Mapping mouse brain circuits, and Algorithmic Phase Transitions in Big Data

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Core Lecture Hall (Room 101)

Abstract

The circuit connectivity of neurons underlies the capabilities of brains, and is important to understand for answering fundamental scientific questions, understanding brain disorders and engineering intelligent machines. Yet after a century of intensive research, comprehensive knowledge about brain circuits for any vertebrate is lacking, including the most widely studied laboratory organisms. This talk will discuss efforts to close this knowledge gap for the Mouse (http://mouse.brainarchitecture.mouse) and in the Marmoset. The second part of the talk will focus on methods from statistical physics applied to problems in machine learning to delineate algorithmic phase boundaries at which qualitative changes in performance take place. Such "big data phase transitions" are relevant for current technology applications, and may also have relations to the architectural principles of neural circuits.

Bio

Partha Mitra received his PhD in theoretical physics from Harvard in 1993. He was a an Assistant Professor of Physics at Caltech (1996) and a member of Theoretical Physics department at Bell Laboratories from 1993-2003. He has been at Cold Spring Harbor Laboratory from 2003 onwards, where he is currently Crick-Clay Professor of Biomathematics. Dr Mitra also holds the H N Mahabala distinguished chair in Computational Brain Research (visiting) at IIT Madras, India and is a senior visiting research at the Brain Sciences Institute, RIKEN, Japan. Dr Mitra has adjunct appointments at Weill Medical College of Cornell University and NYU Medical School. His research currently combines experimental, theoretical and informatics approaches to gain an understanding of how brains work. He originated the idea to map neuronal circuits brain-wide at the mesoscopic scale, and is carrying out this task in the Mouse and in the Marmoset. Dr Mitra is a Fellow of the American Physical Society. Dr Mitra has a broad range of interests including communicating
science to a broad audience, and is a periodic contributor to the Scientific American Mind Matters section.

Faculty Host: Dimitris Metaxas