

Romain Brette

What is the integration time constant of neurons?

Because the membrane potential relaxes to equilibrium after stimulation, two synchronous input spikes are more likely to make a neuron fire than two widely separated spikes. The characteristic time that separates these two behaviors is called the integration time constant. Classically, one relates it to the membrane time constant or to the half-width of postsynaptic potentials, implicitly assuming that effects on the membrane potential directly transfer to spiking probabilities. However, the threshold introduces nonlinearities in the input-output relationship. I will show that the integration time constant of neurons is in fact shorter than expected and depends on the statistics of background activity, the synaptic weights and threshold properties. It implies that neurons are very sensitive to fine correlations in their inputs.