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Department of Data Science
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City University of Hong Kong

Simulating Biological Intelligence: Bridging High-Fidelity Neuronal Modeling with Embodied Agents

特邀讲者
赵梦迪
复旦大学

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讲者信息

赵梦迪，复旦大学脑智研究院助理教授。2015年本科毕业于南京航空航天大学计算机科学与技术学院，2021年博士毕业于北京大学前沿交叉学科研究院，研究方向为计算神经科学，曾在北京智源人工智能研究院从事博士后及研究员工作。2025年8月加入复旦大学脑智研究院。赵梦迪构建了领域内首个基于高精度神经系统模型、可闭环控制线虫身体前向运动的数字线虫模型（Zhao et al.,Nature Computational Science, 2024），该成果被选为当期封面文章，该模型首次实现了跨四个层级、融合八种模态的多模态数据整合，为解析神经结构、神经活动与行为之间的复杂关系提供了全新的研究范式。此外，赵梦迪还在 Neuroscience Bulletin，Zoological Research，BMC Bioinformatics，Quantitative Biology 等期刊，CVPR 等会议上发表了多篇研究成果，涵盖计算神经科学、数字生命、大脑模拟、人工智能、类脑计算、具身智能、图像处理等前沿交叉领域。

报告内容

The behavior of an organism is influenced by the complex interplay between its brain, body and environment. Existing data-driven models focus on either the brain or the body–environment. Here we present an integrative data-driven model of Caenorhabditis elegans, which consists of two submodels: the brain model and the body–environment model. The brain model was built by multicompartment models with realistic morphology, connectome and neural population dynamics based on experimental data. Simultaneously, the body–environment model used a lifelike body and a three-dimensional physical environment. Through the closed-loop interaction between the two submodels, this model reproduced the realistic zigzag movement toward attractors observed in C. elegans. Leveraging this model, we investigated the impact of neural system structure on both neural activities and behaviors. Consequently, it can enhance our understanding of how the brain controls the body to interact with its surrounding environment.