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Spatially correlated step selection analysis

Step selection analysis is a common framework to understand animal movement using telemetry data. It is used in the context of understanding resource selection. Currently, a very popular method is Integrated Step Selection Analysis (iSSA). Despite being a robust and logical approach, this method does not fully take the spatial nature of the data generating process into consideration. In practice, ignoring the spatial structure of the data can lead to violating the independence assumption of the model leading to confounding conclusions.

In most situations, the whole spatial variation of the data can not be explained exclusively by the fixed effects. This is the case because in practice, a researcher can not be certain about what truly leads to animal movement decisions. Thus, the remaining unexplained spatial variation causes spatial correlation. For this reason, we incorporate spatial random effects in the model with help of a Gaussian Process (GP). This is achieved using the Bayesian inference framework R-INLA and the Stochastic Partial Differential Equations (SPDE) technique. In addition, we show through a simulation the consequences of not being able to account for the whole spatial variation with the fixed effects and how this can be fixed by implementing spatial random effects in the model. This method can not only be applied for iSSA but also for its extension time-varying iSSA (tiSSA).