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KDE-likelihood: a tool for fitting stochastic dynamic models to equilibrium data

Stochastic dynamic models are a valuable tool to study the spatial distribution of species and estimate their responses to disturbances and environmental changes. However, fitting such models to observational data can be challenging, because their complexity typically hinders direct application of classical statistical tools such as the likelihood. Hence, modellers often examine the parameter space by applying sampling-based methods (e.g. approximate Bayesian computation, ABC), or they consider aggregated results whose distribution may be approximated via the central limit theorem. However, if the considered species distributions are assumed to be in equilibrium state, reaching these states in simulations requires long runs, making methods such as ABC difficult to apply. At the same time, aggregating results may lead to information loss that could result in identifiability issues corrupting the reliability of the parameter estimates. In this talk, we suggest the kernel-density-estimate-based (KDE-) likelihood as a tool circumventing these issues. The KDE-likelihood allows modellers to exploit the favourable statistical properties of the likelihood function without deriving it in closed form. We showcase the method's advantages in real applications by modelling the distribution of trees in a temperate Chinese forest using the process-based model Formind.