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Nonstandard Analysis and its Application to Markov Chain Convergence Problem

We apply nonstandard analysis to construct a hyperfinite Markov chain which behaves like a finite state space Markov chain but is more widely applicable. I will show how to prove the convergence to its weak stationary distribution using the idea of infinitesimal coupling. I will also present the idea of how to construct a corresponding hyperfinite Markov chain for a standard general state space discrete time chain such that the convergence of the hyperfinite chain would imply the convergence of the original chain. This idea may be extended to more general Markov chains by considering a hyperfinite time line.