spatialreg — A package to fit spatial regression models with isotropic and anisotropic covariance functions

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Abstract

In regression analysis the assumption of uncorrelated residuals is sometimes untenable. The feature of correlated data should be investigated and integrated in the modelling and analysis of the data. Spatial regression models (SRMs) are an appropriate choice to depict the structure of such data.

The classical optimization approach in Design of Experiments facilitates the use of second-order models. If rather complex relationships are to be expected, the benefit of second-order models is limited. In such cases, a further appealing property of SRMs is revealed. These models provide smooth, data-faithful approximations of complex response functions based on a relatively small number of design points.

The SRM is defined as a linear mixed model that omits random effects but incorporates correlated errors. Restricting attention to isotropic covariance functions, a convenient way to fit such a model in R is to apply the function *glm* in the package *nlme* (Pinhero and Bates, 2000). If the assumption of isotropy is too restrictive, anisotropic covariance functions improve the fit of the model. SRMs including these functions are estimable with the R-package *spatialreg*. The two geometrically anisotropic and separable covariance functions implemented in this package were introduced by Sacks, Welch, et al. (1989) and Zimmermann and Harville (1991). A capability of the *spatialreg* package is the fitting of SRMs independently of the dimension of the data. For the deterministic mean model one can choose between polynomials of various degrees. In order to estimate the parameters of the covariance function, the classical ML method and the residual maximum likelihood method (REML) are available. An additional feature of the package is the visualization of the predicted response surface for two non-fixed variables. Examples are provided which show the flexibility of the SRM to approximate complex relationships.

References

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