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Generalized Approachability Results for Stochastic Games with a Single Reachable State

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ABSTRACT

The theory of approachability concerns repeated games with vector-valued reward. A set in the reward space is called approachable if the decision maker can ensure that his long term average reward vector is in the set, no matter what the adversary may do. Approachability theory was introduced for repeated matrix games by Maxwell (1956), where geometric conditions and related approaching policies were given. The theory was later extended to stochastic (Markov) games under the assumption that some fixed state is recurrent under all stationary strategies. In this work we generalize the latter to games with a single reachable state structure. In these games there exists a single state to which a return from any state may be guaranteed by at least one of the players.