In building statistical models for complex systems in many cases we face two major problems: (1) how to choose relevant variables amongst many possible degrees of freedom, and (2) once we have chosen the relevant variables, how can we build meaningful statistical models for them? These questions are particularly important in cases where the phase space of the system, and the possible degrees of freedom are much larger than the number of data points available as samples from the system. Example include recordings from neuronal networks where only few neurons (compared to the whole network) can be observed for a relatively short period of time (compared to the size of the phase space), financial networks, etc. In this talk I will discuss some novel approaches to address these questions. I will first describe a method for selecting reverent variables from small number of samples from a system that are likely to carry meaningful information about what the systems is doing [1]. I will then describe a Bayesian model selection method for learning a sparse graphical model that can provide a statistical description of the data [2] that differ from existing methods for spare model selection in several key aspects.


For more information please go to: [http://www.physics.harvard.edu](http://www.physics.harvard.edu)

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