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Title

Reinforcement learning: computational theory and neural mechanisms

Abstract

Reinforcement learning is a theoretical framework for an active adaptive agent, say, a robot, software, animal or human, to learn a behavior through action exploration and reward feedback.

We will first go through basic concepts in reinforcement learning, including state and action value functions, exploration and exploitation, temporal discounting, temporal difference learning, and model-based approaches.

We will then look into how reinforcement learning is realized in the brain, including reward prediction error coding by dopamine neurons, value coding in the basal ganglia, model-based prediction by cerebellar and cortical circuits, and modulation of temporal discounting by serotonin.

Biography

KENJI DOYA took BS in 1984, MS in 1986, and Ph.D. in 1991 at U. Tokyo. He became a research associate at U. Tokyo in 1986, U. C. San Diego in 1991, and Salk Institute in 1993. He joined Advanced Telecommunications Research International (ATR) in 1994 and became the head of Computational Neurobiology Department, ATR Computational Neuroscience Laboratories in 2003. In 2004, he was appointed as the Principal Investigator of Neural Computation Unit, Okinawa Institute of Science and Technology (OIST) and started Okinawa Computational Neuroscience Course (OCNC) as the chief organizer. As OIST established itself as a graduate university in 2011, he became a Professor and served as the Vice

Provost for Research. He serves as the Co-Editor in Chief of Neural Networks since 2008 and a board member of Japanese Neural Network Society (JNNS) and Japan Neuroscience Society (JNSS). He served as the Program Co-Chair of International Conference on Neural Information Processing (ICONIP) in 2007 and 2016, the Program Chair of JNSS meeting in 2010, and the General Chair of JNNS meeting in 2011 and 2018. He received Tsukahara Award and JSPS Award in 2007, MEXT Prize for Science and Technology in 2012, and Donald O. Hebb Award in 2018. He lead the MEXT project "Prediction and Decision Making" from 2011 to 2016 and currently leads a new MEXT project "Artificial Intelligence and Brain Science". He is interested in understanding the functions of basal ganglia and the cortical circuit based on the theory of reinforcement learning and Bayesian inference.

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