Crosstalk in social dilemmas could hinder cooperation

A new mathematical framework taking into account 'crosstalk' and incorporating the impact of players' interactions in simulations of repeated social dilemmas could help better analyse cooperation dynamics within a population.

The analysis of social dilemmas, situations in which private interests are at odds with collective interests, has attracted a great deal of attention among researchers. This is not surprising because various challenging problems that we face – from the depletion of natural resources to intergroup conflict – are, at their core, social dilemmas.

Researchers frequently use the experimental games method to study such problems with computer simulations. An experimental game – such as the prisoner's dilemma – is a situation in which participants choose between cooperative and non-cooperative alternatives, yielding consequences for themselves and others.

Analyses of this phenomenon have previously assumed that a player engages in only one repeated game at a time, or that a player's action in one game is independent of all of their other interactions. However, a team of scientists, supported by contributions from the EU-funded GRAPH GAMES project, argued that these assumptions don't necessarily apply to real-life social dilemmas where humans are often involved in many simultaneous games, and interactions with other players spill over into other games, meaning these games involve crosstalk.

In such social dilemmas, mutual cooperation is better than mutual defection and yet, there is an incentive to defect. Direct reciprocity, which is based on repeated interactions between the same two players, is a mechanism for cooperation: 'I help you and you help me'. Cooperation can be achieved if participants in such games adopt conditional cooperative strategies such as 'tit-for-tat' (I begin by collaborating and then I'll do whatever you did last), or 'win-stay, lose-shift' (I begin with cooperation, then I'll continue doing what I'm doing until I lose).

Researchers from IST Austria and their collaborators at Harvard, Yale and Stanford universities examined cooperation dynamics through repeated games and introduced a new framework to analyse crosstalk between a player's concurrent games. Writing in the journal 'Nature Communications', they said "a player's decision is subject to 'crosstalk' when an interaction that a player has in one repeated game influences how the very same player behaves in another repeated game."

In order to quantify the overall effect of crosstalk, the researchers represented the structure of the population by arranging players on a graph. The team's findings showed that in the presence of crosstalk, even a single defective player can cause the complete breakdown of cooperation in a society. "Nevertheless, cooperation can prevail if the population is structured and if subjects are sufficiently forgiving," the researchers noted.

According to a statement by one of the research institutes involved in the project, "crosstalk also necessitates strategies with the 'correct' level of forgiveness: too harsh, and you end up with a society where no one cooperates, too generous, and defection can also spread as players learn to take advantage of other players."

The paper concluded that in today's highly connected world, a harsh cooperation strategy such as 'tit-for-tat' is particularly unable to deal with crosstalk.

Some of the discoveries in the GRAPH GAMES project included the analysis of multi-dimensional quantitative objectives in graph games. Results included applications of graph games in domains such as design of security protocols (that are correct by construction and attack-free), and evolutionary game theory (for modelling problems related to population dynamics or model growth of cancer).

For more information, please see:

GRAPH GAMES

Source: Based on project information and media reports

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