Inclusion of Self-Organized Dynamics
in a Game-Theoretic Social Network Model

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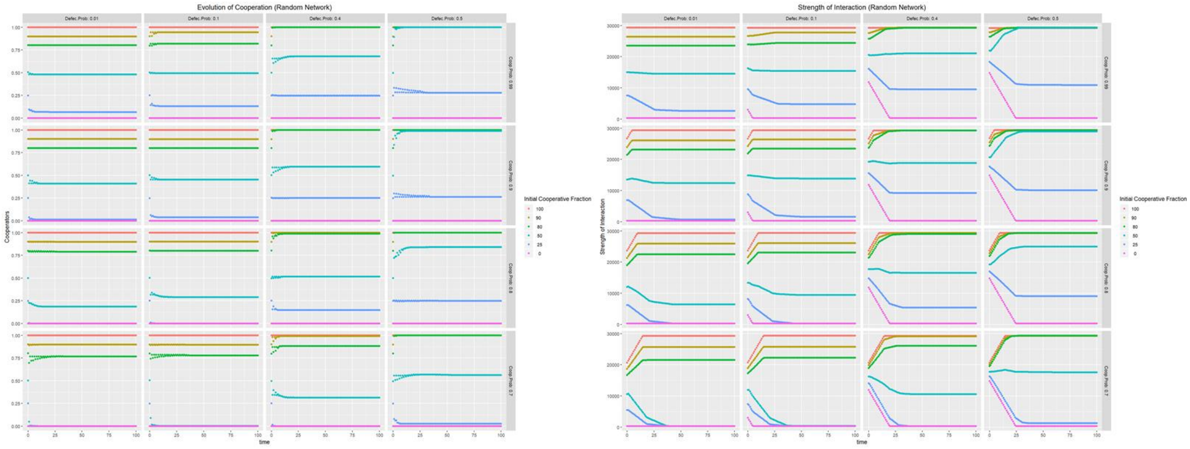
A game-theory model of interactions dynamics for biomedical research social networks was proposed in [1]. In this model the agents engage in two games simultaneously: a Prisoner`s Dilemma game and a Coordination game. An external parameter has a key role in the system's dynamics representing the threshold value that will lead the agents to cooperate or not with their neighbors. This variable may be seen as an external entity telling all the agents on the network which are the key characteristics that they need to look for in the other agents in order to cooperate or defect. To achieve more realistic representation of a research social network, is important let the agents decide when to cooperate or defect based in their own criteria, without the intervention of an external entity.

Using the game-theory based models discussed in [2] and used in [3] it was possible to eliminate the external parameter. Now, the cooperative/defective threshold is defined by the results of the coordination game obtained by each agent while interacting with her neighbors.

In order to eliminate the external variable, the agents now consider their strength of interaction (weight of the link between two agents of the network) as a degree of their willingness to cooperate with other agents.

We compared the main results from [1] (evolution of cooperation, utility, strength of interaction and number of flipper agents) with the results of the proposed model. The evolution of cooperation (number of cooperative agents / time) behavior is similar for both models; for the model presented in [1] there is a value for the mentioned threshold that triggers cooperativeness through the network. In the presented model (Fig. 1a) the key variable is the initial number of cooperative agents. The utility (cumulative payoff of the Prisoners Dilemma game) behavior is similar for both models. The strength of interaction (cumulative payoff of the Coordination game) behavior is different in each model; in the presented model (Fig. 1b) the strength of interaction has a behavior similar to the observed for the evolution of cooperation. The explanation of this is that in this model, the strength of interaction has a key role on the interaction dynamics. Finally, the behavior of the number of agents changing between cooperative and defective strategy in subsequent time steps (number of flipper agents) is different for each model. In the result presented in [1] the impact of the external threshold is noteworthy (values near 0.2 trigger many flippers during all 100 time steps of the simulations). In the presented model, the number of flippers tends to disappear as the agents try to adapt to their environment (cooperativeness of their neighbors). This means that the agents always decide their strategy (cooperative or defective) before 100 interactions and the only way, for the agent, to make a change of strategy is changing the network, i.e. adding/removing nodes or adding/removing links.



a) b)

Figure 1: a) Evolution of Cooperation of a Random Network with the presented model. b) Strength of Interaction of a Random Network with the presented model.

References:

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