Contribution ID: **37** Type: **not specified**

Estimating the structure of lateral interactions in a computational model of cortical networks

Thursday 9 November 2023 16:35 (5 minutes)

Cortical activity patterns, such as those that arise in response to sensory input, depend on the recurrent interaction structure within the cortical network. In the early developing ferret visual cortex, cortical network activity is organized into modular, distributed patterns [Smith et al., 2018]. Computational models have shown that modular patterns can emerge from a lateral interaction motif of local excitation and lateral inhibition (LELI). The statistical features of modular activity patterns, especially their dimensionality and their long-range correlations can be explained by assuming a mild degree of heterogeneity in the LELI interactions. However, the precise structure of this heterogeneity within the cortical network and how it impacts distributed activity patterns is unclear at present. Here, we studied within a recurrent network model how well we can estimate this interaction structure, from samples of input to the network and the corresponding network output activity patterns. We modeled the heterogeneous LELI interaction introducing various shapes of heterogeneity to an isotropic and homogeneous LELI interaction. The strengths of these various heterogeneous components are controlled by parameters d. We used a target model, with predetermined heterogeneity, to perform in silico experiments and generate input/output patterns. We then explored to what degree we can estimate this heterogeneity using a trainable model by fitting its parameters d in order to reproduce the same input/output mapping of the target model. To test the limit of this approach, we varied the strength and structure of the heterogeneity of the target model and assess how the fits are affected when the strength of heterogeneity increases and when different types of heterogeneity are used. Our results indicate that at least for the in silico experiments, already a small number of input/output patterns allows approximating the local interaction structure in recurrent networks that produce modular activity. This work suggests the possibility of applying this framework to in vivo experimental data to estimate the structure of network heterogeneity within developing cortical networks.

Presenter: BUTTI, Lorenzo (FIAS)

Session Classification: Session 7