Date: October 4, 2007.

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Title: Neuronal Avalanches and Brain Plasticity.

Abstract: Cortical networks exhibit diverse patters of activity, including oscillations, synchrony and waves. During neuronal activity, each neuron can receive inputs by thousands of other neurons and, when it reaches a threshold, redistributes this integrated activity back to the neuronal network. Recently it has been shown that another mode of activity is neuronal avalanches, experimentally found in organotypic cultures. Moreover, experimental studies of morphology indicate that neurons develop a network of small-world-like connections, with the possibility of a very high connectivity degree. We will discuss a recent model based on self-organized criticality, which consists of an electrical network with threshold firing and activity-dependent synapse strengths. The model is implemented on regular network, on small world lattices and on the scale-free Apollonian network. The system exhibits an avalanche activity with a power law distribution of sizes and durations. The power spectra of the electrical signal reproduce very robustly the power law behaviour with the exponent 0.8, experimentally measured in electroencephalogram (EEG) spectra. The exponents are found to be quite stable with respect to lattice type, neuronal parameters and strength of plastic remodelling, indicating that universality holds for a wide class of neural network models.

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