May 15th, 2:00 PM - 3:00 PM

Plenary Talk: Data assimilation with applications to neuroscience

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Data assimilation is the study of merging partially-observed time series data with a model to estimate the full dynamics of a system. Methods such as the ensemble Kalman filter have had many successes in geophysical applications but only recently have been under consideration in neuroscience. This is a particularly challenging domain for state and parameter estimation due to the strongly non-linear models combined with large observation noise, a high-dimensional parameter space, and model uncertainty. In particular, we address approaches to inferring intracellular dynamics from extracellular measurements and tracking of neuronal network structure. We discuss recent practical improvements in adaptive filtering, and alternative approaches when model error is large or parts of the model are unknown. In the extreme case that no model is available, we propose a method using delay coordinate reconstruction that merges Kalman filtering with Takens' work on nonlinear data analysis.