Welcome: Spring 2022

Welcome to Psych 495/59511 Introduction to Neural Data Analyses

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Wednesdays: 9:00am-12:00pm Psychology 323

http://amygdala.psychdept.arizona.edu/IntroData/

Code, original data, PDF files are/will be secure. Please do not distribute....

Goal: Basic data analyses of 'point processes'. Emphasis on systematic quantitative thinking, visualization, organization, interpretation.

Textbooks: None. This is a hands on class.... However:

Theoretical Neuroscience (Dayan and Abbott)

Mathematics for Neuroscientists (Gabbiani and Cox)

Matlab for Neuroscientists (Wallisch et al.)

Neuroscience (Purves et al.)

Numerical Recipes in C (Press, Teukolsky, Vetterling, Flannery)

Other requirements: Matlab (easy access), NEURON, Excel (easy access)... Word processor

The plan

- 1/12 Class1: Introduction to biophysical neurons and neural networks.
- 1/19 Class2: Basic recording techniques: single and multi unit data. Generating your own data: surrogate datasets, NEURON simulations.

Part I: Single unit data analyses

- 1/26 Class3: Spontaneous activity: Spike count, firing rate, CV, return maps, fano factor.
- 2/2 Class4: Stimulus driven activity: Histograms, spike triggered average, PSTH.
- 2/9 Class5: Reverse correlations, tuning curves, receptive fields, discriminability and ROC curves.
- 2/16 Class6: Rhythms and oscillations, autocorrelation, field potentials, power spectra and spectrogram.
- 2/23 Class7: Spike timing and spike patterns. Reliability, precision.
- 3/2 Class8: Displaying single unit data and analyses. **Midterm**.

Part II: Multi-unit data analyses

- 3/9 NO CLASS
- 3/16 Class9: Population vectors, cortical maps.
- 3/23 Class 10: Dimension reduction: PCA and ICA.
- 3/30 Class11: Q&A and discussion about projects
- 4/6 Class12: Cross correlations, joint-PSTH, synchrony and coherence.
- 4/13 Class13:Introduction to information theory. Measures of information (Shannon Vs Fisher).
- 4/20 Class14: **Projects presentations**.
- 4/27 Class15: **Projects presentations**.

5/4 - Final exam.

The grading

Prerequisite: Some basic knowledge of Matlab (or any other 'standard' computer language). Some basic knowledge of neuroscience (neurophysiology).

Self test:

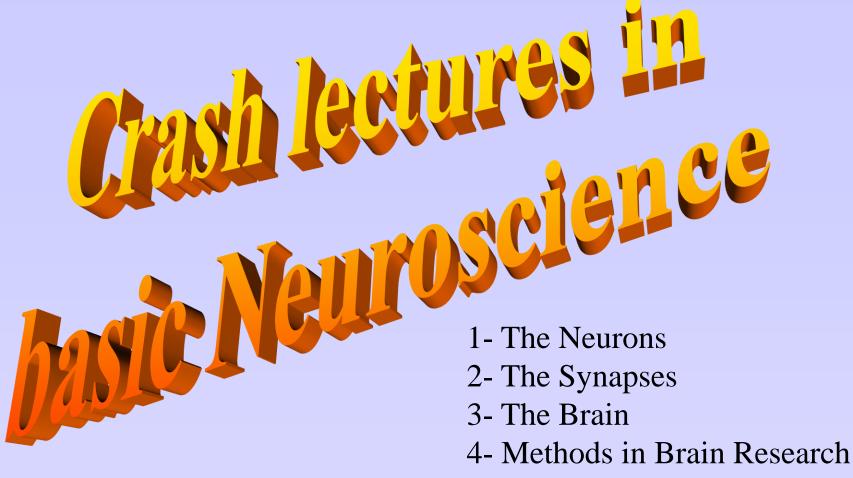
- Generate an array of 1000 real/float random numbers between 1 and 10. Plot the array.
- Compute and plot a histogram (say bins are 0.1 wide) of the differences between 2 consecutive points of the array.
- Sort it in ascending order. Compute its mean and standard deviation.

- Final	30 %
- rinai	30 %

- Midterm 20 %
- Final project (grad students only) 20%
- Homework + class participation 30 % for grad students 50% for undergraduates

Class participation = ask questions/'participate' + present paper/data analyses

Unit 1: Crash Neuroscience



For next class....

- Download and Install NEURON (neuron.yale.edu). No need to go through the tutorials... but feel free ... Test that it is working (run 'NEURON Demo')
- Install Matlab. Do the Self Test (see webpage).

Readings presentations

One or Two papers assigned each week, plus a number of optional papers. One of the 2 papers (or both) will be presented in class. Goal: introduce the topic for the week (and practice your scientific presentation skills)

- 20-30 minutes
- Focus on the figures: What are the 'take-home' messages. Copy/paste figures. OK to skip a few panels in the interest of time (but give the main message)
- Give 2-3 slides of introduction
- Give 2-3 slides of discussion
- No need to present supplemental information
- Each student will give a presentation in Part I and Part II
- Sign up ASAP (1st come, 1st serve). If no-one signs up, the papers will be assigned. Swaps are allowed.
- Next week: 1 paper. Given the circumstances, if no-one signs up, we will skip the 1st presentation.