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Penalized B-spline estimator for regression functions using total variation penalty. (English)
Zbl 1395.62080

Summary: We carry out a study on a penalized regression spline estimator with total variation penalty. In order to provide a spatially adaptive method, we consider total variation penalty for the estimating regression function. This paper adopts B-splines for both numerical implementation and asymptotic analysis because they have small supports, so the information matrices are sparse and banded. Once we express the estimator with a linear combination of B-splines, the coefficients are estimated by minimizing a penalized residual sum of squares. A new coordinate descent algorithm is introduced to handle total variation penalty determined by the B-spline coefficients. For large-sample inference, a nonasymptotic oracle inequality for penalized B-spline estimators is obtained. The oracle inequality is then used to show that the estimator is an optimal adaptive for the estimation of the regression function up to a logarithm factor.

MSC:
62G07 Density estimation
62G08 Nonparametric regression and quantile regression
62G20 Asymptotic properties of nonparametric inference
62J07 Ridge regression; shrinkage estimators (Lasso)

Keywords:
adaptive estimation; coordinate descent algorithm; Lasso; oracle inequalities; penalized least squares; B-spline estimator; regression functions

Software:
SparseM; glmnet

Full Text: DOI

References:

Härdle, W., Smoothing techniques with implementation in S, (1991), Springer · Zbl 0716.62040


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