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A three-step local smoothing approach for estimating the mean and covariance functions of spatio-temporal Data

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Abstract

Spatio-temporal data are common in practice. Existing methods for analyzing such data often employ parametric modelling with different sets of model assumptions. However, spatio-temporal data in practice often have complicated structures, including complex spatial and temporal data variation, latent spatio-temporal data correlation, and unknown data distribution. Because such data structures reflect the complicated impact of confounding variables, such as weather, demographic variables, life styles, and other cultural and environmental factors, they are usually too complicated to describe by parametric models. In this paper, we suggest a general modelling framework for estimating the mean and covariance functions of spatio-temporal data using a three-step local smoothing procedure. The suggested method can well accommodate the complicated structure of real spatio-temporal data. Under some regularity conditions, the consistency of the proposed estimators is established. Both simulation studies and a real-data application show that our proposed method could work well in practice.

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