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Modelization of membrane potentials and information transmission in large systems of neurons

In a first part of the talk, we present a stochastic model for information transmission in large systems of neurons. Here the membrane potential in the single neuron is modelled as a Cox-Ingersoll-Ross type diffusion with explicit time dependence in the drift, and spike generation in this neuron is conditionally Poisson. We give a limit theorem which shows how a large system of neurons processing the same signal can transmit this signal up to some small deformation of its shape.

In a second part of the talk, we consider a set of data where the membrane potential in a pyramidal neuron in the cortex is recorded under different experimental conditions. We use nonparametric estimates for diffusion coefficient and drift to make appear three types of diffusion processes which provide realistic models for the membrane potential in this type of neuron.