**CMSC2xx: Introduction to Computational Methods in Neuroscience (Tentative Syllabus) Best times?**

1. **Basic Biology and Chemistry for Computational Neuroscience**
   1. **Introduction to Biology and Chemistry and its application in Computational Neuroscience.**
   2. **How we apply Computer Science to Neuroscience**
   3. **HW Readings and essay**
2. **Intro to NEURON**
   1. **What is it and why do we use it?**
   2. **HW: Neuron tutorial A/B**
3. **Advanced NEURON**
   1. **Discuss the advanced topics and what can be done with them.**
   2. **HW: Neuron tutorial C**
4. **Introduction to Brain Data**
   1. **Signal Data**
      1. **Different types of Signal Data we can collect**
      2. **Basic ways of analyzing such data**
   2. **Imaging Data**
      1. **Different types of Imaging Data we can collect**
      2. **Basic ways of analyzing such data**
   3. **HW Reading and essay**
5. **Introduction to Data Analysis** 
   1. **Linear Regression**
   2. **Logistic Regression**
   3. **HW:**
6. **Intermediate Data Analysis**
   1. **Support Vector Machines**
   2. **Neural Networks (ANNs, CNNs, RNNs)**
   3. **HW:**
7. **Signal Processing**
   1. **Introduction to signals**
   2. **Fast Fourier Transform**
   3. **HW:**
8. **Signal Processing**
   1. **Wavelet Transform**
   2. **Extracting data from coefficient matrices**
   3. **HW:**
9. **Intro to Graph Theory for Computational Neuroscience**
   1. **HW:**
10. **Intro to Connectomics**
    1. **What is it and why it's important?**
    2. **Difference between functional and structural connectivity**
    3. **How to analyze preprocessed fMRI data to generate a brain graph**
    4. **HW:**
11. **EM Properties basics and advanced**
    1. **Explain EM properties and how they apply to Sim4life**
    2. **HW: Readings and essay**
12. **Explain neuron solver**
    1. **Explain the basics of neuron solver and how it works**
    2. **Homework neuron solver tutorial**
13. **Network connections** 
    1. **Explain the basics of network connections and how it works**
    2. **How we have used it.**
    3. **Homework networking tutorial**
       1. **Extra credit do it with an actual neuron (Cassara, your own etc)**

**GITHUB STUFF:**

**Week 1**

Questions to be answered by the end of the class:

* How does a neuron’s action potential work?
* What is the anatomy of a neuron?
* How can the action potential of a neuron get modeled using computational neuroscience?
* How do ions in neurons work, and why is that important?
  + Supplementary material:
    - <https://www.khanacademy.org/science/biology/ap-biology/ap-human-biology#ap-neuron-nervous-system>
    - <https://www.sciencedaily.com/releases/2018/10/181018141057.htm>

Here is a great read for why you should be really excited to be learning computer science and Neuroscience!

* <https://www.quora.com/What-are-areas-of-neuroscience-that-intersect-with-computer-science>

**Week 2**

Questions to be answered by the end of the class:

* What is NEURON?
* Where did it come from, and why is this why what we use?
* What is Hodgkin-Huxley and why it is important?
* Why we compartmentalize?
* What is ModelDB and why do we care?
* Cool readings on HOC (supplemental)
  + All papers from one of the creators of NEURON (pick whatever interests you): <https://scholar.google.com/citations?user=lgVfVg0AAAAJ&hl=en&oi=sra>

The First Tutorial: <http://web.mit.edu/neuron_v7.4/nrntuthtml/tutorial/tutA.html>

The Second Tutorial: <http://web.mit.edu/neuron_v7.4/nrntuthtml/tutorial/tutB.html>