Opinion Dynamics on Signed Networks Based on Ising and Potts Model

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The evolution dynamics of public opinion is a hot issue in complex networks research. And the Ising model is the earliest classic dynamic model of public opinion. Although signed networks can describe amicable and antagonistic relationship in complex real-world systems accurately, and the research on dynamic process of public opinion evolution on signed networks is valuable, few people have paid attention to that. Previous methods for opinion diffusion cannot be applied to signed network directly, which ignore the important information contained in negative edges.

In this paper, the binary opinion dynamics on signed networks has been modeled by aid of the Ising model. The model is applied both to the synthetic and real-world signed networks. We observe that the proportion and distribution of negative edges have a fundamental effect on the evolutionary result of public opinion on signed networks. There exists the critical ratio. When the proportion of negative edges in the network exceeds the critical ratio, there appears to be a completely different evolutionary result, and the distribution of negative edges affects the value of the critical ratio. In addition, we study the network structural balance in such evolutionary process of opinion on signed networks as complementary.

Furthermore, to study a more complex and realistic evolution process of opinion, we apply the Potts model on signed networks, which can describe several states of one node. With the help of this model, we demonstrate the correlation between national economic industrial structure and election results, especially in the US presidential election, provide a simple election prediction model that requires only readily available economic data, and find some interesting phenomena. Our findings can deepen the understanding of the evolutionary process of opinion in real signed social systems.

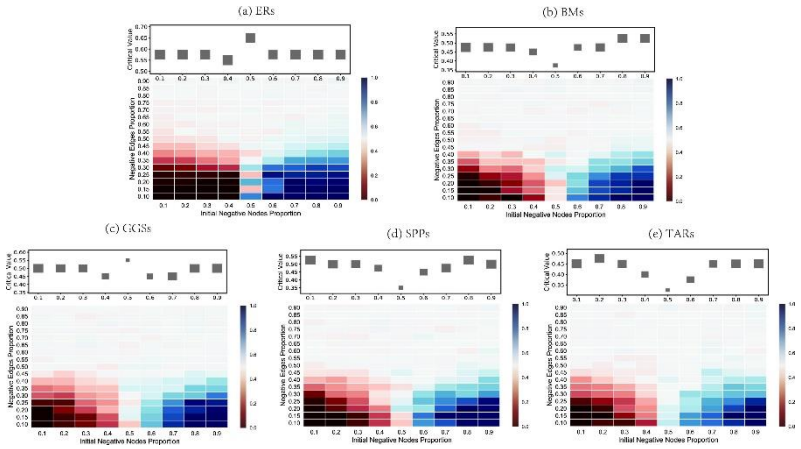

Figure 1: The evolution results on signed networks with different structures.

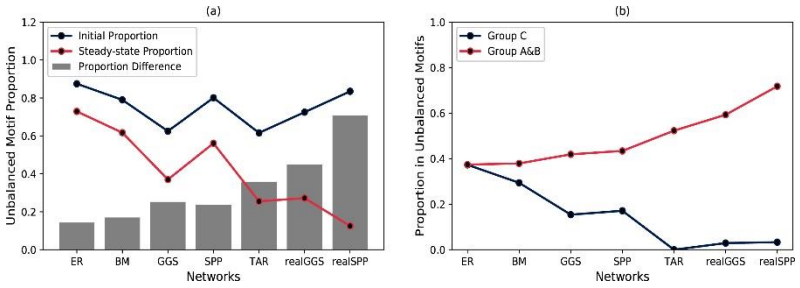

Figure 2: The comparison of network structural balance.

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