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Project Proposal
GSP on the Digital Reconstruction of the Brain

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Introduction and Data

The goal of this project is to explore a digital reconstruction of the brain through graph signal processing techniques. In 2015 the Blue Brain Project published the first digital reconstruction of the microcircuitry of the somatosensory cortex of a juvenile rat [1]. In this project we will focus on data coming from this reconstruction. Part of the data is public available at https://bbp.epfl.ch/nmc-portal/welcome. Additionally the Blue Brain Project provided us with data coming from simulations and analyses of the digital microcircuit. This data set is already clean. Therefore we will strongly focus on further data analyses and exploration.

Goal

We will build our network using the structural connections between the $\sim$ 31000 neurons of the reconstruction. First, we will use spectral clustering to retrieve some information about the neurons. For instance, if the clustering will classify neurons into morphology type, electrical type or by their physical position. We will compare this classification with the one we will do on a Brunel Network, an artificial neural network. Furthermore, we will add signal on the neurons using the data coming from the simulations. In this setting, we will use graph signal processing to analyze our network.

References

[1] Markram, Henry et al. *Reconstruction and Simulation of Neocortical Microcircuitry*, Cell, Volume 163, Issue 2, 456-492.