This talk will be in English.

The 71st Frontier Brain Science Seminar

Sponsored by Research Center for Idling Brain Science (RCIBS)

「知」の創発とその破綻機序の解明に向けて

Learning in intelligent systems

演 者: **牧野　浩史 先生**

慶應義塾大学 医学部 医学研究科 生理学教室 教授

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Recent years have seen a resurgence of interplay between artificial intelligence (AI) and neuroscience. While AI offers new theories on how the brain solves complex problems, neuroscience contributes novel algorithms and neural network architectures that can endow machines with cognitive abilities. However, direct comparisons between artificial and biological intelligent systems remain limited. We addressed this gap by examining behaviors and neural representations across multiple domains of intelligence. By training mice and deep reinforcement learning (RL) agents on the same tasks and analyzing the resulting task representations in their respective neural networks, we found that learning in the mouse cortex exhibits key features reminiscent of deep RL algorithms. Furthermore, by deriving theoretical predictions from AI models and empirically testing them in mice, we discovered that the brain composes novel behaviors through a simple arithmetic combination of pre-acquired action-value representations and a stochastic policy. These findings underscore the remarkable parallels in behaviors and neural representations between the two systems and highlight the value of comparative approaches.

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Organizer: Tsuyoshi Setogawa (Dept. of System Emotional Science) (Ext.7216)