Computing all the mixed-strategy equilibria in the repeated prisoner's dilemma

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This is the first time the subgame-perfect mixed-strategy payoff set is solved in the repeated prisoner's dilemma. The earlier papers have examined the problem either with pure strategies (Berg and Kitti 2012) or with correlated (pure) strategies (Judd et al. 2003, Abreu and Sannikov 2014). Here, we show that the set of mixed-strategy equilibria is dramatically different from both of these earlier models. The players may obtain higher payoffs in mixed strategies and there are more Pareto efficient payoffs.

The computational method is based on solving so-called set-valued games, i.e., games where the players' payoffs are chosen from sets. We show that the set-valued games can be efficiently solved by finding certain extreme points of the set. The set-valued games are solved by splitting the problem into parts by 1) the classification of equilibria (see e.g. Borm 1987), 2) the monotonicity properties of the problem, and 3) the X-Y convex sets (also known as orthogonal or rectilinear convexity).

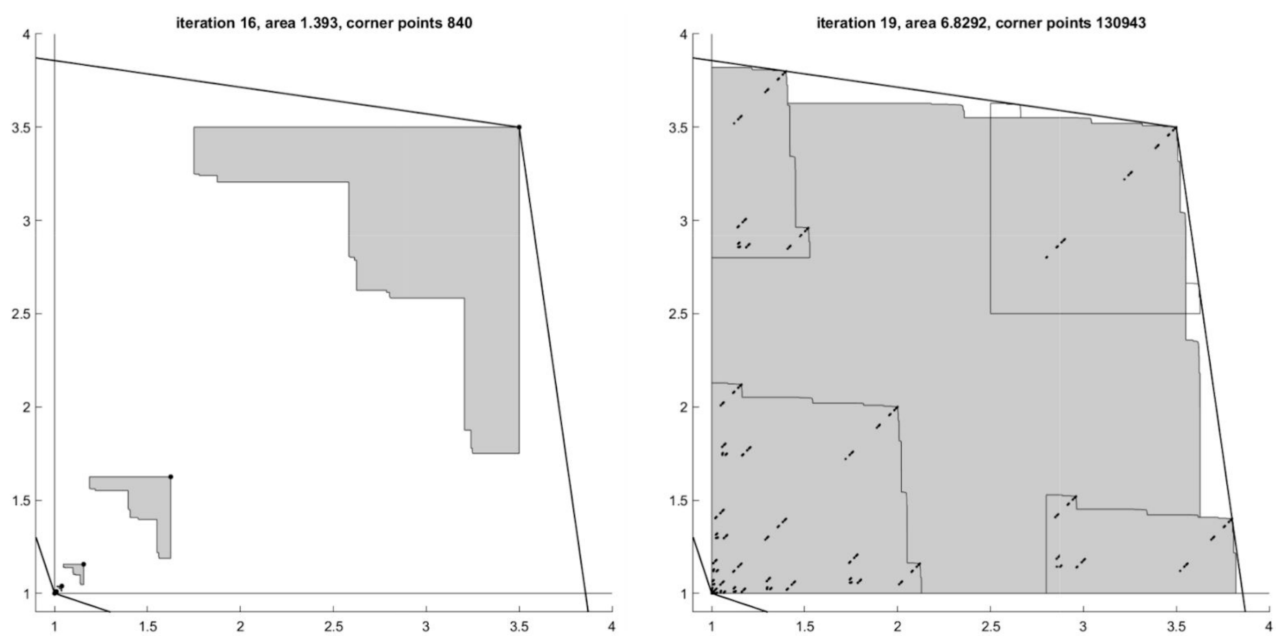

Figure 1: Equilibria in a prisoner's dilemma with $\delta = 0.25$ (left) and $\delta = 0.4$ (right). Shaded area shows the mixed-strategy equilibria and the black dots are the pure equilibria.