Evolutionary Dynamics of Information Diffusion Driven by Internal Synergy and External Incentives

Zhifang Li
Schole of Mathematical Sciences
University of Electronic Science and Technology of China
Chengdu, China
lzf17835419792@163.com

Xiaojie Chen
Schole of Mathematical Sciences
University of Electronic Science and Technology of China
Chengdu, China
xiaojiechen@uestc.edu.cn

***Abstract*—With the rapid development of the Internet, a huge amount of information is created and disseminated through online networks every day. Understanding the mechanisms of information diffusion induced by forwarding behaviors of individuals over the underlying networks is critical to various applications, including online advertisement and rumor control. In the process of information diffusion, the internal synergy and external incentives have a significant impact on individuals' forwarding behavior, which are generally ignored in existing works. In this work, we thereby propose a game-theoretic framework to analyze the evolutionary dynamics of forwarding behavior driven by internal synergy and external incentives. We first consider the evolutionary game model of forwarding behavior with internal synergy factors. Through theoretical analysis, we find that the internal synergy effectively contributes to the spread of forwarding behavior, thus promoting the information diffusion on networks. Furthermore, we obtain a critical synergy factor, above which forwarding behavior is more frequent than non-forwarding behavior in the population. We then introduce institutional incentives as an external intervention to the evolutionary game model in the information diffusion process. We find that the introduction of institutional incentives greatly promotes the emergence of forwarding behavior. Furthermore, we formulate optimization problems about the average income of individuals as well as the average cost of institution. We obtain an optimal incentive scheme, which enables individuals to achieve higher incomes at relatively lower costs for the institution. We also perform computer simulations and show that all simulation outcomes are able to verify the corresponding theoretical predictions.**

Keywords—information diffusion, evolutionary dynamics, synergy factor, external incentives, social networks