

Mathematical Sciences Colloquium

Michigan Technological University

Fisher Hall 127

October 24, 2014

1:05 p.m.

Variable Selection for High-Dimensional Nonparametric ODE Models with Applications to Dynamic Gene Regulatory Networks

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Abstract: The gene regulation network (GRN) is a high-dimensional complex system, which can be represented by various mathematical or statistical models. The ordinary differential equation (ODE) model is one of the popular dynamic GRN models. High-dimensional linear ODE models have been proposed to identify GRNs, but with a limitation of the linear regulation effect assumption. In this talk, I present a nonparametric ODE models, coupled with the two-stage smoothing-based ODE estimation methods and adaptive group LASSO techniques, to model dynamic GRNs that could flexibly deal with nonlinear regulation effects. The method has sound theoretical properties and some benefits in computational efficiency and estimation accuracy. An example for identifying the nonlinear dynamic GRN of T-cell activation is used to illustrate the application of this model.