Statistics Seminar

Department of Mathematics and Statistics

DATE:	Thursday, April 4, 2024
TIME:	1:15pm – 2:15pm
LOCATION:	WH 100E
SPEAKER:	Praveen Niranda, Binghamton University
TITLE:	Robust estimation for ordinary differential equation models

Abstract

Applied scientists frequently employ ordinary differential equations (ODEs) to model intricate dynamic processes found in various fields such as biology, engineering, and medicine. Estimating ODE parameters from noisy data, particularly in the presence of outliers, poses an intriguing yet challenging task. In this paper, the authors present a robust method to tackle this issue. They represent the dynamic process with a nonparametric function, formulated as a linear combination of basis functions. Estimation of the nonparametric function is achieved through a robust penalized smoothing approach. The penalty term is defined utilizing the parametric ODE model, thereby controlling the smoothness of the nonparametric function while preserving its fidelity to the ODE model. The estimation of basis coefficients and ODE parameters is performed through two nested levels of optimization. Treating coefficient estimates as an implicit function of ODE parameters enables the derivation of analytic gradients for optimization using the implicit function theorem. Simulation studies demonstrate that their robust method yields satisfactory parameter estimates for ODEs from noisy data containing outliers. Furthermore, they showcase the effectiveness of their approach by applying it to estimate parameters for a predator-prey ODE model using real ecological data.