Abstract View

NEURAL CODING IN MODELS OF CORTICAL NEURON NETWORKS

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In previous work we have reported that simulated networks of Hodgkin-Huxley neurons with inhibitory feedback produce output spike trains whose rate is directly proportional to the intensity of an applied input current waveform. In addition, noise is suppressed at higher and higher frequencies in the composite output spike train (combination of the spike trains from all of the neurons) as the average input drive is increased and as neurons are added. This allows the transmission of information with large bandwidths despite the slow and imprecise characteristics of individual neurons and synapses. These results have now been extended to the case with spike train inputs, synaptic dynamics of facilitation and depression, and synaptic noise from intracortical connections, as found in vivo. Input/output fidelity and spectral noise power are used as a metric to rank different network configurations. Trials were conducted first with global inhibitory feedback and then with both inhibitory and excitatory feedback incorporating fast spiking inhibitory neurons in the microcircuit. Repeating spatiotemporal patterns in the neuron ensemble were found through cross correlation and compared for similarity across different network configurations with the input spike train held constant. The information content of these patterns was estimated as a percentage of the total information in the composite output spike train.

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