

## Data Science Seminar

Hosted by the Department of Mathematics and Statistics

- Date: Tuesday, April 15, 2025
- Time: 12:00pm - 1:00pm
- Room: Whitney Hall 100E
- Speaker: Dr. Min Xu (Rutgers University - New Brunswick)
- Title: Optimal Convex M-Estimation via Score Matching.

### ***Abstract***

In the context of linear regression, we construct a data-driven convex loss function with respect to which empirical risk minimisation yields optimal asymptotic variance in the downstream estimation of the regression coefficients. Our semiparametric approach targets the best decreasing approximation of the derivative of the log-density of the noise distribution. At the population level, this fitting process is a nonparametric extension of score matching, corresponding to a log-concave projection of the noise distribution with respect to the Fisher divergence. The procedure is computationally efficient, and we prove that it attains the minimal asymptotic covariance among all convex M-estimators. As an example of a non-log-concave setting, for Cauchy errors, the optimal convex loss function is Huber-like, and our procedure yields an asymptotic efficiency greater than 0.87 relative to the oracle maximum likelihood estimator of the regression coefficients that uses knowledge of this error distribution; in this sense, we obtain robustness without sacrificing much efficiency. Numerical experiments using our accompanying R package “asm” confirm the practical merits of our proposal. Joint work with Oliver Feng, Yu-Chun Kao, and Richard Samworth.

Biography of the speaker: Min is an assistant professor in the statistics department at Rutgers University. He received his PhD from Carnegie Mellon University and was a post-doc in the Wharton School of the University of Pennsylvania. Min is an associate editor of *The American Statistician* and one of the main organizers of the IMS International Conference on Statistics and Data Science (ICSDS) from 2023 to 2025. His research on nonparametric estimation and network data analysis is supported by generous grants from NSF and NIH.

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