Instructor: Eero Simoncelli
TA: Jonathan Pillow

Brief Description: A graduate course covering basic mathematical techniques for analysis and modeling of neural systems and data. The goal of the course is to teach students the basic mathematical and computational tools required to solve data analysis and modeling problems, the transformations of raw data into a form in which these tools may be utilized, and the interpretation of such analyses. Lectures on each topic will include some mathematical background, derivation of basic results, and examples relevant to neural science. The course will include weekly problem sets based on the MATLAB software package.

Format: The course will consist of two 2-hour lectures per week. A portion of this time will be devoted to introducing materials in the computer laboratory (Meyer, room 157). The course will have a series of homework assignments, to examine the lecture topics in terms of concrete and realistic problems. Grades will be based on homework.

Texts: Supplementary reading materials will be provided.


II. Linear Systems Theory: Convolution, Fourier Transforms, sampling.

III. Differential Equations: Basic ODE’s, membrane models, Hodgkin-Huxley and other spiking models, coupled diffEQ’s.

IV. Uncertainty & Statistics: basic probability, estimation, bias/efficiency, significance tests, bootstrapping, reverse correlation analysis, decision theory / signal detection theory.