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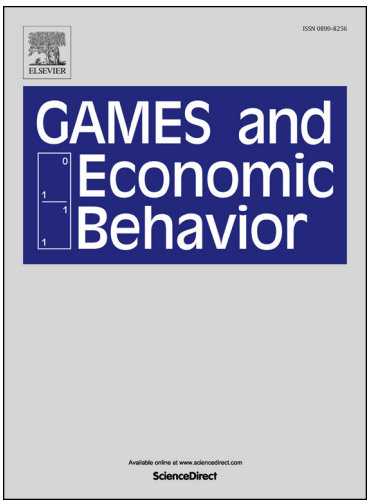

On the robustness of learning in games with stochastically perturbed payoff observations

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On the robustness of learning in games with stochastically perturbed payoff observations[☆]

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Abstract

Motivated by the scarcity of accurate payoff feedback in practical applications of game theory, we examine a class of learning dynamics where players adjust their choices based on past payoff observations that are subject to noise and random disturbances. First, in the single-player case (corresponding to an agent trying to adapt to an arbitrarily changing environment), we show that the stochastic dynamics under study lead to no regret almost surely, irrespective of the noise level in the player's observations. In the multi-player case, we find that dominated strategies become extinct and we show that strict Nash equilibria are stochastically stable and attracting; conversely, if a state is stable or attracting with positive probability, then it is a Nash equilibrium. Finally, we provide an averaging principle for 2-player games, and we show that in zero-sum games with an interior equilibrium, time averages converge to Nash equilibrium for any noise level.

Keywords: Dominated strategies, learning, Nash equilibrium, regret minimization, regularization, robustness, stochastic game dynamics, stochastic stability

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JEL classification: C61, C72, C73.

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