



BOSTON UNIVERSITY STATISTICS  
AND PROBABILITY SEMINAR SERIES

**Response dynamics of Leaky  
Integrate-and-Fire neurons**

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Thursday, January 24, 2008, 4:30-5:30pm  
Mathematics and Computer Science (MCS) Building, Room 149  
111 Cummington Street, Boston

Tea and Cookies at 4:00pm in MCS 153

**Abstract:** This work focuses on determining the response dynamics of the Leaky Integrate-and-Fire model (LIF). The LIF is the simplest neuron model that captures the essential properties of neuronal signaling: integration of inputs by a leaky, capacitive cell membrane, a voltage threshold leading to the generation of a stereotyped action potential, and a subsequent repolarization of the voltage. As a first step the response dynamics, we compare the firing rate response of the LIF to modulations in the mean of the input and to modulations in the variance of the input, and make this comparison for a range of baseline mean and variance levels that span the two basic regimes of LIF behavior. When synapses are instantaneous, we find that the response properties for changes in the variance are quite different than for changes in the mean. Additionally, the filtering properties of the model are strongly dependent on which input parameter is perturbed, as well as the underlying regime of firing behavior. Finally, many of the response differences to perturbations in the variance versus the mean can be understood by noting that ensemble firing rate depends on a multiplicative, and hence non-linear, interaction between separate underlying factors.

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For directions and maps, please see <http://math.bu.edu/research/statistics/statseminar.html>.