Social Games with Collaborative Learning

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Abstract

There is no presumption that a society of self-interested agents in an imperfect world leads to collectively satisfactory results. How well agents do for it in adapting to their social environment is not the same thing as how satisfactory a social environment they collectively create for themselves. This issue will depend crucially on how they interact, respond, adapt, or learn each other. We attempt to probe deeper understanding into this issue by considering the way of individual learning. We address the following question: how do the worlds of self-interested agents generate efficient collective decisions in strategic environments?
In this paper, we investigate social games. Agents are modeled to play several different types of games such as coordination games, anti-coordination games, dilemma games, or hawk-dove games with their neighbors. An interesting problem is under what circumstances will a society of agents converge to efficient equilibrium? This will depend crucially on how they interact each other. It is also an important question to answer the following question: how the society groups its way towards an efficient equilibrium in an imperfect world when self-interested agents learn each other. It is well known that individual learning with the best-response and natural selection do lead to inefficient equilibrium. In this paper, we focus on collaborative learning. Each agent is modeled to learn the interaction rule that is defined as the function of his own strategy and the strategy of his neighbors. They update their interaction rule with evolutionary learning while they repeat games over generation. We show the interaction rules acquired by all agents are categorized into a few rules that share some commonality. We show that those shared rules have features such that they learn to sustain social efficiency.