

Nonparametric Regression with Spatial Data

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Abstract

Nonparametric regression with spatial, or spatio-temporal, data is considered. The conditional mean of a dependent variable, given explanatory ones, is a nonparametric function, while the conditional covariance reflects spatial correlation. Conditional heteroscedasticity is also allowed, as well as non-identically distributed observations.

Instead of mixing conditions, a (possibly non-stationary) linear process is assumed for disturbances, allowing for long range, as well as short-range, dependence, while decay in dependence in explanatory variables is described using a measure based on the departure of the joint density from the product of marginal densities. A basic triangular array setting is employed, with the aim of covering various patterns of spatial observation. Sufficient conditions are established for consistency and asymptotic normality of kernel regression estimates.

When the cross-sectional dependence is sufficiently mild, the asymptotic variance in the central limit theorem is the same as when observations are independent; otherwise, the rate of convergence is slower. We discuss application of our conditions to spatial autoregressive models, and models defined on a regular lattice.

Keywords: Nonparametric regression; Spatial data; Weak dependence; Long range dependence; Heterogeneity; Consistency; Central limit theorem.