COLLOQUIUM

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Covariate Adjusted Functional Principal Component Analysis

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Abstract

Principal component analysis, a standard dimension reduction tool for multivariate data, has been extended to function data and is termed Functional Principal Compo- nentAnalysis (FPCA).Most existing FPCA approaches either are for densely recorded data over time or do not accommodate covariate information. No approach had previously been proposed to accommodate covariate information when the data are sparse. When the covariate was univariate, two nonparametric methods were pro- posed to incorporate covariate information for both functional and longitudinal data and some general asymptotic theories for both approaches were developed. This ap- proach is modified and applied to analyze PET imaging data in order to recover the true latent PET concentration trajectories, measured only at finitely many temporal positions and further contaminated by noise. The numerical studies suggest that the FPCA preprocessing procedure outperforms the state-of-art parametric compartment modeling approach.

Finally, to handle the multidimensional covariate cases, a single index model is de- veloped for functional and longitudinal data to accommodate multidimensional co- variates in order to alleviate the curse of dimensionality often encountered in non- parametric smoothing procedures. We adapted a dimension reduction tool, termed Minimum Average conditional Variance Estimation method, to estimate the index co- efficients. With appropriate initial values,we showed thepn-consistency and asymp- totic normality of our estimator.

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