BMC Neuroscience

Oral presentation

Open Access

Non-renewal Markov models for spike-frequency adapting neural ensembles

Eilif Muller*, Johannes Schemmel and Karlheinz Meier

Address: Kirchhoff Institute for Physics, University of Heidelberg, Heidelberg, Germany

Email: Eilif Muller* - emueller@kip.uni-heidelberg.de

* Corresponding author

from Sixteenth Annual Computational Neuroscience Meeting: CNS*2007
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, **8**(Suppl 2):S12 doi:10.1186/1471-2202-8-S2-S12

We present a continuous Markov process model for spike-frequency adapting neural ensembles which synthesizes existing mean-adaptation approaches and inhomogeneous renewal theory. Unlike renewal theory, the Markov process can account for interspike interval correlations, and an expression for the first-order interspike interval correlation is derived. The Markov process in two dimensions is shown to accurately capture the firing-rate dynamics and interspike interval correlations of a spike-frequency adapting and relative refractory conductance-based integrate-and-fire neuron driven by Poisson spike trains. Using the Master equation for the proposed process, the assumptions of the standard mean-adaptation approach are clarified, and a mean+variance adaptation theory is derived which corrects the mean-adaptation firing-rate predictions for the biologically parameterized integrate-and-fire neuron model considered. An exact recipe for generating inhomogeneous realizations of the proposed Markov process is given.