

Title:

Nonuniversal collective dynamics of QIF neurons with Lorentzian heterogeneity

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Abstract:

Low-dimensional mean-field descriptions of neuronal networks are a powerful tool for studying the collective behavior of a large number of interacting neurons. Recently, an exact mean-field reduction has been achieved for quadratic integrate-and-fire (QIF) neurons that are coupled with electrical synapses. The resulting firing rate equations are surprisingly simple when assuming a Lorentzian distribution of input currents, but this form of heterogeneity has been reported to lead to nonuniversal results in the theory of coupled oscillators. Here, we uncover paradoxical effects in networks of electrically coupled QIF neurons when changing the input distribution from Lorentzian to Gaussian. Importantly, these effects are captured by low-dimensional firing rate equations with near-Gaussian heterogeneity.