Introduction to Computational Neuroscience (MAP 5932)

Syllabus, Spring 2018

M,W,F 11:15–12:05 201 Love Bldg.

Professor: Dr. Richard Bertram
Office Hours: M,W,F 10:00–11:00, or by appointment
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Prerequisite: permission of instructor.

Some good books :

- Principles of Computational Modeling in Neuroscience, by Sterratt, Graham, Gillies, and Willshaw, Cambridge Press, 2014. This is a very readable text on computational neuroscience.
- Ion Channels of Excitable Membranes, by Bertil Hille, Sinauer Associates Press, 2001. This is the best book out there on the biophysics of ion channels and their role in electrical excitability.
- Nonlinear Dynamics and Chaos, by Steve Strogatz, Westview Press, 2001. This is the best introductory book on nonlinear dynamical systems, and is very readable.

Course Topics: Topics include passive and active neural membranes, the Hodgkin-Huxley model and simpler versions of it, linear stability analysis and bifurcations, more sophisticated neural models, coupling between neurons, firing rate models of neural networks, and intracellular signaling.

Course Objective: To convey how modeling and computer simulations can provide useful information about neurons and networks of neurons. The focus will be on conceptual ideas, and not on sophisticated mathematical analyses or computer programming.

Computer Platform: Each student should have a laptop computer with the free XPPAUT software installed. Many of the class meetings will be computer based, requiring that computers be brought to class.

Expectations: You are expected to attend class, complete assignments and do an oral presentation (with a partner).

Assignments: There will be a number of in-class assignments involving computer simulations. You can mostly work through these in class, but should then write up a short (roughly 2 pages) report answering questions posed in the assignment. This is to be turned in at the next class meeting to avoid a 20% grade reduction for late work (late assignments accepted, with penalty, within 2 days of the due date).

Presentations: You will need to do an oral presentation with a partner. This will be a description of a computational neuroscience research article. Presentations will be done during the last weeks of the semester.

Grading: Students who attend class and successfully complete all assignments and the presentation will receive a grade of A or A^-. Lower grades will be given in cases where some of the work is not successfully completed.

Honor Code: A copy of the University Academic Honor Code can be found in the current Student Handbook. You are bound by this in all of your academic work. It is based on the premise that each student has the responsibility 1) to uphold the highest standards of academic integrity in the student's own work, 2) to refuse to tolerate violations of academic integrity in the University community, and 3) to foster a high sense of integrity and social responsibility on the part of the University community. You may discuss homework assignments with other students in the class, but the work you turn in must be your own. Plagiarizing the work of others is academically dishonest and will result in a grade of 0.

American Disabilities Act: Students with disabilities needing academic accommodations should: 1) register with and provide documentation to the Student Disability Resource Center (SDRC); 2) bring a letter to the instructor from SDRC indicating you need academic accommodations. This should be done within the first week of class.