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nimbleHMC: Hamiltonian Monte Carlo Sampling with NIMBLE

We present the nimbleHMC R package, which provides Hamiltonian Monte Carlo (HMC) sampling for hierarchical models as an extension to the NIMBLE package's MCMC engine. HMC is a derivative-based MCMC sampling algorithm, which can facilitate rapid exploration of posterior distributions and thus fast mixing of MCMC chains. The nimbleHMC package operates seamlessly within NIMBLE's MCMC framework, and provides the No-U-Turn (NUTS) variety of HMC. Using nimbleHMC, HMC sampling can be applied to arbitrary subsets of model dimensions and can be used in combination with NIMBLE's other sampling algorithms. These combinations allow greater flexibility of MCMC methods than is available in many other MCMC packages. In this talk, we explain the functionality and design decisions underlying nimbleHMC, and how HMC sampling can be applied to entire models or subsets of model dimensions. We demonstrate the usage and performance of nimbleHMC using a variety of hierarchical models, including common ecological model structures.