Math & Brain seminars

DIPARTIMENTO MATEMATICA
DIPARTIMENTO DI MATEMATICA "TULLIO LEVI-CIVITA"

PADOVA neuroscience CENTER

Matematica e Cervello

Wednesday 11/12/24 - 17:30
Room 1AD100

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Theoretical neuroscience: the geometry and dynamics of behavior, cognition, and learning

Recent years have brought tremendous progress in the fields of artificial intelligence and neuroscience, however, a comprehensive framework to explain the computational principles of complex cognitive function and flexible behavior is still lacking. Addressing the complexity within large-scale, multi-area neuronal recordings with simultaneous monitoring of behavioral variables demands novel and deeper connections between the different axes of theoretical neuroscience. In this talk, I will review current approaches and highlight challenges in the upcoming NeuroAI field with particular focus on the following questions: i) What kind of dynamical systems can explain the complex spatiotemporal features of naturalistic animal behavior? ii) What new physical ingredients should recurrent neural networks incorporate to explain the richness observed in large-scale neural activity during behavior? iii) What is the geometry of neural representations in animal brains and how is it related to the geometry of deep learning? Finally, I will show some recent work in my lab showing how the optimal cognitive function known as the Yerkes-Dodson law of psychology relies on a phase transition occurring in sensory cortical circuits.

Organizers

S. De Marchi, W. Erb, M. Formentin, V. Franceschi, F. Marchetti, R. Monti, F. Rinaldi