# IROS Workshop on: Robot Embodied Computational Neuroscience

## Organizers


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** Gizem Özdil organized the workshop: "Agent-Based Models in Neuroscience: Complex Planning, Embodiment and Beyond" at the Computational and Systems Neuroscience (COSYNE) 2025 conference.

*** Kamilo Melo organized the tutorial: "Low-cost, Fast-development, Modular Snake Robot Open Platforms," at ICRA 2014, and served as the Program Chair of the International Symposium on Safety, Security and Rescue Robotics, SSRR-2016.


## Abstract and website: https://neural-robots.github.io/ws/


Computational neuroscience provides powerful methodologies to address one of the most significant scientific challenges of our era: understanding how the nervous system controls behavior. Models of the nervous system allow for exploring the roles of neural circuits in sensory processing, cognition, behavior generation, and motor control. However, it is infeasible to understand how the nervous system controls behavior without the body it evolved to operate in. Embodiment addresses this critical aspect by closing the perception-action loop through real-world physical interactions. Robotics and physics-simulators effectively bridge this gap by providing physical embodiment to computational neural models, facilitating tangible interactions with the environment. Additionally, biological neural circuits have already evolved to provide robust solutions to challenges analogous to those faced in robotics, such as motor learning, adaptation, robust locomotion, and navigation in complex environments. Thus, robotics could substantially benefit from the insights derived from millions of years of evolutionary refinement encoded in biological neural systems.

This workshop at IROS 2025 brings together roboticists using computational neuroscience approaches to solve robotics challenges and neuroscientists using robots to understand neural functions. Unlike previous related events, this workshop introduces cutting-edge approaches in neuroAI, neuromorphic engineering, embodied neural computation, and bio-inspired robotics solutions to enhance the real-world applicability and robustness of robotic systems. The workshop promotes interdisciplinary collaborations, advancing fundamental understanding in neuroscience while simultaneously fostering innovative, bio-inspired solutions to contemporary robotic challenges.


WORKSHOP PROPOSAL

## Content of the workshop and expected impact

### Objectives:

The primary objective of this workshop is to **foster interdisciplinary collaboration** between roboticists and neuroscientists, promoting mutual understanding, knowledge exchange, and the development of innovative ideas at the intersection of computational neuroscience and robotics.

Specifically, the workshop aims to **discuss** and advance the development, refinement, and practical application of embodied neural models within robotics, enabling more effective and biologically inspired interactions with the physical environment. By leveraging biological insights derived from neural circuit research, the workshop seeks to **brainstorm** ideas to significantly enhance robotic capabilities in areas such as sensory processing, motor control, adaptive learning, navigation, and robust behavior generation. Additionally, the event aims to **identify** new research opportunities among the participants and promote the integration of state-of-the-art computational neuroscience methodologies into robotic systems, ultimately driving progress in both fields through mutual inspiration and collaboration.

### Quality:

The workshop content quality will reflect the invited speakers' cutting-edge developments and state-of-the-art methodologies in robotics and computational neuroscience. Expert speakers and leading researchers from both neuroscience and bio-robotics will be carefully selected to present their latest findings, technological advancements, and innovative theoretical frameworks. Interactive presentations will span topics from embodied neural computation and neuromorphic engineering to bio-inspired robotic systems, ensuring comprehensive coverage of recent breakthroughs and future trends at the interdisciplinary boundary.

To maintain high quality, the organizing committee—comprising emerging scholars from neuroscience and robotics—will personally invite speakers based on their established expertise and contributions to their fields. Strict guidelines and clear communication standards will be provided to ensure adherence to the workshop's simplified and structured format, promoting effective knowledge transfer and interdisciplinary dialogue throughout the event.

### Engagement and Idea Exchange:

To facilitate deep engagement and effective knowledge exchange, the workshop will employ a structured, interactive format rather than traditional long-form lectures. Each presentation (10 minutes) will follow a concise, standardized outline designed to clearly communicate core concepts, methodologies, results, and implications, ensuring accessibility for participants from diverse disciplinary backgrounds. After each structured talk, there will be dedicated mini interactive sessions (10 minutes) for immediate questions, discussions, and collaborative idea exploration. This format will significantly enhance speakers and participants engagement alike, allowing attendees to better understand, critique, and build upon the presented research.

### Originality and Diversity:

Compared to previous workshops at IROS and ICRA, this workshop uniquely emphasizes the integration of robotics and computational neuroscience in an innovative format that will focus on interactive discussions rather than traditional lectures. It will introduce novel interdisciplinary perspectives and showcase pioneering research that enhances diversity in both content and participant backgrounds, expanding the conceptual and practical boundaries of robotics research. Moreover, the organizing committee and invited speakers reflect the diversity of nationalities and gender that this workshop is committed to promote.