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From Biological to Artificial Intelligence: Computational Principles for Perception, Learning, and Memory

Abstract. Despite remarkable advances in artificial intelligence, humans remain strikingly more efficient and adaptive in how they perceive, learn from, and interact with the world. What computational principles underlying biological intelligence might help close this gap? In this talk, I will present our work at the intersection of artificial intelligence, cognitive science, and neuroscience, focusing on three complementary directions. First, I will examine active and selective perception: how humans efficiently direct attention toward behaviorally relevant information, integrate sensory cues, and choose informative views of the world. I will show how these principles can inspire AI systems for visual search, audiovisual localization, and active 3D perception. Second, I will ask whether the structure of developmental experience itself provides useful inductive biases for learning. By modeling changes in visual acuity, color perception, and temporal continuity during development, we find that infant-like visual diets can lead to more robust and generalizable visual representations. Finally, I will turn to memory—not simply as information storage, but as a computational mechanism for organizing experience and supporting behavior. I will discuss how recurrence, learned priors, and structured memory geometries can support working memory, biological motion perception, and 3D spatial reasoning. Together, these studies illustrate a broader approach to NeuroAI: using behavioral and neuroscientific principles not merely to reproduce biological mechanisms, but to identify computational ingredients that enable more robust, efficient, and generalizable intelligence.

Speaker Bio. Mengmi Zhang is an Assistant Professor and the Angela Goh Career Development Professor in Computer Science and Engineering at Nanyang Technological University (NTU), Singapore, where she leads the Deep NeuroCognition Lab. Her research lies at the intersection of artificial intelligence, computational neuroscience, and cognitive science, with a focus on understanding and building computational mechanisms for attention, memory, learning, and generalization. Her group combines human psychophysics, biologically inspired computational modeling, and modern machine learning to study both biological and artificial intelligence. Before joining NTU, she was a Principal Scientist and Principal Investigator at A*STAR and a Research Fellow at the Harvard-MIT Center for Brains, Minds and Machines. She is a recipient of the Singapore National Research Foundation Fellowship, was recognized as one of Singapore's 100 Women in Tech in 2023, and was named to the global list of MIT Technology Review's Innovators Under 35 in 2026.



Place & Time.

Building O27 room 4308
Friday, September 18, 2026
10:00 am

Host: Prof. Dr. Heiko Neumann
Institute of Neural Information Processing