



香港中文大學統計學系

Department of Statistics
THE CHINESE UNIVERSITY OF HONG KONG

SEMINAR

DEPARTMENT OF STATISTICS

THE CHINESE UNIVERSITY OF HONG KONG

Monotone Curve Estimation via Convex Duality

INVITED SPEAKER

Tongseok Lim

Assistant professor

Quantitative Methods Department

Purdue University's Daniels School of Business

TIME

July 15th, 2025 (Tue) · 2:30 pm - 3:30 pm

VENUE

LHC 103 (1/F) · Y C Liang Hall (LHC) · CUHK

ABSTRACT

A principal curve serves as a powerful tool for uncovering underlying structures of data through 1-dimensional smooth and continuous representations. On the basis of optimal transport theories, this paper introduces a novel principal curve framework constrained by monotonicity with rigorous theoretical justifications. We establish statistical guarantees for our monotone curve estimate, including expected empirical and generalized mean squared errors, while proving the existence of such estimates. These statistical foundations justify adopting the popular early stopping procedure in machine learning to implement our numeric algorithm with neural networks. Comprehensive simulation studies reveal that the proposed monotone curve estimate outperforms competing methods in terms of accuracy when the data exhibits a monotonic structure. Moreover, through two real-world applications on future prices of copper, gold, and silver, and avocado prices and sales volume, we underline the robustness of our curve estimate against variable transformation, further confirming its effective applicability for noisy and complex data sets. We believe that this monotone curve-fitting framework offers significant potential for numerous applications where monotonic relationships are intrinsic or need to be imposed.