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TITLE: Simultaneous Inference for Dense Functional Data

ABSTRACT:
A polynomial spline estimator is proposed for the mean function of dense functional data together with a simultaneous confidence band which is asymptotically correct. In addition, the spline estimator and its accompanying confidence band enjoy “oracle” efficiency in the sense that they are asymptotically the same as if all random trajectories are observed entirely and without errors. The confidence band is also extended to the difference of mean functions of two populations of functional data. We also consider nonparametric estimation of the covariance function for dense functional data using tensor product B-splines. We develop both local and global asymptotic distributions for the proposed estimator, and show that our estimator is as efficient as an “oracle” estimator where the true mean function is known. Simultaneous confidence envelopes are developed based on asymptotic theory to quantify the variability in the covariance estimator and to make global inferences on the true covariance. Simulation experiments provide strong evidence that corroborates the asymptotic theory while computing is efficient. Several real data examples on near infrared spectroscopy data, remotely sensed data and speech recognition data are also provided to illustrate the proposed methods.