

TEST THE PRINCIPLE OF MAXIMUM ENTROPY IN POPULATION RPS GAMES: EVIDENCE IN EXPERIMENTAL ECONOMICS

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Abstract

Principle of maximum entropy (Maxent) is one of the most common rules in many-body interaction systems. In social economics systems, Maxent approach has been shown to be useful theoretically; however it has rarely been supported experimentally. Recently, in experimental games with variety parameters, we (Xu et.al.[1]) find the human system in laboratory fixed-paired two-person constant-sum 2×2 games obey the principle of Maxent. Population game is more important for modeling social aggregative behavior [2]. In this presentation, we focus on the performance of Maxent in laboratory population games.

By using laboratory experimental economics data of the population standard rock-paper-scissors (RPS) games, an ideal mixed strategy Nash equilibrium system, we investigate the distribution and the entropy of social outcomes. The efficiency and accuracy of the Maxent method is evaluated quantitatively. Firstly in laboratory population RPS games with different population size, we confirm that the social aggregative behavior obeys the principle of Maxent.

Results also show that the individual behaviors in the population RPS games differ from that in two-person RPS game significantly; however, the distributions of the social aggregative behavior – both in two-person RPS game or population RPS game – obey the prediction of the principle of Maxent. The applications of Maxent for game behavior in both of the theoretical and empirical aspects are discussed, e.g., on the noise property analysis [3] and on the learning model developing [4]. Our experimental findings suggest that social aggregative behavior has the common foundations as statistical physics, statistical inference, and information theory.

References:

- [1] B. Xu et al. *Physics Letters A*, **376**, 1318 (2012).
- [2] W. Sandholm. *Population games and evolutionary dynamics*, MIT press (2011).
- [3] J. Hey. *Experimental economics*, **8**, 325 (2005).
- [4] Wolpert et al. *Phys. Rev. E*, 036102 (2012).

Key Words: Principle of maximum entropy; Experimental economics; Game theory; Mixed Strategy Equilibrium; Population game; Social science