8.10.2024 Day 2.

Modeling in neuroscience

Hodgkin-Huxley model

Main tasks for today:

1. What do people do here? Let’s find out!
2. Learn the basics of basal ganglia system.
3. Familiarize yourself with a paper on deep brain stimulation during Parkinson’s disease.

We will implement a Hodgkin-Huxley model of a part of basal ganglia system based on:

<https://pubmed.ncbi.nlm.nih.gov/21984318/>

<https://link.springer.com/article/10.1023/B:JCNS.0000025686.47117.67>

We will study STN, GPe and GPi nuclei in a “healthy” state of the network.

1. Download a Python notebook on the topic using github repository.
2. Familiarize yourself with different types of computational models and different levels of computational modelling.
3. To model a system, let’s delve into what is *a neuron* and how does it transmit action potential through its *synapses*.

A primer on the topic could be found here:

<https://qbi.uq.edu.au/brain-basics/brain/brain-physiology/action-potentials-and-synapses>

1. In a notebook let’s find out what is Hodgkin-Huxley model.
2. Let’s go through the notebook and learn what are the essential parts of the code to solve a system of differential equations that represent the part of basal ganglia network in a “healthy” state.

Learning outcomes:

1. Getting familiar with basic brain structure.
2. Learning about basal ganglia system.
3. Learning about Parkinson’s disease and computational modelling related to it.
4. Learning about types of models in computational neuroscience.
5. Learning about the Hodgkin-Huxley model.
6. Implementing Hodgkin-Huxley model in Python.