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Covariance tapering for prediction of large spatial data sets in transformed random fields

Toshihiro Hirano · Yoshihiro Yajima

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Abstract The best linear unbiased predictor (BLUP) is called a kriging predictor and has been widely used to interpolate a spatially correlated random process in scientific areas such as geostatistics. However, if an underlying random field is not Gaussian, the optimality of the BLUP in the mean squared error (MSE) sense is unclear because it is not always identical with the conditional expectation. Moreover, in many cases, data sets in spatial problems are often so large that a kriging predictor is impractically time-consuming. To reduce the computational complexity, covariance tapering has been developed for large spatial data sets. In this paper, we consider covariance tapering in a class of transformed Gaussian models for random fields and show that the BLUP using covariance tapering, the BLUP and the optimal predictor are asymptotically equivalent in the MSE sense if the underlying Gaussian random field has the Matérn covariance function.

Keywords Covariance tapering · Hermite polynomials · Kriging · Spatial statistics · Spectral density · Transformed random field