

A Functional Time Series Model with Stochastic Functional Covariates for High-Frequency Data and Its Applications

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Abstract

This paper proposes a functional autoregressive model with stochastic functional covariates, denoted by FARSX, to depict high-frequency data dynamics. A two-stage procedure is proposed to estimate the model parameters under the frameworks of an expansion of multi-resolution B-spline basis functions and an adaptive lasso criterion with a two-layer sparsity assumption. We derive the consistency of the proposed estimators under mild conditions. Our simulation examples show that the FARSX model and the proposed estimation procedure is capable of obtaining satisfactory results in a robust manner. In the empirical study, we consider predicting Belgium's intraday electricity consumptions from 2014 to 2019 using the associated intraday temperatures in Antwerp, Belgium, as a functional covariate under a rolling window framework. The investigation results reveal that the FARSX model provides more reliable one-day-ahead predictions than two existing models.

Keywords : B-spline, functional time series, multiresolution, two-layer sparsity adaptive Lasso criterion.