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Bayesian Inference and the Symbolic Dynamics of Deterministic Chaos CHRISTOPHER C. STRELIOFF, Center for Complex Systems Research and Department of Physics, University of Illinois at Urbana-Champaign, JAMES CRUTCHFIELD, Computational Science and Engineering Center and Department of Physics, University of California at Davis, ALFRED HUBLER, Center for Complex Systems Research and Department of Physics, University of Illinois at Urbana-Champaign — Symbolic dynamics has proven to be an invaluable tool in analyzing the mechanisms that lead to unpredictability and random behavior in nonlinear dynamical systems. Surprisingly, a discrete partition of continuous state space can produce a coarse-grained description of the behavior that accurately describes the invariant properties of an underlying chaotic attractor. In particular, measures of the rate of information production–the topological and metric entropy rates–can be estimated from the outputs of Markov or generating partitions. Here we develop Bayesian inference for k-th order Markov chains as a method for finding generating partitions and estimating entropy rates from finite samples of discretized data produced by coarse-grained dynamical systems.

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