BMC Neuroscience

Poster presentation

Identifying spike-timing dependent plasticity in spike train models of synaptically-coupled neuronal ensembles

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from Sixteenth Annual Computational Neuroscience Meeting: CNS*2007
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, **8**(Suppl 2):P193 doi:10.1186/1471-2202-8-S2-P193

Identifying plasticity in cortical neural ensembles is important in studying systems neuroscience to permit tracking the dynamics of biological cortical networks during learning and behavior. Recently, we proposed an algorithm to identify clusters of neurons that exhibit functional interdependency in local and global contexts across multiple time scales. In this paper, we examine the applicability of the algorithm to identify and track functional plasticity in a probabilistic point process model of integrate and fire neural network with time varying synaptic coupling. Three types of coupling between the neurons are considered: auto-inhibition, cross-inhibition, and excitation. A stimulus-dependent synaptic plasticity is induced randomly to mimic artificial sensory inputs. The results demonstrate that when the stimulus input duration increases such that new synaptic coupling occurs between otherwise uncoupled neurons, the algorithm correctly identifies the change in the circuit topology indicated by the number of clusters of functionally interdependent neurons and their labels. We report the clustering performance of the approach applied to simulated data with spontaneous activity as well as a stimulus driven activity across multiple trials.