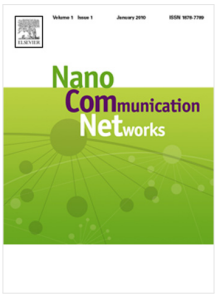
Accepted Manuscript



Detection in neuronal communications with finite channel state

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PII: S1878-7789(16)30030-8
DOI: http://dx.doi.org/10.1016/j.nancom.2017.08.002
Reference: NANCOM 189

To appear in: *Nano Communication Networks*

Received date : 14 September 2016
Revised date : 9 May 2017
Accepted date : 7 August 2017

Please cite this article as: A. Amiri, S. Salehkalaibar, B. Maham, Detection in neuronal communications with finite channel state, *Nano Communication Networks* (2017), http://dx.doi.org/10.1016/j.nancom.2017.08.002

Detection In Neuronal Communications with Finite Channel State

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Abstract

Nano-networks are the key factors in developing future nano-machines. The use of molecules to transmit information in such networks is the subject of molecular communications. The future of the nano-networks depends on the development of the molecular communications. Neuro-synaptic communication, which models the data transmission in the body nervous system, is an important example of molecular communication. In this paper, we introduce a comprehensive channel model for the neuro-synaptic communication channel. Our model incorporates the effect of different channel states and spike rates that exist in the body nervous system. We propose a finite state Markov channel scheme for the communication system. This scheme has a two dimensional state space according to the neural firing rate and the number of available carrier resources. Next, we suggest an M-ary signaling scheme for the synaptic area that models the synaptic multi-site activity. In this activity, several neuronal endpoints participate in the neurotransmitter release process. Moreover, we obtain a closed-form solution for the detector at the destination neuron. Finally, we evaluate the decision rules in the detector with simulations.

Keywords:
Molecular communications, Neuro-synaptic communications, Finite state Markov channel, MAP detector.

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