Department of Statistics

SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

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A Biophysically Inspired Point Process Encoding Model for Extracting Synaptic Conductances from Extracellular Spike Train Data

THURSDAY, November 13, 2014 at 4:30 PM
133 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

Sensory neurons respond to stimuli in a manner that depends on the integration of excitatory and inhibitory synaptic inputs. In this talk, I will describe a novel point process model, an extension of the well-known generalized linear model (GLM), that can characterize the tuning of a neuron's excitatory and inhibitory synaptic inputs from its extracellularly recorded spike responses. This work makes two novel theoretical contributions: first, we show that the standard Poisson generalized linear model can be written as a conductance-based model in which the stimulus linearly modulates excitatory and inhibitory conductances in an equal and opposite "push-pull"' fashion. Second, we relax these assumptions to obtain a more flexible, biophysically realistic model in which conductances have distinct tuning and nonlinear stimulus dependence. The resulting conductance-based model can exhibit stimulus-induced changes in both gain and dynamics, providing a more flexible and more biophysically accurate description of neural spike responses. Using data from primate retinal ganglion cells, I will show that the model can predict excitatory and inhibitory synaptic conductances with nearly the same accuracy as a model fit directly to intracellular measurements.

Organizers:
Lek-Heng Lim, Department of Statistics, lekheng@galton.uchicago.edu, Ridgway Scott, Departments of Computer Science and Mathematics, ridg@cs.uchicago.edu, Jonathan Weare, Department of Statistics and The James Franck Institute, weare@uchicago.edu. SSC Seminar URL: http://www.stat.uchicago.edu/seminars/SSC_seminars.shtml.

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