

Review and reproduction of *Learning dynamics in social dilemmas*

Macy, M.W., Flache, A., 2002

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Abstract

One of the most popular concepts in the discipline of learning dynamics is undoubtedly the Nash Equilibrium. However this concept has some weaknesses, indeed on the one hand it does not allow to know precisely how a population goes from one equilibrium to another, on the other hand it does not allow to make a correct prediction in the case where we study the outcomes of a game repeated a large number of times. Thus, the limitations of this concept have led the scientific community to look at models that take into account previous actions and the rewards associated with them to create agents capable of adaptation. In these pages we will study one of these models, the one defined by Bush and Mosteller, in which the concepts of aspiration and habituation are introduced.

Introduction

When we talk about social dilemmas, we mean games in which the players (agents) are forced to collaborate to maximize their respective rewards. MORE

In the case where players play only one game of these games their best choice is in the Nash Equilibrium of the payoff matrix, however in these pages we will deal with social dilemmas with two players in the repeated game setting. Thus, in the case of repeated games, the search for the Nash Equilibrium does not lead to the best reward on average. To do so, the two agents will use their experience acquired during the previous games to choose the best action and thus maximize their profits, thus the agents learn from their mistakes and their success, they evolve over time. These mistakes and successes are defined here by rewards or punishments.

Many solutions have been proposed to allow agents to learn as they progress in the game. One of the first solutions we can think of would be to never again reproduce an action that led the agent to a punishment. However this naive solution does not allow much experimentation and is therefore of little interest. Another more interesting solution often used to allow agents to learn is Q-Learning. The latter, introduced by Richard Bellman in the late 1950s, allows agents to choose the best action according to the state they are in. The solution on which we will focus was proposed by Robert R.

Bush and Frederick Mosteller in 1953 and modified by the authors of the article we are reproducing, Michael W. Macy and Andreas Flache in 2002, who introduced the principles of aspiration and habituation.

In the following pages we will use this learning model on three types of social dilemmas: Prisoner's dilemmas, Stag Hunt and Chicken game. For each of these games, we will compare the different results obtained by varying the values of aspiration and habituation, we will also analyze for which values the agents reach (or not) the complete cooperation called the Self-Reinforcing Equilibrium (SRE).

Method

Learning

Results

Discussion

Effect of the Aspiration

Effect of the habituation

Conclusion

References