Equilibrium properties of temporally asymmetric Hebbian plasticity

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Abstract:

A theory of temporally asymmetric Hebb rules, which depress or potentiate synapses depending upon whether the postsynaptic cell fires before or after the presynaptic one, is presented. Using the {Fokker-Planck} formalism, we show that the equilibrium synaptic distribution induced by such rules is highly sensitive to the manner in which bounds on the allowed range of synaptic values are imposed. In a biologically plausible multiplicative model, the synapses in asynchronous networks reach a distribution that is invariant to the firing rates of either the presynaptic or postsynaptic cells. When these cells are temporally correlated, the synaptic strength varies smoothly with the degree and phase of their synchrony.

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