

Computational Neuroscience

Faculty: Larry Abbott, Ken Miller, Ashok Litwin Kumar, Stefano Fusi, Lea Dunker, Kim Stachenfeld

TAs: Ben Antin, Tala Fakoury, Chase King, Albert Wakhloo

Meetings: Tuesdays & Thursdays 2:00-3:30

Location: Green Science Center, Fifth Floor, Rm L5.084

Text: Theoretical Neuroscience by P. Dayan and L.F. Abbott (MIT Press)

Webpage: <https://ctn.zuckermaninstitute.columbia.edu/courses>

September

- 3 (Larry) Electrical Properties of Neurons, Integrate-and-Fire Model
- 5 (Larry) Adaptation, Synapses, Synaptic Plasticity
- 10 (Larry) Numerical Methods, Filtering, Receptive Fields (Assignment 1)
- 12 (Larry) The Hodgkin-Huxley Model
- 17 (Larry) Probability, Encoding, Decoding (Assignment 2)
- 18 Assignment 1 Due
- 19 ZI SciFest
- 24 (Lea) Generalized Linear Models
- 25 Assignment 2 Due
- 26 NB&B Retreat

October

- 1 (Ken) Linear Algebra I
- 3 (Ken) Linear Algebra II
- 8 (Ken) PCA (Assignment 3)
- 10 (Lea) Dimensionality Reduction, Population Analysis
- 15 (Lea) Latent Variables, Estimation-Maximization (Assignment 4)
- 16 Assignment 3 Due
- 17 (Ashok) Feedforward Networks and Dimensionality
- 22 (Ken) Rate Networks, Fixed-Point and Chaotic Attractors (Assignment 5)
- 23 Assignment 4 Due
- 24 (Ken) E-I Networks
- 29 (Ashok) Continuous Attractor and Low Rank Networks (Assignment 6)
- 30 Assignment 5 Due
- 31 (Lea) Dynamic Systems Approaches to Cognition

November

- 5 Holiday
- 6 Assignment 6 Due
- 7 (Ashok) Spiking Networks
- 12 (Ashok) Connectomics (Assignment 7)
- 14 (Stefano) Perceptrons
- 19 (Ashok) Convex Optimization and Support Vector Machines (Assignment 8)
- 20 Assignment 7 Due
- 21 (Stefano) Multilayer Perceptrons and Mixed Selectivity
- 26 (Stefano) Deep Learning
- 28 Holiday

December

- 3 (Stefano) Learning in Recurrent Networks (Assignment 9)
- 4 Assignment 8 Due
- 5 (Stefano) Continual Learning and Catastrophic Forgetting
- 10 (Kim) Reinforcement Learning
- 11 Assignment 9 Due