for robotics
- Whole-brain probabilistic generative models
- Cognitive development and symbol emergence in robotics
- Neuro/brain-inspired cognitive systems for robotic
- Software frameworks for the application of world models and predictive coding in robotics
- Cognitive architectures for robots
- Symbol emergence with world modeling and predictive coding
- Model based intention prediction in robotics
- Adaptive world and agents models for social robotics

Submission:

The full-length manuscript (either PDF or Microsoft Word file) should be sent to the office of Advanced Robotics, Robotics Society of Japan, through its homepage at: <https://www.rsj.or.jp/pub/ar/submission.html>. Templates for the manuscript and instructions for the authors are available on the homepage.

Website:

Further information will be provided via the following website: <https://world-model.emergent-symbol.systems/>.