

## Collective Strategies Dominate in Spatial Iterated Prisoners Dilemma

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**Abstract :** How cooperation emerges and persists in a population of selfish agents is a fundamental question in evolutionary game theory. Our research shows that Collective Strategies with Master-Slave Mechanism (CSMSM) defeat Tit-for-Tat and other well-known strategies in spatial iterated prisoner's dilemma. A CSMSM identifies kin members by means of a handshaking mechanism. If the opponent is identified as non-kin, a CSMSM will always defect. Once two CSMSMs meet, they play master and slave roles. A master defects and a slave cooperates in order to maximize the master's payoff. CSMSM outperforms non-collective strategies in spatial IPD even if there is only a small cluster of CSMSMs in the population. The existence and performance of CSMSM in spatial iterated prisoner's dilemma suggests that cooperation first appears and persists in a group of collective agents.

**Keywords :** Evolutionary game theory, spatial prisoners dilemma, collective strategy, master-slave mechanism

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