Estimation and prediction of the slope operator in functional linear model by a smoothness shift and self-normalization.

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1 Abstract

The paper delves into the linear regression model ($Y = SX + \epsilon$) with functional variables, where both regressors X and responses Y are functions within Hilbert spaces. The slope S is modeled as a Hilbert-Schmidt operator. Key innovations include a sequential version of the well-known spectral cut-off estimator $\hat{S}_N$ for S. Moreover, our estimator $\|\hat{S}_N - S_0\|^2$ is shown to be $N^{1/2}$-consistent. Convergence rates in the functional data settings are usually slower. This rate is achieved through a new proof technique termed "smoothness shift," applicable to various statistical inverse problems beyond the scope of this study. Furthermore, the paper addresses practical statistical inference issues using self-normalization principles to facilitate "robust", parameter-free inference.