Doeblin's Ergodicity Coefficient: Lower-complexity Approximation of Occupancy Distributions

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Abstract

In this talk, I will extend Doeblin's ergodicity coefficient (originally defined for finite dimensional stochastic matrices) to kernels of time-homogenous Markov chains over Polish spaces, and show how a strictly positive Doeblin's coefficient leads to low- to moderate-complexity approximations of the occupancy distributions of subsets of the state space. Such approximations may be particularly useful in the regime where exact calculations are impractical and asymptotic approximations may not yet be reliable. The key idea is to use Doeblin's coefficient to approximate a Markov chain of duration n by independent realizations of an auxiliary chain of duration $O(\ln(n))$. A byproduct of the analysis shows that Doeblin's coefficient satisfies a sub-multiplicative type inequality, which leads to a new and elementary proof of Doeblin's characterization of the weak-ergodicity of non-homogeneous Markov chains over finite state spaces. This research has been partially supported by NSF grant DMS 0805950.