

Uniform convergence rates for nonparametric regression and principal component analysis in functional/longitudinal data

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Abstract

We consider nonparametric estimation of the mean and covariance functions for functional/longitudinal data. Strong uniform convergence rates are developed for estimators that are local-linear smoothers. Our results are obtained in a unified framework in which the number of observations within each curve/cluster can be of any rate relative to the sample size. We show that the convergence rates for the procedures depend on both the number of sample curves and the number of observations on each curve. For sparse functional data, these rates are equivalent to the optimal rates in nonparametric regression. For dense functional data, root- n rates of convergence can be achieved with proper choices of bandwidths. We further derive almost sure rates of convergence for principal component analysis using the estimated covariance function.