Stochastic Thermodynamics of Imitation Models

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ABSTRACT

The recent development of stochastic thermodynamics has provided robust theoretical tools that can be applied to a wide variety of systems. In the present work, we explore one such application in a social-imitation model. Our aim is to investigate what new perspectives a derivation and analysis based on stochastic-thermodynamics methods can bring to this class of models. To this end, we introduce a minimal imitation framework—combining herding and anticonformity interactions—formulated as a continuous-time Markov process. We derive its mesoscopic master equation, identify both its stationary and equilibrium states, and characterize its critical behavio. By analyzing probability currents, dynamical activity, and entropy-production rates, we demonstrate how the stochastic-thermodynamics formalism quantifies irreversibility and reveals emergent collective phenomena in social systems.

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