Evolution of Cooperation in Endogenous Networks

Austen Mack-Crane and Jeremy Van Cleve

In this work we plan to expand upon recent studies that have investigated the coevolution of network structure and strategy choice in prisoners' dilemma games played repeatedly on a network. This literature finds that assortative link formation is an important support for the evolution of cooperative behavior, and that the stability of cooperative equilibria depends on the time scale on which the network evolves. Some recent work also provides simulations which show that realistic small-world networks can result from the link-switching dynamics in these evolutionary games.

We will consider several extensions of this literature: first, we will evaluate the assumptions made in existing computational models, that govern strategy switching and link creation and destruction. Where these assumptions can be relaxed, we can run similar simulations to consider different parameter values, initial conditions, or behavioral rules, to ascertain their effect on global behavior.

Second, we will explore the possibility of representing players' types as utility functions, with a variable parameter representing other-regarding preference, rather than pure strategies. This allows players to optimize their strategies for each interaction rather than playing a static strategy, as they are constrained in previous simulations. Using this utility representation, we can also explore a continuous strategy space, and consider the difference between models with one-shot and repeated interactions in each time step.

The models we develop will suggest whether cooperative equilibria become stronger or weaker when agents are given greater latitude in their decisions, and whether these rules can be a realistic model of network formation. This research will contribute to our understanding of the underpinnings of human cooperation, by observing simulated dynamics under more realistic assumptions than have previously been used.