

Computational Neuroscience

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

TAs: Ching Fang, Ishani Ganguly, Francisco Sacadura, Erica Shook

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

- 5 (Larry) Introduction to Course and to Computational Neuroscience
- 7 (Larry) Electrical Properties of Neurons, Integrate-and-Fire Model
- 12 (Larry) Numerical Methods, Filtering (Assignment 1)
- 14 (Larry) The Hodgkin-Huxley Model
- 19 (Larry) Types of Neuron Models and Networks (Assignment 2)
- 20 Assignment 1 Due
- 21 (Larry) Adaptation, Synapses, Synaptic Plasticity
- 26 (Ashok) Generalized Linear Models
- 27 Assignment 2 Due
- 28 (Ken) Linear Algebra I (Assignment 3)

October

- 3 (Ken) Linear Algebra II
- 5 (Ken) PCA and Dimensionality Reduction
- 10 (Ken) Rate Networks/E-I networks I (Assignment 4)
- 11 Assignment 3 Due
- 12 (Ken) Rate Networks/E-I networks II
- 17 (Ken) Unsupervised/Hebbian Learning, Developmental Models (Assignment 5)
- 18 Assignment 4 Due
- 19 (Ashok) Chaotic Networks
- 24 (Ashok) Low Rank Networks
- 25 Assignment 5 Due
- 26 (Ashok) Introduction to Probability, Encoding, Decoding (Assignment 6)
- 31 (Ashok) Fisher Information

November

- 2 (Stefano) Perceptrons I (Assignment 7)
- 7 Holiday
- 8 Assignment 6 Due
- 9 (Stefano) Perceptrons II
- 14 (Ashok) Dimensionality (Assignment 8)
- 15 Assignment 7 Due
- 16 (Stefano) Multilayer Perceptrons and Mixed Selectivity
- 21 (Stefano) Deep Learning (Assignment 9)
- 22 Assignment 8 Due
- 23 Holiday
- 28 (Stefano) Learning in Recurrent Networks
- 30 (Stefano) Continual Learning and Catastrophic Forgetting

December

- 5 (Kim) Reinforcement Learning (Assignment 10)
- 6 Assignment 9 Due
- 7 Course Wrapup
- 13 Assignment 10 Due