Quantitative Biology > Neurons and Cognition

Input-Dependent Suppression of Chaos in Recurrent Neural Networks

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Neuronal activity arises from an interaction between ongoing firing generated spontaneously by neural circuits and responses driven by external stimuli. Using mean-field analysis, we ask how a neural network that intrinsically generates chaotic patterns of activity can remain sensitive to extrinsic input. We find that inputs not only drive network responses, they also actively suppress ongoing activity, ultimately leading to a phase transition in which chaos is completely eliminated. The phase transition reveals a resonant frequency at which input is most effective at suppressing chaos even though the power spectrum of the spontaneous activity peaks at zero and falls exponentially. In the spatial domain, inputs suppress chaos most effectively when they match the spatial pattern of the leading principal component vectors of the spontaneous network activity.

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