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UniEnt: uniform entropy model for the dynamics of a neuronal population[1] DAMIAN HERNANDEZ LAHME, Department of Physics, Emory University, ILYA NEMENMAN, Department of Physics and Department of Biology, Emory University — Sensory information and motor responses are encoded in the brain in a collective spiking activity of a large number of neurons. Understanding the neural code requires inferring statistical properties of such collective dynamics from multicellular neurophysiological recordings. Questions of whether synchronous activity or silence of multiple neurons carries information about the stimuli or the motor responses are especially interesting. Unfortunately, detection of such high order statistical interactions from data is especially challenging due to the exponentially large dimensionality of the state space of neural collectives. Here we present UniEnt, a method for the inference of strengths of multivariate neural interaction patterns. The method is based on the Bayesian prior that makes no assumptions (uniform a priori expectations) about the value of the entropy of the observed multivariate neural activity, in contrast to popular approaches that maximize this entropy. We then study previously published multi-electrode recordings data from salamander retina, exposing the relevance of higher order neural interaction patterns for information encoding in this system.

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