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Polynomial spline estimation and inference for varying coefficient models with longitudinal data. (English) Zbl 1073.62036

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Summary: We consider nonparametric estimation of coefficient functions in a varying coefficient model of the form $Y_{ij} = X_i^T(t_{ij})\beta(t_{ij}) + \varepsilon_i(t_{ij})$ based on longitudinal observations $\{(Y_{ij}, X_i(t_{ij}), t_{ij}),\ i = 1, \ldots, n,\ j = 1, \ldots, n_i\}$, where t_{in} and n_i are the time of the jth measurement and the number of repeated measurements for the ith subject, and Y_{ij} and $X_i(t_{ij}) = (X_{i0}(t_{ij}), \ldots, X_{iL}(t_{ij}))^T$ for $L \geq 0$ are the ith subject's observed outcome and covariates at t_{ij}. We approximate each coefficient function by a polynomial spline and employ the least squares method to do the estimation.

An asymptotic theory for the resulting estimates is established, including consistency, rate of convergence and asymptotic distribution. The asymptotic distribution results are used as a guideline to construct approximate confidence intervals and confidence bands for components of $\beta(t)$. We also propose a polynomial spline estimate of the covariance structure of $\varepsilon(t)$, which is used to estimate the variance of the spline estimate $\widehat{\beta}(t)$. A data example in epidemiologv and a simulation study are used to demonstrate our methods.

MSC:

62G08	Nonparametric regression and quantile regression
62G20	Asymptotic properties of nonparametric inference
62J10	Analysis of variance and covariance (ANOVA)
65C40	Numerical analysis or methods applied to Markov chains
65C05	Monte Carlo methods
65D07	Numerical computation using splines

Keywords:

asymptotic normality; confidence intervals; repeated measurements; varying coefficient models; CD4 depletion; HIV infection