Abstract View

ENTRAINMENT BY SYNCHRONIZED INHIBITION BOOSTS INFORMATION TRANSFER IN NEOCORTICAL NEURONS.

J.V. Jose[1*]; P.H. Tiesinga[1,2]; J.M. Fellous[3]; T.J. Sejnowski[2,3]

1. Ctr Interdiscip Res Complex Syst, Northeastern Univ, Boston, MA, USA
2. Sloan Center for Theoretical Neurobiology, Salk Institute, La Jolla, California, CA, USA
3. Howard Hughes Medical Inst,, Salk Institute, La Jolla, California, CA, USA

Synchronized electrical activity due to the firing of action potentials by neurons in synaptically connected networks is ubiquitous in the nervous system. We investigate, theoretically and experimentally, the ability of a single pyramidal neuron to transduce the information content of a synchronized inhibitory synaptic drive, generated by an interneuron network, into an information-rich output of neuron spike times. The neuron is entrained to the periodic network drive when the jitter in the input spike times is sufficiently small (i.e. high precision), and the number of presynaptic spikes during one drive cycle is sufficiently large. The Shannon entropy of the output of spike times is reduced sharply during entrainment. Surprisingly, however, the amount of transduced information as measured by the mutual information is significantly increased during entrainment. This increase is due to the reduced contribution of the internal dynamics to the output variability. This has consequences for the regulation of cortical information processing by neuromodulators.
Supported by: Northeastern CIRCS fund, Sloan Foundation and the Howard Hughes Medical Institute.

close