

DREXEL ANALYSIS SEMINAR

April 28, 2023

12-1 PM, Korman 245

**Speaker:** Thomas Yu (Drexel)

**Title:** The Exact Line-Search Gradient Descent Method and Polynomial Optimization Problems

**Abstract:** It is well-known that the gradient descent method converges slowly for objectives with an ill-conditioned Hessian at the minimizer. In the case of exact line search GD, the mathematical analysis involves an interesting dynamical system, which the optimization literature usually avoids by analyzing only the worst-case rate of convergence (among all seed vectors) using the Kantovorich inequality. Using the dynamical system approach, we show that the average ROC slows down only when ill-conditioning is in cahoots with an intermediate eigenvalue of the Hessian. Amusingly, in the absence of an intermediate eigenvalue, the average ROC gets arbitrarily fast – not slow – when the Hessian gets increasingly ill-conditioned.

We shall also discuss the applications of exact line search GD to a couple of polynomial optimization problems arising from imaging and data sciences.