NETWORK ANALYSIS OF ITERATED PRISONERS' DILEMMA GAMES WITH A SINGLE STEP MEMORY

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Using replicator dynamics to study Iterated Prisoners Dilemma Games (IPDG) with a single-step memory, we investigate the win-lose relations between strategies of IPDG by using a directed network to display the replicator dynamics results. In the giant strongly-connected component of the win/lose network, we find win-lose circulations similar to rock-paper-scissors and analyze the fixed points and their stability. Applying the network motif concept, we introduce dynamic motifs, which describe the population dynamics relations among three strategies. Through exact enumeration, we find 22 dynamic motifs and display their phase portraits. Network visualization and motif analysis are useful methods to make complex dynamic behavior look simple in order to understand it more intuitively. We find that the result of IPDG is changed by value of payoffs - T, R, P, and S. We discover the fine phase structure of relations of strategies using modified payoff with two parameters T' and R'. In a specific payoff area, Pavlov, *i.e.*, win-stay and lose-shift, is the most powerful strategy in a homogeneous population.