
*Thursday, November 20th, 2014
13h30, Room AAC 132*

Computational Neuroscience Seminar

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Phase Transition in an Excitatory Integrate-and-Fire Neural Network

In a neural network, when a cell emits an action potential, it activates the downstream synapses. It implies, with a certain probability, the release of neurotransmitters. The flow of positively charged ions into the postsynaptic cell raises (depolarizes) the membrane potential, bringing it closer to threshold (excitatory postsynaptic potentials, EPSP). Assuming an all-to-all coupling, when a neuron fires, each cell of the network should be affected by the action potential. Nonetheless, since the release of neurotransmitters is stochastic, the depolarization of the postsynaptic membrane potential only occurs according to a certain probability. As a result of neurotransmitters releases, the firing of a neuron may bring the postsynaptic cell to the threshold. Consequently, the postsynaptic neuron may fire and bring another cell to the threshold, and so on. There is then a possibility of a domino effect in which many of the neurons fire in unison. The stochastic system exhibits what physicists call a non-equilibrium phase transitions. We study under which circumstances, the phase transition occurs.