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A Maximum Entropy Model Applied to Temporal Correlations in Cortical Networks WEI CHEN, AONAN TANG, JON HOBBS, JODI L. SMITH, HEMA PATEL, ANITA PRIETO, JOHN BEGGS, Indiana University, DAVID JACKSON, Brown University, DUMITRU PETRUSCA, MATTHEW I. GRIVICH, ALEXANDER SHER, ALAN M. LITKE, University of California, Santa Cruz — Multi-neuron firing states are often observed, yet are predicted to be rare by models that assume independent firing. To predict these states, two groups recently applied a second-order maximum entropy model that used only observed firing rates and pairwise interactions as parameters (Schneidman et al., 2006; Shlens et al., 2006). Interestingly, these models predicted 90-99% of network correlations. If generally applicable, this approach could vastly simplify analyses of complex networks. However, this work did not address the temporal evolution of correlated states. We applied the model to multielectrode data from cortical slices and cultures. In 8/13 preparations the observed sequences of correlated states were significantly longer than predicted by concatenating states from the model. We found a significant relationship between strong pairwise temporal correlations and observed sequence length, suggesting that pairwise temporal correlations may allow the model to be extended into the temporal domain.

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