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IPS Paper

Bayesian Modeling with Spatial Curvature Processes

Author: Dr Aritra Halder

Coauthors: Sudipto Banerjee, Dipak K. Dey

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Brief Description

Spatial process models are widely used for modeling point-referenced variables arising from diverse scientific domains.

Analyzing the resulting random surface provides deeper insights into the nature of latent dependence within the studied response.

We develop Bayesian modeling and inference for rapid changes on the response surface to assess directional curvature along a given trajectory.

Such trajectories or curves of rapid change, often referred to as wombling boundaries, occur in geographic space in the form of rivers in a flood plain, roads, mountains or plateaus or other topographic features leading to high gradients on the response surface.

We demonstrate fully model based Bayesian inference on directional curvature processes to analyze differential behavior in responses along wombling boundaries.

We illustrate our methodology with a number of simulated experiments followed by multiple applications featuring the Boston Housing data; Meuse river data; and temperature data from the Northeastern United States.

Abstract

Spatial process models are widely used for modeling point-referenced variables arising from diverse scientific domains. Analyzing the resulting random surface provides deeper insights into the nature of latent dependence within the studied response. We develop Bayesian modeling and inference for rapid changes on the response surface to assess directional curvature along a given trajectory. Such trajectories or curves of rapid change, often referred to as wombling boundaries, occur in geographic space in the form of rivers in a flood plain, roads, mountains or plateaus or other topographic features leading to high gradients on the response surface. We demonstrate fully model based Bayesian inference on directional curvature processes to analyze differential behavior in responses along wombling boundaries. We illustrate our methodology with a number of simulated experiments followed by multiple applications featuring the Boston Housing data; Meuse river data; and temperature data from the Northeastern United States.