Opinion formation in the population has attracted extensive research interest. Various models have been introduced and studied, including the ones with individuals’ free will allowing them to change their opinions. Such models, however, have not taken into account the fact that individuals with different opinions may have different levels of loyalty, and consequently, different probabilities of changing their opinions. In this work, we study on how the non-uniform distribution of the opinion changing probability may affect the final state of opinion distribution. By simulating a few different cases with different symmetric and asymmetric non-uniform patterns of opinion changing probabilities, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.

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I. INTRODUCTION

As the diversity in the current modern society increases, the diversified opinions strongly impact the decision-making of individuals. In this paper, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.

II. RELATED WORK

A. Opinion Formation

Opinion formation is a process through which people make consensus decisions, and their opinions tend to be highly correlated with the final opinion distribution. The propagation of diversified opinions strongly affects the final opinion distribution, and it is observed that opinion formation in the population has been studied extensively. In this paper, we study on how the non-uniform distribution of the opinion changing probability may affect the final state of opinion distribution. By simulating a few different cases with different symmetric and asymmetric non-uniform patterns of opinion changing probabilities, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.

III. METHODS

A. Voter Model

The voter model is a simple stochastic model for the propagation of opinions in a social network. It is a model of opinion dynamics that describes how individuals with different opinions may change their opinions through social interactions. In the voter model, each individual has an opinion that is either 0 or 1, and the probability of changing their opinion is determined by the opinion held by the randomly chosen individual. In this paper, we study on how the non-uniform distribution of the opinion changing probability may affect the final state of opinion distribution. By simulating a few different cases with different symmetric and asymmetric non-uniform patterns of opinion changing probabilities, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.

IV. RESULTS

A. Non-uniform Opinion Changing Probability

In this section, we study on how the non-uniform distribution of the opinion changing probability may affect the final state of opinion distribution. By simulating a few different cases with different symmetric and asymmetric non-uniform patterns of opinion changing probabilities, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.

V. CONCLUSION

In this paper, we study on how the non-uniform distribution of the opinion changing probability may affect the final state of opinion distribution. By simulating a few different cases with different symmetric and asymmetric non-uniform patterns of opinion changing probabilities, we demonstrate the significant effects that the different loyalty levels of different opinions have on the final state of the opinion distribution.
A. Review of the Deffuant model with random opinion change

We consider the simplest case where the mutation probabilities, we introduce a mutation probability function as defined as:

\[ P(x) = \alpha x - \mu + p \]

where \( \alpha \) is the opinion change tolerance, \( \mu \) is the mean, and \( p \) is the noise. The initial mutation probability distribution is assumed to be uniform. Assume that the free will of individuals holding different opinions may have different mutation probabilities, we introduce a mutation probability function of the class of symmetric mutation probability functions. The mutation probability increases or decreases linearly with the opinion difference.

\[ \frac{d}{dt} A = o(t) A + o(t) B \]

\[ \frac{d}{dt} B = o(t) B - o(t) A \]

\( o(t) \) is less than 1. In the rest of the paper, we may assume \( o(t) \) is constant and \( s_{i} = t_{j} \) for -.

\[ (0.25, 0.5) \ \cup \ (0.75, 1) \]

\[ P(x) = \begin{cases} \alpha x - \mu + p & 0 \leq x \leq 0.5 \\ -\alpha x - \mu + p & 0.5 < x \leq 1 \end{cases} \]

\( x \) is within the range (0, ½].

B. Non-uniform opinion change

For all the existing studies, to the best of our knowledge, have assumed a uniform distribution of mutation probability for different opinions, that is, the Deffuant model and its random opinion change. A smaller value of \( \alpha \) makes consensus between the two nodes hard to achieve. As long as \( \alpha = 0.01 \) or all these cases, (a) asymmetric cases; (b) symmetric cases.

For \( \alpha = 0.01 \), we set the slope value as 0.02, 0.01, 0.01, 0.02. If the difference term such as that in most studies, as in the case where \( \alpha = 0.01 \) and for decrease mutation probability functions, we examine the simple case

\[ P(x) = \alpha x - \mu + p \]

where \( \alpha \) is the opinion change tolerance, \( \mu \) is the mean, and \( p \) is the noise. The initial mutation probability distribution is assumed to be uniform. Assume that the free will of individuals holding different opinions may have different mutation probabilities, we introduce a mutation probability function of the class of symmetric mutation probability functions. The mutation probability increases or decreases linearly with the opinion difference.

\[ \frac{d}{dt} A = o(t) A + o(t) B \]

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\( x \) is within the range (0, ½].

A. Bifurcation patterns

We carry out random operation as follows:

\[ \frac{d}{dt} A = o(t) A + o(t) B \]

\[ \frac{d}{dt} B = o(t) B - o(t) A \]

\( o(t) \) is less than 1. In the rest of the paper, we may assume \( o(t) \) is constant and \( s_{i} = t_{j} \) for -.
For every simulation, we shall observe changes in the opinion distribution when the system evolves. For the cases of symmetric mutation probability functions shown as Equation (3), the opinion tolerance is of a symmetric pattern. For the cases with asymmetric mutation probability functions, we find the evolution of the opinion distribution also changes. In Figures 2(b) to 2(e), we see that the steady state opinion with high values of $\alpha$ becomes more obvious when $t = 10$. For most time steps, long enough for the network to reach the steady state opinion as defined in Equation (3), the opinion distribution for different uniform and non-uniform networks are shown as $P(x): N = 10$. For each round of simulation, different values of $\alpha$ are taken as an example. We see that the steady mutation rate at central opinion is of a relatively larger absolute value than the outside value. Meanwhile, the peak numbers would diminish. Finally, when system evolves, the central opinion is closest to the center after a transitional change when the value of $\alpha$ is large enough, and it continues to diminish. Meanwhile, the peaks continue to move away from the center when the mutation probability functions are asymmetric. For most time steps, long enough for the network to reach the steady state opinion, the opinion distribution also changes. In Figures 2(b) and 2(e), we observe the bifurcation pattern of moving away from the center, until finally merge into a single peak at the center. This trend of moving away from the center after a transitional change when the value of $\alpha$ is large enough, is of a relatively larger absolute value. The color map on of peak numbers would clearly illustrate the opinion tolerance. When $t = 10$, the opinion distribution of the last 1000 steps have important observation when we adopt the ER random network. The average degree of $d$ is for the case with $\alpha = 0.02, 0.01, 0.01, 0.02$. The average degree of $d$ is for the case with $\alpha = 0.04, 0.02, 0.02, 0.04$. The function where $\alpha$ is for the case with $\alpha = 0.02, 0.01, 0.01, 0.02$. Finally, we could see that when system evolves, the opinion distribution of $x$ and for most time steps, long enough for the network to reach the steady state opinion as defined in Equation (3), the opinion distribution for different uniform and non-uniform networks are shown as $P(x)$.
B. Opinion distribution

For the 9 cases $\alpha = 0.04$; (g) $\alpha = 0.02$; and (i) $\alpha = 0.01$. Comparing these results with existing studies, we demonstrated that both the steady state opinion distribution and the bifurcation pattern in complex networks are consistent with those in previous studies on cases with uniform mutation probability, where the exception of only some very special cases (Detailed discussion of Tolerance towards “change of mind”)}
Intersociety Continuous opinion dynamics under bounded

dynamics, the voter model


