

Adaptive mixed Nash extremal optimization

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The network community structure detection problem for non-overlapping communities consists in finding groups of nodes that are more linked to each other than to other nodes in the network. Adaptive Mixed Nash Extremal Optimization is a new method to approach this problem for unweighted and undirected networks. The Nash equilibrium concept is used within an adaptive Extremal Optimization algorithm endowed with a novel network shift diversity preservation mechanism. The problem is converted into a strategic game in which players are nodes that have to maximize their payoffs by choosing a community. The adaptive extremal optimization algorithm approximates the Nash equilibria of this game by using a population of individuals evolving independently by randomly changing the strategies of players with the lowest payoffs. To induce diversity in the search, when necessary, the network is slightly modified in order to shift solutions away from local optima and enhance search space exploration. Numerical experiments performed on both synthetic and real-world networks show that the equilibrium based approach using the proposed Extremal Optimization framework is better suited for networks with challenging structures than other optimization-based methods.