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Titulo: Criticality of the Brain

Resumo:

The activity of the resting state of the brain exhibits avalanches of spiking activity of sizes that follow a power-law distribution. I will present self-organized and driven models that do reproduce avalanches fulfilling the scaling laws of a general theory for crackling noise. The power spectrum, however, does not agree with this theory. We explain this deviation by establishing a phase diagram involving the fraction of inhibitory neurons and finding that the brain operates at a certain distance from the critical point. In an alternative attempt to grasp brain criticality we investigate the spiking patterns of in vitro and in vivo neural systems mapping them to a fully connected Ising model with local fields and interaction constants which are obtained by a Boltzmann machine. The distributions of these fields and interaction constants seem to be universal. A Monte Carlo simulation suggests that this Ising system operates at a critical point separating a ferromagnetic from a paramagnetic phase.