

The Logic of Knowledge-Based Cooperation in the Social Dilemma

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Social dilemma is a situation in which individual rationality leads to collective irrationality. That is, individually reasonable behavior leads to a situation in which everyone is worse off than they might have been otherwise [Kol98]. There are four types of social dilemmas: prisoner's dilemmas, assurance games, chicken games, and coordination games. This paper aims to find a possible solution for Social dilemma. In this paper, we focus on a two-person social dilemma: Prisoner's Dilemma and propose a contract which is negotiated by authorities to solve this problem. The contract says that the cooperators can be rewarded and the defectors will be punished. However, the player's collective rationality will ultimately depend on their knowledge about the contract. By introducing the third person: a secretary whose task is to convey the contract to the players and who is completely truthful, we transform the two-player static game into a two-coalition dynamic game, one for the two-player and the other for secretary. In this new game, the secretary's rationality tells her to perform the strategy 'convey', which will bring her better payoff than the strategy 'not convey', since the authorities will punish her seriously if she balks at the task. In addition, the secretary is completely truthful. Thus, once the two players, Bob and Jim, learn the contract from the secretary, they will realize that the cooperation is their best choice as a coalition after knowing that their previous payoffs would have been changed. After introducing the notion of knowledge-based cooperation, we offer an S5, history-based semantics proposed by Parikh and Ramanujam [PR03] to express this notion. These enable us to represent how the contract is transmitted between the two coalitions, and how their knowledge changes, which make the players perform the collective action. The contribution of our work is that we formalize the players' reasoning in this new dynamic game and a semantic and axiomatic system is provided.

References

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