From Theory to Practice: How Ideas in Computational Neuroscience can be Translated into Neurotechnology

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A major goal of research in my lab is to translate insights from computational modelling of brain function into helpful neurotechnology. One line of research focuses on the theory of critical brain dynamics, namely, the idea that neural networks in the brain are poised on the border between two different phases of network dynamics. One phase is characterized by weak connectivity and premature termination of activity propagation, whereas the other phase is characterized by strong connectivity, which can lead to hallucinations and epileptic seizures. Computational theories suggest that this state is optimal for information processing. However, deviations from the critical state can manifest as neurological or neuropsychiatric disorders. Using quantitative measures from the theory of critical dynamics, we analyze EEG and MEG data and identify deviations from critical dynamics. The utility of these measures as neuromarkers will be demonstrated in the context of sleep deprivation, epilepsy and disorders of consciousness.

The talk will also describe our efforts to establish an active academic community that focuses on brain technologies and to incorporate the topic of brain tech in undergraduate and graduate programs.