Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Criticality in neural ensembles: a mean field approach to expand network size from measured data VAIBHAV WASNIK, Department of Physics, Simon Fraser University, BARAK CARACHEO, JEREMY SEAMANS, Brain Research Center, University of British Columbia, ELDON EMBERLY, Department of Physics, Simon Fraser University — At the point of a second order phase transition also termed as a critical point, systems display long range order and their macroscopic behaviours are independent of the microscopic details making up the system. This makes the idea of criticality interesting for studying biological systems which even though are different microscopically still have similar macroscopic behaviours. Recent high-throughput methods in neuroscience are making it possible to explore whether criticality exists in neural networks. Despite being high-throughput, many data sets are still only a minute sample of the neural system and methods towards expanding these data sets have to be considered in order to study the existence of criticality. Using measurements of firing neurons from the pre-frontal cortex (PFC) of rats, we map the data to a system of Ising spins and calculate the specific heat as a function of the measured network size, looking for the existence of critical points. In order to go to the thermodynamic limit, we propose a mean field approach for expanding such data. Our preliminary results show that such an approach can capture the statistical properties of much larger neuronal populations even when only a smaller subset is measured.

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Date submitted: 07 Jan 2014 Electronic form version 1.4