THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

Dissertation Defense:

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Sparsity, Nonconvexity and Geometric Constraints on Statistical Inverse Problems

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Jones 111, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

In this talk, statistical inverse problems with a focus on Bayesian approaches will be presented under sparsity, nonconvexity, and geometric constraints. The talk will cover novel methodologies for addressing these challenges across various contexts, including compressed sensing, dynamical systems learning, and parameter estimation of differential equations on Euclidean space and manifolds. The work encompasses various methodologies based on mean-field variational inference, ensemble Kalman methods, Bayesian optimization, and graph Gaussian process to obtain point estimates for the quantity of interest as well as comprehensive uncertainty quantification associated with it. How the introduced methods improve computational efficiency and accuracy in parameter estimation and uncertainty analysis across complex models will be showcased. This is achieved through a blend of theoretical analyses and numerical studies, inspired by a wide array of practical scenarios.