THE LATENT SCALE COVARIOGRAM: A TOOL FOR EXPLORING THE SPATIAL DEPENDENCE STRUCTURE OF NON-NORMAL RESPONSES

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When modelling spatially distributed normal responses Y_i, one may use their empirical variogram to determine an appropriate parametric form for the autocorrelation function. Suppose, however, that the responses are not normally distributed: for example, if Y_i measures disease prevalence or species richness in region *i*, then a Poisson or binomial distribution could be more appropriate. In such cases one may use a hierarchical generalized linear model in which, conditional on a latent gaussian field $\mathbf{Z} = \{ Z_i \}$, the Y_i have independent distributions from the exponential family, with link function *g* such that $g(E[Y_i \mid Z]) = \mathbf{x}_i^t \beta + Z_i$ for vectors $\mathbf{x}_i$ of possible explanatory variables. The question then is how to determine an appropriate model for the autorcorrelation function of $\mathbf{Z}$. The empirical variogram of the Y_i is no longer appropriate, since it is on the wrong scale. We propose here an alternative, the latent scale covariogram, whose graph reflects the variance and autocorrelation structure of the underlying normal field. We illustrate its use on a number of real examples, as well as simulated data.