Azhar, Feraz; **Anderson, William S.**

Predicting single-neuron activity in locally connected networks. (English) Zbl 1268.92018

Neural Comput. 24, No. 10, 2655-2677 (2012).

Summary: The characterization of coordinated activity in neuronal populations has received renewed interest in the light of advancing experimental techniques that allow recordings from multiple units simultaneously. Across both in vitro and in vivo preparations, nearby neurons show coordinated responses when spontaneously active and when subject to external stimuli. Recent work [*W. Truccolo*, *L.R. Hochberg* and . *P. Donoghue*, Collective dynamics in human and monkey sensorimotor cortex: predicting single neuron spikes. Nat. Neurosci. 13, 105–111 (2010)] has connected these coordinated responses to behavior, showing that small ensembles of neurons in arm-related areas of the sensorimotor cortex can reliably predict single-neuron spikes in behaving monkeys and humans.

We investigate this phenomenon using an analogous point process model, showing that in the case of a computational model of the cortex responding to random background inputs, one is similarly able to predict the future state of a single neuron by considering its own spiking history, together with the spiking histories of randomly sampled ensembles of nearby neurons. This model exhibits a realistic cortical architecture and displays bursting episodes in the two distinct connectivity schemes studied. We conjecture that the baseline predictability we find in these instances is characteristic of locally connected networks more broadly considered.

MSC:

92C20 Neural biology
92B20 Neural networks for/in biological studies, artificial life and related topics
60G55 Point processes (e.g., Poisson, Cox, Hawkes processes)
92-08 Computational methods for problems pertaining to biology

Full Text: DOI

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