On some stochastic neuronal models

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Neuronal data are of different types: at the scale of a single neuron (intra-cellular data), of a set of hundred neurons (extra-cellular data) or at the scale of a region of the brain (fMRI, EEG, MEG data). Neuronal data are intrinsically stochastic.

In this lecture, I will present an overview of stochastic models that have been proposed to describe neuronal data at different scales: stochastic differential equations either elliptic or hypoelliptic, Hawkes processes, functional processes.

I will explain the link between the different models, and recent advances in understanding networks of neurons, how different populations of neurons interact and synchronize. Then I will give an overview of statistical inference methods that have been proposed in the literature to estimate these models from the available data.