

Forecasting density-valued functional panel data

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We introduce a statistical method for modeling and forecasting functional panel data, where each element is a density. Density functions are nonnegative and have a constrained integral and thus do not constitute a linear vector space. We implement a center log-ratio transformation to transform densities into unconstrained functions. These functions exhibit cross-sectionally correlation and temporal dependence. Via a functional analysis of variance decomposition, we decompose the unconstrained functional panel data into a deterministic trend component and a time-varying residual component. A functional time series forecasting method, based on dynamic functional principal component analysis, is implemented to produce forecasts for the time-varying residual component. By combining the forecasts of the time-varying residual component with the deterministic trend component, we obtain h-step-ahead forecast curves for multiple populations. Illustrated by age- and sex-specific life-table death counts in the United States, we apply the statistical method to produce mortality forecasts for 51 states. (co-authored with C. F. Jimenez-Varon and Y. Sun, King Abdullah University of Science and Technology)