Abstract View

A BIOPHYSICAL NEURONAL MODEL EXPLORING ATTENTION MECHANISMS IN VISUAL CORTEX

J.Mishra[1*]; J.M.Fellous[2]; T.J.Sejnowski[1,2]

1. Div. of Biological Sci., UCSD, La Jolla, CA, USA
2. CNL, The Salk Inst., La Jolla, CA, USA

Neurons in areas V2 and V4 exhibit stimulus specific tuning. When two stimuli that are differentially preferred by a V4 neuron are simultaneously presented within its receptive field, its response to the pair is intermediate between the responses to either of the two stimuli presented alone. When the animal attends to one of the two stimuli, the neuronal response shifts from the pair response towards what would be its response if the stimulus were presented alone. In addition, the effect of attention when single stimuli are presented is to enhance the response sensitivity of the neuron.
The intrinsic and network mechanisms that result in these effects are investigated in a realistic multi-compartmental biophysical model of a reconstructed cat visual cortical neuron with thousands of excitatory and inhibitory dynamical synapses. The neuron received stimulus independent background inputs and feedforward synaptic inputs from two V2 populations that represented its preferred and non-preferred stimuli. We found that the best stimulus tuning was generated when the V2 populations differed in the number of projecting synapses, rather than in their firing rates or synaptic strengths. The pair response when both input populations to the neuron were active could be generated if feedforward inhibition was broadly tuned. Sharply tuned or stimulus specific inhibition devoid of interactions amongst interneuronal populations could not produce a significantly intermediate pair response. Aspects of attention could be simulated in the neuron through correlations amongst its input spike trains and via enhanced variations in the firing of top-down background feedback synapses.
Support Contributed By: Howard Hughes Medical Institute

Citation:J. Mishra, J.M. Fellous, T.J. Sejnowski. A BIOPHYSICAL NEURONAL MODEL EXPLORING ATTENTION MECHANISMS IN VISUAL CORTEX Program No. 331.14. 2004 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2004. Online.