

Fast, exact inference for discretely observed Markov jump processes using finite rate matrices

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Abstract

We consider inference for a discretely observed Markov jump process with an infinite statespace, such as occurs in biological and environmental systems. When the statespace is finite, inference for the resulting continuous-time Markov chain using its rate matrix is straightforward, but in the case of an infinite state space the method of choice is particle MCMC. We provide a new method, the minimal extended statespace algorithm (MESA) for exact Bayesian inference, that uses finite-dimensional rate matrices even though the statespace is infinite. In contrast to particle MCMC, MESA is most efficient when there is no observation noise.