Conference in Numerical Analysis 2014 (NumAn 2014)
September 2-5, 2014
Chania, Greece

Do Brain Networks Evolve by Maximizing Flow of Information?

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Abstract

In this talk, I will first present unexpected structural and functional similarities we have, recently, been able to find in the *C.elegans* and human brain networks. Based on these findings, we then propose an appropriately constructed model for the evolution of such networks by adding and retaining new connections between neurons of the network that lead to a subsequent increase of the upper bound of Mutual Information Rate (MIR), a quantity related to the amount of information the brain network can process. This idea is reminiscent of the Hebbian rule of learning and synaptic plasticity. I will show the ability of our model for brain evolution to capture important properties, such as synchronization and upper bound of MIR patterns, of realistic already evolved brain networks. Finally, I will comment on some of the computational aspects arising in this study, like numerical integration methods, accuracy and computation time regarding the serial or parallel implementation of the model.

Key words:
Brain networks, Evolutionary process, Hindmarsh-Rose dynamics, Synchronization, Mutual Information Rate (MIR), Upper bound of MIR