Building model prototypes from time-course data

A primary challenge in building predictive models from temporal data is selecting the appropriate network and the regulatory functions that describe the data. Equation learning (EQ) methods for differential equation (DE) models start with a collection of time course data and then "recovers" the governing equations using a library of functions. Many methods for EQ for DE models are based on formulating the inference problem as a parameter estimation problem that can be solved via optimization techniques. Analogue methods for equation learning of discrete models that can learn both the network and the functions are still under development. Some of these existing methods can provide network candidates (i.e., possible wiring diagrams) that can explain the data. Other methods can provide candidate functions based on interpolating the data. In this talk we introduce a method for building model prototypes that consist of a network and a set of functions that can explain the time course data. This prototype model can be used for simulations to compare with the actual data and then to perform interventions. The method uses a discretized version of average of the replicas over time. We use our toolbox to simulate the prototype model as a stochastic Boolean network. We applied our method to a set of gene expression data of several time-points with many replicas. Our method provides a model that can qualitatively reproduce the patterns of the original data. This method can further be used for attractor analysis and control of the initial models.