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Mean-field diffusions in stochastic spatial death-birth models

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Abstract

The Moran process is a canonical probability model for death and birth of species. In the limit of a large population, the model is well-known for its rich probability structure by several perspectives including coalescence in the time-reversed genealogy. On the other hand, central studies in evolutionary game theory have significantly relied on the generalization of the Moran process for populations organized by graphs, known as the voter model, and a further generalization featuring complex asymmetry in reproductive rates.

In this talk, I will discuss the recent mathematical results for these generalized Moran processes, where physics methods in theoretical biology and modern methods for branching-coalescing interacting particle systems interact nontrivially. The discussion will be centered around a seminal discovery in evolutionary game theory. The discovery remarkably predicts by some advanced mean-field method to cut off growing dimensions in the dynamics, and thereby, leads to the quantification of fixation by appropriate one-dimensional Wright–Fisher diffusions.