

Colloquium February 13, 2025 | Peijun Sang

Title: Functional principal component analysis with informative observation times.

Abstract: Functional principal component analysis has been shown to be invaluable for revealing variation modes of longitudinal outcomes, which serves as important building blocks for forecasting and model building. Decades of research have advanced methods for functional principal component analysis often assuming independence between the observation times and longitudinal outcomes. Yet such assumptions are fragile in real-world settings where observation times may be driven by outcome-related reasons. Rather than ignoring the informative observation time process, we explicitly model the observational times by a general counting process dependent on time-varying prognostic factors. Identification of the mean, covariance function, and functional principal components ensues via inverse intensity weighting. We propose using weighted penalized splines for estimation and establish consistency and convergence rates for the weighted estimators. Simulation studies demonstrate that the proposed estimators are substantially more accurate than the existing ones in the presence of a correlation between the observation time process and the longitudinal outcome process. We further examine the finite-sample performance of the proposed method using the Acute Infection and Early Disease Research Program study.