BIOENGINEERING DEPARTMENT

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Location: JC, Room B
Date: May 17, 2018
Time: 12:00 pm - 1:00 pm

Topic: The fabric of the neocortex

Abstract

The neocortex is responsible for cognition, perception and action and is thought to be most responsible for intelligence. Despite significant advances in our understanding of its structural and functional organization during the last few decades, its underlying computational principles remain largely unknown. The problem lies in understanding how billions of neurons communicating through trillions of synaptic connections learn from data and orchestrate their activities to give rise to our mental faculties. If there are underlying principles and rules that govern this complexity, then discovering these principles could reduce this impenetrable intricacy to a manageable scale. One such principle is provided by the hypothesis that the neocortex is composed of repeating circuit motifs that contain numerous cell types wired together according to stereotypical rules which perform canonical algorithms. I will describe our findings so far towards our quest to determine what constitutes the elementary computational circuit motif in the neocortex, characterize its structure and function, decipher its canonical computation(s) and how we are beginning to transfer these algorithms to advance AI.

Biography

Dr. Tolias studies how microcircuits in the cerebral cortex of mice and non-human primates are functionally organized and how they process information. Research in his lab combines electrophysiological (whole-cell and multi-electrode extracellular), multi-photon imaging, molecular, behavioral and computational methods. His goal is to dissect and understand the functional organization of neocortical microcircuits and decipher their structure and the canonical computations they perform with an emphasis on the role top-down influences in visual processing. In parallel his research team is also trying to apply these canonical computation principles in machine learning tasks in order to advance the field of artificial intelligence.