MATHEMATICS OF LIFE

HGS MathComp

IWR Interdisciplinary Center for Scientific Computing

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

IWR Colloquium & HGS MathComp “Mathematics of Life” Winter Semester 2022 / 2023

November 30, 2022 • 16:15
Mathematikon • Conference Room / 5th Floor

Speaker:
Dr. Johannes Zierenber, Postdoctoral Researcher
Max Planck Institute for Dynamics and Self-Organization

Title:
“Neuromorphic Computing With Self-Organized Networks"

Abstract:
Our brains are comprised of billions of neurons that form a complex network. This network is a result of both evolutionary optimization (fostering a modular arrangement including highly specialized areas) and our own experience (storing memories and skills by adapting connection strengths) and determines how we process sensory input to produce meaningful responses. Since neurons communicate with short electrical pulses only when necessary, they are extremely energy efficient. Given our worldwide increase in computing demand, there is thus a strong incentive to develop low-energy neuromorphic computing paradigms that mimic the working principles of the brain. But what are the relevant working principles of the brain? How does a neural network develop useful dynamics?

In this seminar, I will present minimal principles to ensure stable collective neural dynamics from a statistical physics perspective, discuss how these can be used to tune network states to task requirements and show how they can be applied to neuromorphic computing. While I mainly focus on experience-driven self-organization, I will finish with some ideas to include evolutionary-driven architectures in the future.

“Mathematics of Life” is a special interest group organized by doctoral students of the HGS MathComp.

Website Dr. Johannes Zierenberg:
www.ds.mpg.de/person/51598/2247

Website IWR Colloquium:
www.iwr.uni-heidelberg.de/events/iwr-colloquium

Website HGS MathComp "Mathematics of Life":
www.mathcomp.uni-heidelberg.de/mathematics-of-life