first meeting minutes

model fitting to personalized data

Goal: personalize Brain dynamics that cause e.g. depression. i.e. we want to find the connections that are indicative of a “depressed brain” to find ways to personalize medical treatment.

Methods: Neuro imaging device, or MRI data = we get signals, make models, models consist of nodes, and each node is an oscillator-system with unclear interconnectedness in itself.

The project consists of three teams:

-Coupling function

This team works with the kuramoto model:

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If the phase difference between j and I (theta j – theta i) is close to 90, the function will have a great value. Small phase difference, small value. The problem is if we were to find a ping related coupling function, what would it look like. Ping model does not utilize phase difference, rather it deals with the interaction of E and I- cells. Use machine learning approaches to find the coupling function with a data-driven approach. create a coupling function with the least error, basically.

First implement free form transfer function and gradient descent to make error adjustments.

Next use the function in a ping model

Finally use real data.

-Connectome fit

Create a model which correctly predicts oscillator (node) internal connectivity based on given data i.e. model that creates optimal topology of connectome.

Both of this and the first team works with hierarchical Kuramoto models.

-Ping model

E and I cells will naturally organize in to a mechanic where they counteract each other. The job of this group is to take the Ping model and create a functioning python version, which will have a type of UI, where one can specify uni-or bidirectionally connected nodes, which are made up of E and I cells.

First, Generate a Ping model time series = proof of concept

The general rule of Ping is the function between coupling and order. Basically, you need to prove that when there is high coupling, synchronization (order) is high.

We agreed to spend a week getting familiar with these concepts and meet again next Monday (22.1.)

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