Title: Wiener Meets von Neumann: Feedback Dictates Intelligence

Abstract: Evolutionary game dynamics on complex networks consist of three components: games, network structures, and strategy updating rules. Games define the set of individual strategies and the mapping from strategy profiles to payoffs; network structures indicate who can interact with whom; strategy updating rules specify how individuals use their own and social information to determine their future strategies. As is well known, the evolutionary outcomes of such feedback dynamical systems induced by imitation-based update rules are sensitive to model characteristics, such as network structures and ways of imitation. Consequently, it is often difficult to generalize conclusions under imitation-based update rules across different models (Ohtsuki, et al. Nature, 2006； Allen, et al. Nature, 2017). By contrast, self-evaluation-based update rules are shown to generate invariant evolutionary outcomes on both complete and regular graphs. In this talk, I will introduce our recent work on evolutionary dynamics under self-evaluation-based update rules (namely, aspiration dynamics) over arbitrary weighted networks (Zhou, Wu, Du, and Wang. Nature Communications, 2021). We prove that under mild conditions, aspiration dynamics generate invariant evolutionary outcomes for any type of weighted networks, any distribution of aspiration values, and for individualized ways of self-evaluation. In other words, aspiration dynamics generate robust predictions for heterogeneous feedback systems. Our theoretical derivation and numerical simulations reveal the intrinsic difference between imitative and aspiration dynamics, highlighting the advantage of generating robust predictions under aspiration dynamics.

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