

Simons Center for Data Analysis

Lead Investigator:

Dmitri “Mitya” Chklovskii

Group members:

Arjun Bharioke

Cengiz Pehlevan

Eftychios Pnevmatikakis

Understanding neural computation

- My goal is to explain salient features of neuronal circuit structure and function as biological implementations of mathematical algorithms. To this end, we analyze experimental datasets, both anatomical and physiological, and develop a theory of neural computation by formulating biologically plausible online learning algorithms inspired by the fields of machine learning and signal processing.
- We can contribute to the MICrONS program on all levels. But our main interest is in
 - proposing neuronal circuit implementations of machine learning algorithms that can be tested by connectomics reconstructions and activity imaging
 - modeling the function of reconstructed connectomes on the “mesoscopic” level in terms of experimentally measurable neuronal activity and synaptic weights while course-graining the unmanageable complexity of ion channel physiology

Qualifications and capabilities

- We have an extensive experience with all experimental and theoretical aspects of connectome reconstructions, computational analysis of connectomics data, functional modeling of neuronal circuits, and formulating biologically plausible machine learning algorithms.
- We have reconstructed the largest, by synapse count, connectome, that of the *Drosophila* optic medulla.
- We have discovered a circuit motif responsible for motion detection in the medulla connectome.
- We have previously demonstrated that a cortical column is characterized by all-to-all potential synaptic connections and highly non-random actual synaptic connections.
- We have proposed a theoretical framework of neuronal computation based on statistical signal processing.

Looking to partner with experimentalists

I would like to collaborate with an experimental group collecting both physiological (Ca imaging of neuronal activity) and anatomical (EM for connectomics reconstructions) datasets. I am particularly interested in experiments where both kinds of data are obtained on the same cortical circuit by sequentially imaging it in vivo and post mortem.

Contact Information

Dmitri “Mitya” Chklovskii

Group Leader for Neuroscience

Simons Center for Data Analysis

dchklovskii@simonsfoundation.org

646-751-1276

<http://www.simonsfoundation.org/>