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Mixing time and stationary expected social welfare of logit dynamics. (English)

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Summary: We study *logit dynamics* [*L. E. Blume*, Games Econ. Behav. 5, No. 3, 387–424 (1993; Zbl 0797.90123)] for strategic games. This dynamics works as follows: at every stage of the game a player is selected uniformly at random and she plays according to a *noisy* best-response where the noise level is tuned by a parameter β . Such a dynamics defines a family of ergodic Markov chains, indexed by β , over the set of strategy profiles. We believe that the stationary distribution of these Markov chains gives a meaningful description of the long-term behavior for systems whose agents are not completely rational.

Our aim is twofold: On the one hand, we are interested in evaluating the performance of the game at equilibrium, i.e. the expected social welfare when the strategy profiles are random according to the stationary distribution. On the other hand, we want to estimate how long it takes, for a system starting at an arbitrary profile and running the logit dynamics, to get close to its stationary distribution; i.e., the *mixing time* of the chain.

In this paper we study the stationary expected social welfare for the 3-player CK game [*G. Christodoulou* and *E. Koutsoupias*, in: STOC'05: Proceedings of the 37th annual ACM symposium on theory of computing, Baltimore, MD, USA, 2005. New York, NY: Association for Computing Machinery (ACM). 67–73 (2005; Zbl 1192.91039)], for 2-player coordination games, and for two simple n -player games. For all these games, we also give almost tight upper and lower bounds on the mixing time of logit dynamics. Our results show two different behaviors: in some games the mixing time depends exponentially on β , while for other games it can be upper bounded by a function independent of β .

MSC:

91A22 Evolutionary games

91B15 Welfare economics

60J20 Applications of Markov chains and discrete-time Markov processes on general state spaces (social mobility, learning theory, industrial processes, etc.)

Cited in 8 Documents

Keywords:

logit dynamics; mixing time; social welfare; equilibria

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