Statistical inference for dynamical systems

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Abstract: Dynamical systems arise frequently as mathematical models of physical and biological systems that evolve over time. In this talk, I will discuss several questions regarding the theory and practice of performing statistical inference from time-series observations of dynamical systems. In particular, I will focus on the question of system inference; that is, how should one estimate the structure or parameters of a model using time-series data?

Recent theoretical results show that under suitable hypotheses maximum likelihood estimation (MLE) yields consistent estimates of the model as the number of observations tends to infinity. However, in some applied settings, MLE may be computationally intractable. In the specific setting of inference of gene regulatory networks from time-series gene expression data, I will discuss a recently developed estimation method that is computationally tractable. This talk is based on two projects: one is joint work with S. Mukherjee, A. Nobel, and N. Pillai, and the other is joint with X. Guo, A. Deckard, A. Leman, C. Kelliher, S. Haase, and J. Harer.