

A derivation of Markov process from path entropy maximization

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Markov processes are routinely used as models for stochastic processes. They are often justified on the basis of randomization and coarse-graining assumptions. Here instead, we derive n -th-order Markov processes and the time-homogeneous master equation as unique solutions to an inverse problem. In particular, we find that when the constraints are not enough to uniquely determine the stochastic model, the n -th-order Markov process emerges as the unique maximum entropy solution to this otherwise under-determined problem. This gives a rigorous alternative for justifying such models while providing a systematic recipe for generalizing widely accepted stochastic models usually assumed to follow from first principles.