The Mathematics of Altruism and Selfish Cooperation

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ABSTRACT:

This talk describes a mathematical framework for cooperation and some resulting insights into social networks and pursuit-evasion games. The mathematics underlying cooperation is a largely unexplored area. Is there a way to "prove" that a multi-agent system is truly cooperative? Can an observer watching a team of robots distinguish how much of the team's success is from individual abilities and how much is from the team's synergy? Our framework provides answers to many of these questions regarding cooperation. It includes metrics of altruism and "selfish" cooperation that can be applied in a wide variety of scenarios. Together with some basic graph theory, the framework also provides a mathematical backbone for the discussion of cooperation within social networks. In pursuit-evasion games, the framework provides a way to compare algorithms by their level of altruism and cooperation, in addition to their success. Using a Java platform designed for experimenting with such games, we will provide some examples demonstrating altruism and cooperation within multiplayer games.

KEYWORDS: pursuit-evasion, cooperation, game theory, multi-agent systems, simulation, social networks

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