A Forecast-oriented Parameter Estimation Method for Geostatistical Models

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Abstract

We consider geostatistical regression models to predict spatial variables of interest. It is known that parameters in the Matérn covariogram cannot be estimated well by the likelihood-based methods. Although a best linear unbiased predictor has been proposed when model parameters are known, a predictor with estimated parameters is nonlinear and may be not the best in practice. To evaluate the predicted ability of the nonlinear spatial predictor, an adjusted procedure for the likelihood-based estimates is constructed. The adjusted parameter estimators based on minimizing a corrected Stein's unbiased risk estimator tend to have less bias than the conventional likelihood-based estimators, and the resulting spatial predictor is more accurate and more stable. Statistical inference for the proposed methodology is justified both theoretically and numerically. To verify the practicability of the proposed method, a groundwater data set in Bangladesh is analyzed.

Keywords: geostatistics, Matérn covariogram, parameter estimation, smoothing parameter, spatial prediction.