Frontier of Artificial Network

Department of Data Science
香港城市大學
City University of Hong Kong

Synthetic Biological Intelligence: Learning, Adaptation, and Brain-Inspired AI

Invited Speaker
Adeel Razi
Monash University
Date: July 20, 2026 (Mon)
Time: 11:00am (HKT)
Zoom Meeting: 801 137 0362

Biography

Adeel Razi is a Professor of Computational Neuroscience at the School of Psychological Sciences, Monash University, Australia. He is affiliated with the Turner Institute for Brain and Mental Health and the Monash Data Futures Institute. His research combines engineering, physics, machine learning, and neurobiology to develop statistical and computational methods for understanding brain function. His main interests include neuroimaging time-series analysis, state-space modelling, Bayesian statistics, and dynamical systems theory. He has made important contributions to the development and application of Dynamic Causal Modelling, particularly for resting-state functional MRI, providing tools for in-vivo investigation of human brain function. His research has implications for neuroscience-inspired artificial intelligence, brain disease treatment, and neurotechnology. His work has appeared in leading journals including Nature, Nature Human Behaviour, Nature Mental Health, Nature Reviews Neuroscience, Neuron, Nature Communications, and PNAS. Before joining Monash, he conducted postdoctoral research at the Wellcome Centre for Human Neuroimaging, UCL. He received his Ph.D. in Electrical Engineering from the University of New South Wales in 2012.

Abstract

Synthetic biological intelligence (SBI) provides a new way to study learning and adaptive intelligence by embedding living neuronal networks in closed-loop interactive environments. Recent studies show that neuronal cultures can self-organize, learn task-relevant behaviours, and adapt to sparse sensory feedback in real time. These systems offer a valuable contrast to conventional reinforcement learning, especially in terms of sample efficiency and adaptive flexibility. In this talk, I will introduce SBI platforms such as DishBrain as experimental testbeds for understanding the computational principles of biological learning and for developing brain-inspired artificial intelligence. I will discuss recent work that combines active inference, dynamical systems modelling, and experiment-informed generative models to characterize how neuronal cultures interact with virtual environments. These studies provide insights into how adaptive behaviour can emerge from sparse feedback, prediction, and self-organization in living systems. More broadly, SBI points to new directions for AI beyond scale-driven deep learning, including efficient learning, embodied intelligence, continual adaptation, and neuromorphic computation.