

A Neural Mechanism for the generation of Non-Critical Power laws

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It is common knowledge that “a healthy cortex is a well-balanced cortex”, this balance allowing to operate near criticality and thus optimize information processing and computation. Here we analyze the meaning of “balance” in a noisy system of excitatory and inhibitory neurons and clarify its relation with criticality. The regime of balance produces a “reactive” system, characterized by an avalanching-like (finite size) behavior where the system wanders through an almost-linear phase space which is very wide with respect to the noise level. The mathematical rationale of “non-normal” forms allows to explain the emergence of a non-differentiable manifold close to the fixed point, as well as the anomalously large transient behavior which is the proxy for avalanches. Moreover, we show that the described mechanism is not a peculiarity of the excitatory/inhibitory framework, but applies to a wider scenario, for example if regulation is implemented by synaptic plasticity.