International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18 (2026) pp. 1-15

https://doi.org/10.70917/ijcisim-2026-0048
Article

Multidimensional Communication and Innovative Path of Red Culture in Civic Education of Colleges and Universities Driven by Artificial Intelligence

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Abstract: Red cultural resources have a long history, rich content and deep heritage, which are rooted in the excellent traditional Chinese culture, innovated in the historical process of Marxism's Chineseization, and formed in various historical periods of revolution, construction and reform. The study proposes the SNIIR communication model in response to the insufficient phenomenon in the SIR model communication process for the effective communication of red culture in ideological and political education in colleges and universities. The data sets of Advogato and Anybeat social network platforms are selected for static topological characterization, and the overall structure of the network and its importance in information dissemination are explored, and the results show that the research results indicate that 46 and 157 in the network will have a high degree of activity in terms of the role of information release and information dissemination, and that they have a stronger ability to guide the dissemination of information in the network. Taking the content dissemination of red culture articles as an example, we get the change of the number of retweets in each hour of the first 24 hours, and optimize the corresponding parameters of the SNIIR model and the traditional SIR model to get the optimal parameters about the fitting of the case event data. On the basis of the case data, we compare and verify the effects of the traditional SIR model and the improved SIR model, and the results of the experimental comparison show that the SNIIR model can better illustrate the general evolution of the topic spreading on the social network, and is more in line with the current information dissemination process of the social network.

Keywords: SIR model; civic education; information dissemination; red culture

1. Introduction

With the rapid development of artificial intelligence technology, society is undergoing a profound change. The era of artificial intelligence is an era of data-driven, human-computer interaction, cross-border integration, and sharing and co-creativity, and human production, life, and way of thinking have produced all-round and fundamental changes [1]. In particular, the construction of college students' ideological and political courses should actively follow the trend of the times, and grasp the dividends of the times empowered by artificial intelligence under the guidance of the support of national education policies [2-3]. With the wide application of artificial intelligence technology, the speed of information acquisition and dissemination has been greatly accelerated, and people's vision has been broadened, but at the same time, it also brings the problems of information overload, and it is difficult to distinguish between true and false [4-6]. This makes teachers in the Civic and Political Education, not only to focus on the transmission of knowledge, but also to cultivate students' critical thinking and independent judgment, so that students can sift out the valuable content in the huge amount of information, and form the correct worldview, outlook on life and values [7-8].

Red culture is an effective carrier for the inheritance of red genes, and it is also a vivid teaching material for ideological and political theory courses in colleges and universities to cultivate the roots and cast the soul, enlighten the mind and moisten the heart [9]. Taking red culture as a carrier, integrating the red gene into the ideological and political education of college students is the necessary work of ideological and political education in colleges and universities [10]. At present, due to the fact that China's red culture is mainly concentrated in red resources such as museums, memorial halls, party history museums and old revolutionary sites, not many special red cultural heritage activities for colleges and universities have been carried out [11-13]. From the perspective of technical support, empowering the dissemination of red culture in colleges and universities through artificial intelligence is not only a strong support for red culture inheritance, but also a strong support for the ideological education in colleges and universities, which provides an important resource way for college teachers to carry out the integration of red culture into the ideological education [14-16].

In this paper, the dissemination of red culture in the ideological and political education in colleges and universities is studied, and the SNIIR network information dissemination model is constructed on the basis of the SIR model in the dynamics of infectious diseases. The two data sets of Advogato and Anybeat selected for topological characterization and analysis of the centrality metrics of individual nodes in different networks, the research case and the visualization of the dissemination of red cultural information content are selected, and the parameters of the SNIIR model and the traditional SIR model under the dissemination of information are selected. The actual forwarding data of the case is used to compare and verify the effect of the traditional SIR model and the SNIIR information dissemination model, and finally, the dissemination pathway of the red cultural resources into the ideological education of colleges and universities is proposed.

2. Artificial Intelligence-Driven Multidimensional Communication Model of Red Culture

2.1. Complex Network of Multidimensional Dissemination of Red Culture

2.1.1. Degree and Degree Distribution of Complex Network Nodes

The degree k_i of a node V_i is defined as the number of edges connected to the node V_i. Intuitively, the higher the degree of a node, the more "important" the node is in some sense.

The average of the degrees k_i of all nodes V_i in the network $G(V,E)$ is called the average degree of the network, denoted as $\langle k\rangle$, i.e.,:

$$\langle k\rangle = \frac{1}{N}\sum_{i=1}^{N} k_i \tag{1}$$

The degree distribution in a network is usually described by the distribution function $P(k)$, where $P(k)$ denotes the proportion of nodes with degree k in the network.

The degree distribution of a completely randomized network is approximated by the Poisson distribution [17] (Poisson distribution), whose shape decreases exponentially away from the peak $\langle k\rangle$. A great deal of research in recent years has shown that the degree distributions of many actual complex networks are significantly different from the Poisson distribution and are instead described by the power-law form $P(k)\sim \alpha k^{-\beta}$.

Power-law distributions are also known as scale-free distributions, and networks with power-law distributions are called scale-free networks.

2.1.2. Average Path Length of Complex Networks

The distance d_{ij} between two nodes V_i and V_j in the network is defined as the number of edges on the shortest path connecting these two nodes, and its inverse $1/d_{ij}$ is called the efficiency between nodes V_i and V_j, and is denoted ε_{ij}.

The maximum value of the distance between any two nodes in the network is called the diameter of the network and is denoted as D, i.e., $D=\max\limits_{1\le i<j\le N} d_{ij}$, where N is the number of nodes in the network.

The average path length L in the network is defined as the average of the distances between any two

nodes, i.e., $L = \frac{1}{C_N^2} \sum_{1 \le i < j \le N} d_{ij}$, where N is the number of nodes in the network.

2.1.3. Clustering Coefficients for Complex Networks

The ratio of the number of edges E_i actually existing between the k_i neighboring nodes of node V_i and the total number of possible edges $C_{k_i}^2$ is defined as the clustering coefficient C_i of node V_i, where $C_i = \frac{E_i}{C_{k_i}^2}$. The average of the clustering coefficients C_i of all nodes V_i in the whole network is defined as the clustering coefficient C of the network, where $C = \frac{1}{N} \sum_{i=1}^{N} C_i$. Clearly, $0 \le C \le 1$.

2.2. Propagation Dynamics Model

2.2.1. SI Model

There are only two states in the SI model: S is the susceptible state and I is the infected state. The SI model is generally used to portray the spread of diseases that cannot be cured and will not be able to change state once infected. Its infection mechanism can be expressed by equation (2):

$$S(i) + I(j) \xrightarrow{\lambda} I(i) + I(j) \tag{2}$$

The SI model state transfer rules are shown in Figure 1.

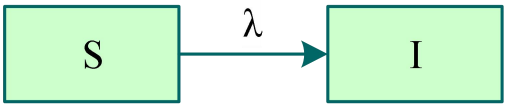


Figure 1. SI model.

The differential equation for the SI model is:

$$\begin{cases} \frac{ds(t)}{dt} = -\lambda s(t) i(t) \\ \frac{di(t)}{dt} = \lambda s(t) i(t) \end{cases} \tag{3}$$

2.2.2. SIR Model

The SIR model state transfer rules are shown in Figure 2:

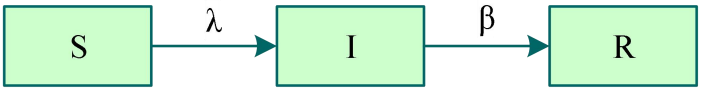


Figure 2. SIR Model.

Assuming that the densities of S -states, I -states, and R -states are $s(t)$, $i(t)$, and $r(t)$, respectively, and that each infected individual can infect $\lambda s(t)$ unknowns per day to become infected during the t time after the disease occurs, and that the ill individual is $Ni(t)$, so there are $\lambda s(t)\,\mathrm{Ni}(t)$ who become infected every day, and at the same time there will be a portion of infected people who become immune from being infected due to treatment or recovering through their own immune function,

the number of people who become immune from being infected is $\beta s(t)i(t)$, and so $\lambda s(t)Ni(t)-\beta s(t)i(t)$ is the rate of increase of $Ni(t)$.

That is, there is:

$$\frac{dI(t)}{dt}N=\lambda s(t)i(t)N-\beta i(t)N \tag{4}$$

From the above it can be concluded that for the rate of increase of the disease is:

$$\begin{cases}\dfrac{ds(t)}{dt}=-\lambda s(t)i(t)\\ \dfrac{di(t)}{dt}=\lambda s(t)i(t)-\beta i(t)\\ \dfrac{dr(t)}{dt}=\beta i(t)\\ S(t)+I(t)+R(t)=1\end{cases} \tag{5}$$

As the disease continues to spread, the number of infected people will surge until the number of infected people reaches a peak, after which it will slowly decrease and finally the infection of the disease will end. In the SIR model, there is a threshold value λ_c, when $\lambda>\lambda_c$, the disease spreads on a large scale, and vice versa, the disease spreads on a small scale for a short period of time and then ends.

2.2.3. SEIR Model

There are three states in the SEIR model: S is the susceptible state, E is the latent state, I is the infected state, and R is the immune state.The SEIR model is suitable for describing the process of infection of some diseases with a latent period, which are not always infected after contact with the source of the infection, and which go through a period of latent time before striking with a certain probability. The mechanism of infection can be expressed by equation (6):

$$\begin{aligned}S(i)+I(j)&\xrightarrow{\mu}E(i)+I(j)\\ E(i)+I(j)&\xrightarrow{\lambda}I(i)+I(j)\\ I(i)&\xrightarrow{\beta}R(i)\end{aligned} \tag{6}$$

The differential equation for the SEIR model is:

$$\begin{cases}\dfrac{ds(t)}{dt}=-\mu s(t)i(t)\\ \dfrac{de(t)}{dt}=\mu s(t)i(t)-\lambda e(t)i(t)\\ \dfrac{di(t)}{dt}=\lambda e(t)i(t)-\beta i(t)\\ \dfrac{dr(t)}{dt}=\beta i(t)\\ S(t)+E(t)+I(t)+R(t)=1\end{cases} \tag{7}$$

2.3. Introduction and Construction of Improved Models

2.3.1. Model Propagation Process

The current information dissemination models include, SIR model [18], SEIR model and H-SEIR, etc., whose infectors or secondary disseminators are only considered the external dissemination of information. Realistic information dissemination is the synergistic diffusion of multiple viewpoints that

influence each other to reach the final state. Therefore, this paper absorbs the advantages of the existing propagation model, makes improvements to the state of the nodes, takes into account people's reaction to the information, and is divided into opposing viewpoints nodes and silencers nodes, and constructs the SNIIR model, where S is susceptible, N is silencer, I_1 is the viewpoint holder, and I_2 is the opposing viewpoint holder.

The information dissemination model in this paper has the following propagation rule: the source node generates the viewpoint I_1 node with probability p and influences the associated node with probability p. The I_1 node is shaken in the process of information dissemination due to the increasing amount of information in the process of information dissemination, its viewpoint is shaken and converted into a silencer N node with probability δ. And in the process of propagation with probability ω to lose interest in the information, converted to information immunizer node R. The I_2 node propagation path is the same as I_1. In addition, the source node generates the silencer node N with probability λ, and due to the silencer effect, N node's information propagation ability is much less than I_1 and I_2, and is only a transformation node. N node is not equivalent to the information immunity node R although its information dissemination capacity is small, due to the increase of information in the information dissemination process, its attitude of remaining neutral may be changed to be converted into I_1, I_2 nodes with the probability of p, q, and join in the path of information dissemination. N node gradually loses interest in the information during the information dissemination process, and converts to information-immune node R with probability μ.

2.3.2. Construction of the Model

This model assumes that the total number of online social network users remains constant at a certain time t, i.e., the total number of nodes in the network remains constant and the network structure remains constant. Denote by $S(t)$, $I_1(t)$, $I_2(t)$, $N(t)$, and $R(t)$ the number of susceptible nodes $S(Susceptibles)$, I_1 nodes $(Infectives1)$, opposing viewpoints $I_2(Infectives2)$, silencers $N(Neutral)$ nodes, and immune nodes R that have lost interest in the information during the t time period, respectively. Let the total number of nodes be P, then there are $S(t)+I_1(t)+I_2(t)+N(t)+R(t)=P$. corresponding to each state node conversion formula is as follows.

$$\begin{cases} S^I + I_1^j \xrightarrow{p} I_1^I + I_1^j \\ S^I + N^j \xrightarrow{\lambda} N^I + N^j \\ S^I + I_2^j \xrightarrow{q} I_2^I + I_2^j \\ N^I \xrightarrow{p} I_1^I \\ N^I \xrightarrow{q} I_2^I \\ I_1^I \xrightarrow{\delta} N^I \\ I_2^I \xrightarrow{\delta} N^I \\ I_1^I \xrightarrow{\omega} R^I \\ I_2^I \xrightarrow{\omega} R^I \\ N^I \xrightarrow{\mu} R^I \end{cases} \tag{8}$$

where p, q, δ, λ, ω, and μ are node transition probabilities.

According to its dynamical mechanism, it can be described by the following system of differential equations.

$$\begin{cases} \dfrac{dS(t)}{dt} = -pI_1(t)S(t) - qI_2(t)S(t) - \lambda N(t)S(t) \\ \dfrac{dI_1(t)}{dt} = pI_1(t)S(t) + pN(t) - \omega I_1(t) - \delta I_1(t) \\ \dfrac{dN(t)}{dt} = \lambda N(t)S(t) + \delta I_1(t) + \delta I_2(t) - \mu N(t) - pN(t) - qN(t) \\ \dfrac{dI_2(t)}{dt} = qI_2(t)S(t) + qN(t) - \omega I_2(t) - \delta I_2(t) \\ \dfrac{dR(t)}{dt} = \omega I_1(t) + \omega I_2(t) + \omega N(t) \end{cases} \tag{9}$$

$$\frac{dS(t)}{dt} + \frac{dI_1(t)}{dt} + \frac{dN(t)}{dt} + \frac{dI_2(t)}{dt} + \frac{dR(t)}{dt} = 0 \tag{10}$$

$S(0) = P - 3$, $I_1(0) = 1$, $I_2(0) = 1$, $N(t) = 1$, and $N(t) = 0$ are the initial values, i.e., all but three initial nodes of each state are susceptible. When $\delta = \lambda = q = 0$, this model is the same as the SIR model.

3. Analysis of the Multidimensional Dissemination of Red Culture in the Ideological and Political Education of Higher Education Institutions

3.1. Topological Analysis of Social Networks

3.1.1. Selection and Processing of Data Sets

In this paper, two datasets have been selected and tested to analyze and compare different topologies and propagation models.

(1) SOC-Advogato dataset: it is a dataset that contains the interaction behaviors between users on the Advogato.org website. This dataset contains user trust relationships in the Advogato community, where each user can choose to trust other users to demonstrate their expertise and competence in a particular technology or domain, forming a trust network.

(2) The SOC-Anybeat dataset is a social media dataset containing friend relationships between users from the Anybeat social media platform.The SOC-Anybeat dataset has been widely used in research and practice in social network analysis, user behavior prediction, and recommender system development The

Above are the two social network datasets selected for this paper, both from the Network Repository website. This website is a public online social network dataset repository that collects social network datasets from different domains and application scenarios. These social network datasets include various types such as academic research, social media, online communities and so on.

3.1.2. Analysis of Centrality Indicators of Network Nodes

(1) Degree centrality

Degree centrality is expressed as the number of neighbors of a node, which directly indicates the size of influence, and is used in social networks to view the ability of an individual as a communicator, when the more neighbors it has, it indicates that more individuals need to be contacted through it, which also indicates that the individual node has a wide range of influence in the whole network and is in the core position. The degree distribution of the network is analyzed according to the definition of degree centrality and the results are shown in Figure 3.

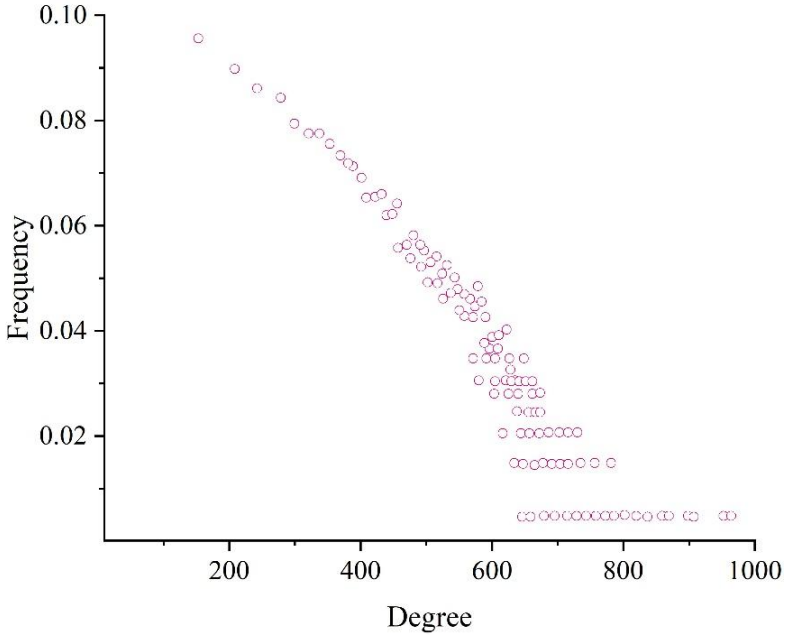


Figure 3. Network node distribution.

According to the empirical analysis of existing research on complex networks such as social networks and natural biological networks, it can be seen that the node degree are obeying the power rate distribution, i.e., $P(k) = k^{-\lambda}$. As seen from the above node degree distribution graph, the network has the scale-free characteristics of complex networks, and it can be researched in accordance with scale-free networks. The dissemination of information can be carried out through friends forwarding, next show the social network node degree centrality indicators (excerpt of the first 20 nodes) as shown in Table 1. The nodes in the table are arranged according to the node centrality degree from small to large, and the data show that, in terms of degree centrality, the above node degree value is higher, indicating that these users are more concerned by other users in the information dissemination network, and they belong to the core node users who have a large dissemination influence and a wide dissemination audience; and at the same time, it indicates that these users may obtain a larger amount of information and access to a wide variety of channels and public opinion dissemination, and play the key role of opinion leaders in social At the same time, it shows that these users may have access to large amounts of information and multiple channels and spread public opinion, playing the key role of opinion leaders in the social network and showing strong information dissemination guidance ability.

Table 1. Degree centrality index of network A(excerpts from the top 20).

Node number	Degree central value	Standardized degree central value	Node number	Degree central value	Standardized degree central value
157	781	22.743	329	221	6.847
46	743	21.851	429	216	6.573
597	537	15.794	172	212	6.452
30	522	15.018	736	212	6.452
328	395	11.639	9	206	6.371
232	378	11.874	739	201	6.183
126	325	9.814	22	199	6.092
438	284	8.247	780	193	5.892
286	251	7.299	326	191	5.763
719	225	6.874	431	186	5.632

(2) Proximity centrality

Proximity centrality reflects the independence of individual nodes in disseminating information and refers to the convenient distance and of a node compared to other nodes, further refined to the ability to be independent and free from the control of other nodes. It is expressed in terms of the path of attention and not the ownership relationship. In this case, when the value of distance is smaller, it indicates that the

closer the node is to the other, the more independent it is in its ability to disseminate information. Therefore, we measure proximity centrality for social network analysis for both platforms, first looking at the distribution of proximity centrality, as shown in Figure 4. As can be seen from the distribution chart, the proximity centrality values of the network nodes are between 0.2 and 0.55, especially concentrated between 0.3 and 0.4, indicating that the nodes are very closely connected and the users are very closely connected, which means that the information can be quickly disseminated between the nodes.

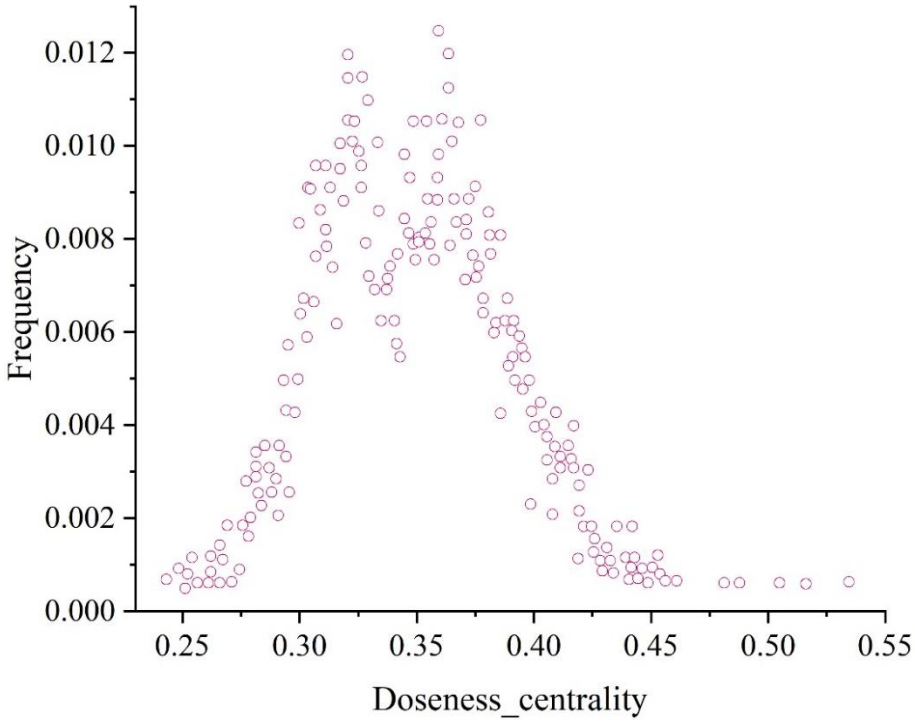


Figure 4. The network is close to the central distribution.

The following excerpt of 20 nodes and their proximity centrality values are listed as shown in Table 2. From the results of the proximity centrality of the two social networks in the above table, it can be seen that in the process of information dissemination, users with a low degree of node centrality also have a relatively low proximity centrality, which indicates that in the whole public opinion network, the information resources are not easy to be controlled by individuals or small groups of actors. Users with a high degree of centrality also have a high degree of proximity centrality, which indicates that they are highly independent in receiving information, can control the direction of public opinion in the network, are less controlled by other nodes, and when they release information, other nodes can receive it effectively and smoothly.

Table 2. The network is close to the central indicator (excerpts from the top 20).

Node number	Degree central value	Standardized degree central value	Node number	Degree central value	Standardized degree central value
157	0.533	4.902	593	0.451	2.815
46	0.515	4.538	9	0.451	2.815
597	0.501	4.211	791	0.451	2.815
30	0.484	3.794	438	0.452	2.726
232	0.477	3.616	286	0.450	2.714
328	0.475	3.534	719	0.450	2.694
172	0.455	3.102	126	0.450	2.694
429	0.446	2.973	2537	0.437	2.597
577	0.443	2.752	242	0.437	2.597
329	0.443	2.743	736	0.437	2.397

(3) Median centrality

Median centrality is a measure of how many nodes in a network are more or less at the “center” of other nodes. If a node is on many propagation paths, it can be assumed that it acts as a “bridge” and will act as an intermediary to control other nodes. As with other metrics, first observe the distribution of the number of node mediators, as shown in Figure 5. As can be seen from the figure, more than 50% of the nodes in network A have a centrality of about 0, and 2 nodes have a centrality of between 0.3 and 0.6.

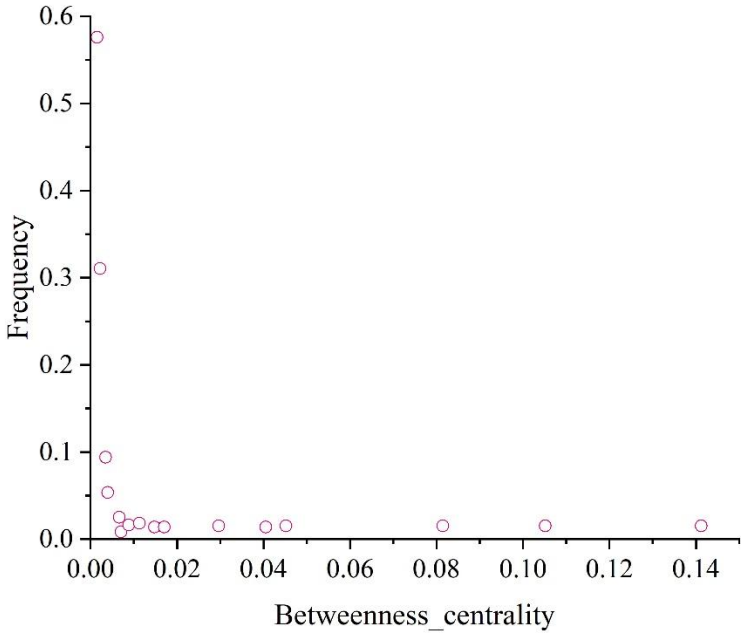


Figure 5. The network is a central distribution map.

The meso-centrality metrics of the network (excerpt 20 nodes) are shown in Table 3. The data in the above table show that users with high node degree also have high meso-centrality, indicating that these users occupy a central position in the network topology, occupy a relatively rich information resource in the social network, and play a great role as a bridge in the overall dissemination of information in the social network, and through the data, we found that the relative meso-centrality between users in the network is 25.173 at the maximum, and the minimum value is 3.141. As the “authoritative” user of the platform, it plays a very important role in the dissemination of information, without this node, many paths will be changed, and may also affect the dissemination of information to a certain extent.

Table 3. Network number central index (excerpts from the top 20).

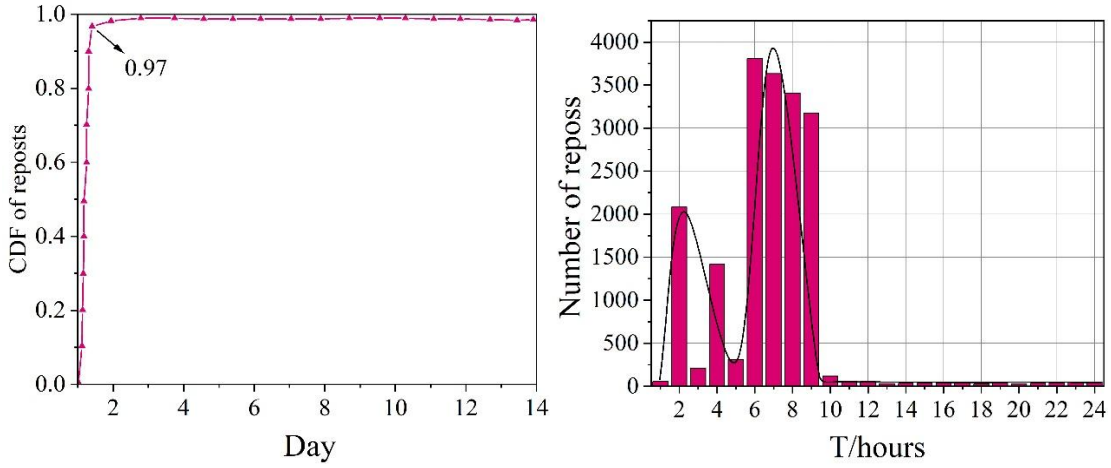
Node number	Degree central value	Standardized degree central value	Node number	Degree central value	Standardized degree central value
157	0.145	25.173	9	0.015	2.214
46	0.109	18.428	429	0.015	2.214
597	0.085	14.673	22	0.014	1.986
30	0.048	8.511	1223	0.011	1.813
232	0.044	7.782	1378	0.011	1.813
328	0.039	6.551	736	0.010	1.645
126	0.032	5.216	584	0.010	1.645
438	0.019	3.573	172	0.009	1.475
286	0.019	3.573	329	0.009	1.476
610	0.017	3.141	62	0.009	1.476

3.2. Validation of the Effectiveness of the Improved Model

As a case study, we chose one tweet from Red Culture's various offer tweets and used its retweet count to demonstrate the validity of the constructed SNIIR model. This tweet affected a large number of users and generated 3291 retweeters. The temporal distribution of the number of infected retweeting users is shown in Fig. 6, and the cumulative distribution function of the real change in the number of case

retweets is shown in Fig. 6(a). From the figure, we can find that the dissemination process of the message occurred mainly on day 2. It generated 2083 retweets within 24 hours. The number of retweets gradually stabilizes at around 50 in the subsequent hours, and the first 24 hours alone account for 96.9% of the retweets. Therefore, it is true and reliable to analyze the model validity based on the data of the first 24 hours.

According to the change of the number of retweets of this tweet at each time, we can obtain the change of the number of retweets every 60 minutes in 24 hours (for the convenience of the study we use 60 minutes as the interval of the change of the number of retweets) where the change of the number of ordinary retweets corresponds to the change of the ordinary infected state I in the SEAIR model, and the change of the number of the popular retweets in it corresponds to the change of the super propagator A state in the model. Variation. In order to combine the real scenario and the mathematical model, we roughly distinguish the common forwarders as state I and the popular forwarders as state A, assuming that the popular forwarders exhibit super-spreading properties.



(**a**) The CDF of the repost number (**b**) The repost number within the first 24 hours

Figure 6 Case data collected from the Baidu App promotional advertisement in Weibo

Table 4 lists the parameter ranges for the SEAIR and SIR models.

Table 4. Constraints of SIR Model and SNIIR model parameters.

Model	Parameter	Range	Default value
SNIIR	$\overline{k_1}$	[1,229]	3.1
	$\overline{k_2}$	[10,1000]	569
	α	(0,1)	0.01
	ε	(0,1)	0.7
	β_1	(0,1)	0.4
	β_2	(0,1)	0.4
	λ_1	(0,∞)	1
	λ_2	(0,∞)	2
	λ_3	(0,∞)	2
	Λ	(0,∞)	$0.1\times N(t)$
	u	(0,1)	0.2
SIR	$\overline{k}$	[1,400]	21.2
	β	(0,1)	0.3
	γ	(0,∞)	2

The degree distribution generated for this network with 600,000 nodes is shown in Figure 7, which

shows a regular distribution with an approximate power rate. It also has a long tail similar to the real network (representing the presence of a very small percentage of users with a large degree of nodes). Such a degree distribution also indicates that the majority of users in the network influence a relatively small percentage of other users, while the vast majority of users are influenced by a small percentage of them. A study of the articles reveals that this characteristic exists for most of the highly retweeted popular message events. In addition, according to the generated degree distribution, with the large degree node as the part that occupies 0.00624% of the whole node, so we take $\overline{k_1}$ =3.24 and $\overline{k_2}$ =565, and through the study on the size of the user followers of this network, we take the network's fan of all users as the average value is taken as $\bar{k}$ = 19.6.

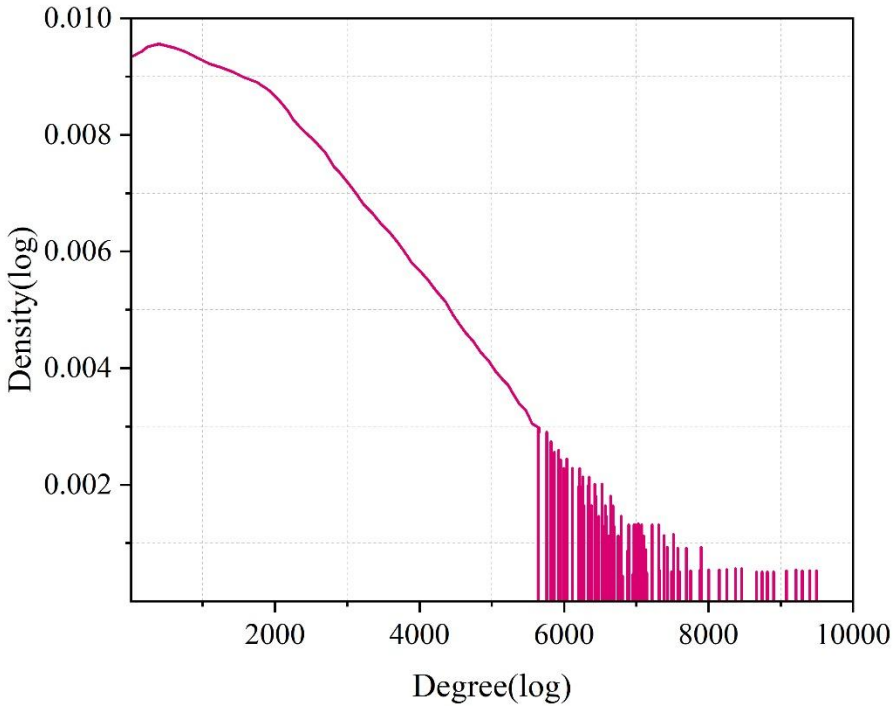


Figure 7. The degree distribution of the 600,000-node network.

3.3. Comparative Analysis of Improved Propagation Models

Finally, starting from the content of red culture that we studied in the previous chapter, compared with the traditional model, to verify whether the improved SIR model is more persuasive and closer to the real results, so let's make a practical comparison. The actual dissemination data of the topic is shown in Figure 8, from which it can be seen that the vertical coordinate is the actual number of forwarding users about the topic of red culture, and the horizontal coordinate is the intercepted time period, we can see that in the initial stage, there is a tendency for information dissemination to focus on the outbreak of information, and in a short period of time there will be a peak, and there will be an explosive growth in the number of information disseminators, and then as time passes, people gradually lose their interest in the topic and the infection rate will be reduced. Afterwards, as time passes, people gradually lose interest in the topic, and the infection rate slowly declines, but the decline is different from the initial rise, and tends to level off, and finally, the spreading state slowly stabilizes.

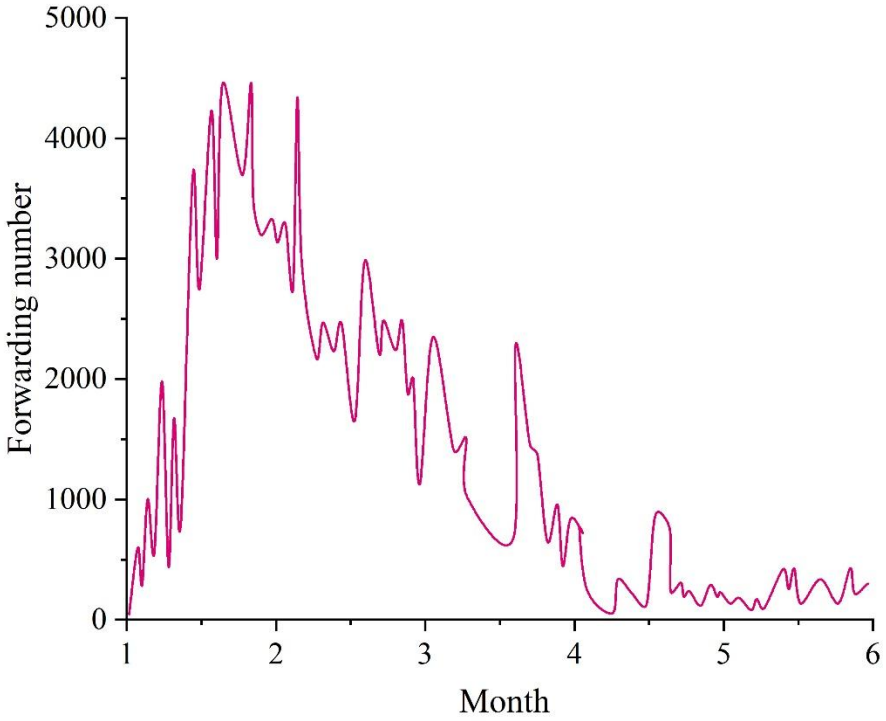


Figure 8. The actual dissemination of red culture topics.

Since the intercepted microblogging data is from February to June, the number of people concerned with the topic of red culture is initially about 100,000 people, we determine the same infection rate, immunization rate, etc. according to the above model and the process of parameter adjustment, and get the results of the model comparison, as shown in Figure 9.

It can be seen that there is a certain degree of difference between the specific performance of the traditional classic SIR model and the improved SIR model in terms of the changes in the unknown and infected states. The traditional SIR model, in the initial stage, is still in a flat situation, after which it slowly rises and reaches the peak state before slowly falling. The specific performance of the improved SIR model is that, when the topic information begins to appear the spread of the situation, the initial spread of less forwarding, the infection state is relatively slow, some users are not interested in the information, in the hesitation period, the duration is very short, after that, there will be an explosive rise in the dissemination of information, rapid growth, in the information outbreak, and slowly, as time passes, people may gradually lose interest in this type of information or the emergence of other news topics, and then slowly fall down. interest or the emergence of other news topics, at the same time, there will also be some similar derivative topics, so that some users can recall the information, from not interested to interested, will also carry out a small-scale forwarding dissemination, in short, the information dissemination trend decline is not as dramatic as the explosive, will not go up, and finally, the information will slowly disappear from the public's field of view, the exposure rate declined, also No more users to forward, so the time in this stage will be longer.

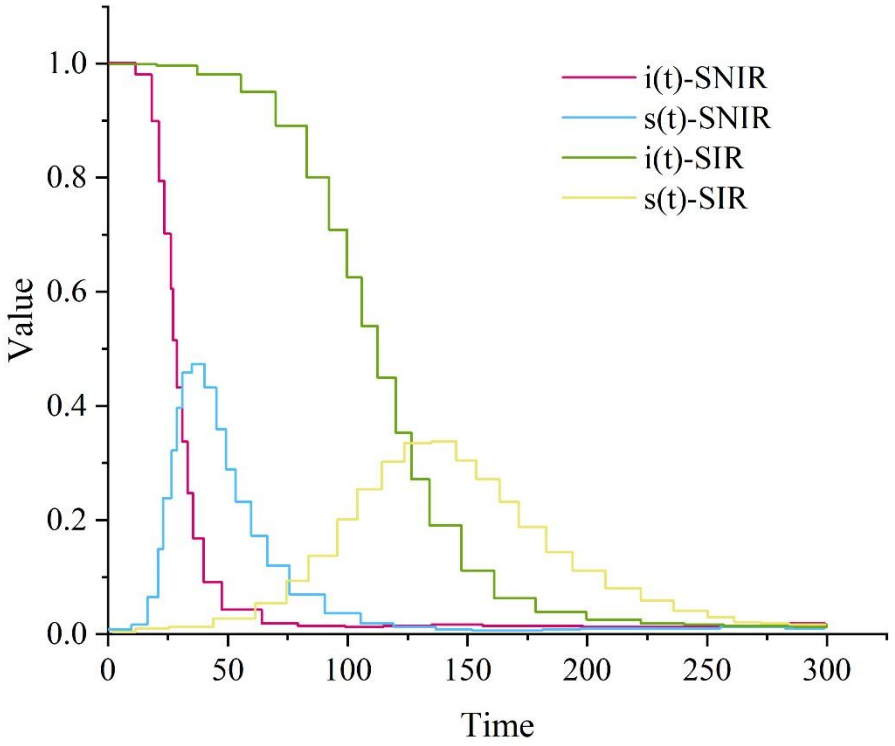


Figure 9. Comparison of traditional SIR and improved SIR.

Finally, we can see that the improved model peaks earlier and more strongly than the traditional model, and the proportion of infected people rises faster and more, and the declining trend is also longer compared to the traditional model, and ultimately become stable, which is due to the increase of the conversion rate, and the derivation rate.

According to the above comparison of the actual data evolution results, the traditional SIR model is more idealized results, compared with the improved SIR model is more in line with the current reality of information dissemination in the social network of the public, more realistic and accurate.

4. Multi-Dimensional Transmission Paths of Red Culture in Ideological and Political Education in Higher Educational Institutions

4.1. Do a Good Job of New Media Audio-Visual Products to Enhance the Influence of Red Culture

In the era of mobile Internet, short video has rapidly emerged as an important form of dissemination of various cultural information in today's society, and also provides a new path for the dissemination of red culture. Therefore, we should analyze the habits of young user groups in accepting media information, make full use of short video means to change the traditional video production of red culture, enhance the communication experience with young audiences, so as to effectively promote the propaganda of red culture and expand the social influence of red culture.

4.2. Playing the Role of Major Themes in Spreading the Spiritual Roots of Red Culture

With the arrival of the 70th anniversary of the founding of the People's Republic of China, the centennial of the founding of the Party and other major historical moments, a large number of excellent red cultural film and television drama works based on major red themes have emerged. These film and television drama works focusing on revolutionary figures or related red events are presented in a visual artistic expression, with profound thoughts, exquisite art and excellent production, promoting the national spirit with patriotism as the core, and the spirit of the times with reform and innovation as the core, and greatly exerting the function of positive and positive value orientation of red culture.

The documentary is faithful to history, but not bound to historical facts; reproduces history, but does not carry historical materials; explores the reality of history, and understands the significance of history; does not only highlight cultural relics, but also explores the humanistic value behind cultural relics; touches the pulse of history, and pays attention to the warmth of the expression.

4.3. Innovative Cultural Presentation Modes to Facilitate Multi-Channel Dissemination of Red Culture

In the process of promoting the dissemination of red culture, it is crucial to expand diversified cultural dissemination channels. To explore the new mode of red culture dissemination, it is necessary to innovate the system of dissemination and promotion of cultural values, relying on the in-depth excavation of red resources, creatively transforming the cultural essence and epochal value embedded in red culture into cultural products that can be felt, touched, and experienced, improving the vividness and interestingness of dissemination, and increasing the interactivity with the audience. Through these ways, people are inspired to actively and positively accept the enthusiasm of red culture, and feel and understand red culture more deeply.

The influence of social media should be fully utilized to invite famous bloggers and netizens to participate in the dissemination of red culture. Through their influence and fan base, they guide the audience to actively participate in the discussion of red culture, and pass the red culture to a wider audience group.

4.4. Developing a Multimedia Interactive Platform to Enhance the Dissemination of Red Culture

With the development of media integration, the integrated media communication platform has become an important channel for the dissemination of red culture, which can not only combine red cultural resources with network communication, but also has the advantages of interactivity, openness and information transmission, storage and protection. This can provide a more comprehensive red cultural communication environment, and better meet people's needs for cultural communication and learning with its lasting vitality and attraction. When developing the multimedia interactive platform of red culture, the connotation of red culture should be deeply excavated, and people's cognition, understanding and dissemination of red culture should be enhanced through the establishment of professional red cultural knowledge websites and other forms.

Through the guide roaming, host explanation, voice commentary, graphic audio and video display, etc., people will be brought into the old red sites, relics and venues to visit the experience, to provide a new audience to accept the experience of red culture, communication and interaction platform, immersive lead people online to feel different handheld patriotism education and learning.

5. Conclusion

Based on the traditional SIR model, this paper constructs SNIIR model propagation rules, visualizes the network structure, and analyzes it from the three perspectives of degree centrality, intermediate centrality, and proximity centrality to user nodes. The research data show that nodes such as network 46 and 157 will be highly active in information release, information dissemination and leading role, playing the key role of opinion leaders in the dissemination process, and at the same time indicating that they have strong information dissemination guiding ability in the network. After model comparison, it is proved that the SNIIR model has greatly improved the accuracy and reasonableness of the portrayal of the information dissemination characteristics of red culture compared with the traditional SIR. Finally, we propose the communication path of red culture in the ideological education of colleges and universities to activate the penetration power of red culture communication.

Acknowledgements

Research Project on Ideological and Political Theory Course Teachers in Colleges and Universities in 2023 of the Ministry of Education: Research on the Innovation of Teaching Mode to Realize “Three-Dimensional Synergy” through “Quadruple Dialogues” (No. 23JDSZK119).

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