

Profile likelihood method for spatio-temporal partially linear model

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Abstract

Spatio-temporal processes with a continuous index in space and time are useful for modeling spatio-temporal data in many scientific disciplines such as environmental and health sciences. However, approaches that enable simultaneous estimation of the mean and covariance functions for such spatio-temporal processes are limited. Here, we propose a flexible spatio-temporal model with partially linear regression in the mean function and local stationarity in the covariance function. We develop a profile likelihood method for estimation and an effective bandwidth selection in the presence of spatio-temporally correlated errors. Specifically, we employ a family of bimodal kernels to alleviate bias, which may be of independent interest for semiparametric spatial statistics. The theoretical properties of our profile likelihood estimation, including consistency and asymptotic normality, are established. A simulation study is conducted and suggests sound empirical properties, while a health hazard data example further illustrates the methodology.