Matlab-Based Simulation Analysis on Allocation of Creative Intellectual Resources in the Internet Copyright Industry

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Abstract: In the current dynamic open and developing Internet era, the key of copyright operation competition is the optimal allocation of creative intelligence resources. This paper focuses on studying the mechanism of intellectual resource allocation in the value chain of the Internet copyright industry from the perspective of organizational ecology. Through introducing competition and symbiotic system models, the necessity and effectiveness of the introduction of good IP is demonstrated. Then, the modeling tool of Matlab has been carried out for simulation verification of the logistic growth mechanism on the evolution of the Internet copyright industry value chain. The results show that it is reasonable and feasible to use the Logistic growth curve equation to explain and describe the evolution process of the intellectual resource symbiosis system of the Internet copyright industry. Finally, the chaos theory is adopted to simulate the evolution process of the intellectual resource symbiosis system of the Internet copyright industry, and various external influence factors are compared and analyzed. The model proposed in this paper provides a new idea for the allocation of intellectual resources in the value chain of the Internet copyright industry, and can provide a basis for the formulation of related policies in the future.

Key words: Organizational Ecology Internet Copyright Industry Creative Intellectual Resources Optimization Allocation

1 Introduction

In the context of media fusion, “content is king” is widely accepted, the operation of content in various cultural resources revolves closely around the development and operation of Internet copyright. Internet copyright industry provides the core driving force for cultural and creative industries [1]. As the core element resources of cultural industry, the organization, production mode and operation mechanism of the copyright operator behind “content” will have a decisive influence on the scale and quality of content. In the process of generating the real copyright value of original content, creative intellectual resources, as the basic unit of the Internet copyright industry, have different composition and configuration in different types of participating subjects [2] [3]. This paper makes an in-depth study on the allocation mechanism

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of intellectual resources in the Internet copyright industry from the perspective of organizational ecology, explores the reasonable way of developing the creative intellectual resources of the Internet copyright industry, which can provide ideas and references for the development of Internet copyright economy in China, and provides decision-making reference and suggestions for higher authorities to formulate development plans.

2 Analysis of life-like forms of creative intellectual resources in the Internet copyright industry

Internet copyright development is a dynamic process starting with audience attention gathering, high-quality IP resources must have the conditions of potentially high flow rate. The growth of fans in online literature reflects the increased attention paid to the works, which is conducive to achieving higher commercial value in the subsequent development of various links in the value chain.

Copyright content and creative intellectual resources derived from copyright have the life cycle of life-like bodies, which show new-born, mature, reproduction, extinction and other life phenomena in the form of individual life forms [4], which are similar to the more macro life phenomena such as species and communities in the world of life. They have cooperative behavior among participating subjects and competitive relations as well. The following is the analysis of the life characteristics of intellectual resources in the value chain of the Internet copyright industry:

(1) With a complete circulatory system, the cells of life activity should rely on the material transport system which are independent and interconnected, forming an organic whole in the collaborative work and completing their life activities [5]. The creative intellectual resources in the Internet copyright industry can be regarded as a kind of life form, which has a complete division of industry and organization, corresponding to the Internet copyright industry's creation, circulation, consumption, dissemination and other system links to coordinate, to achieve its survival and activities like the value and law of life [6].

(2) With a specialized neural transmission system, the development of meta IP needs to survive and develop through a highly specialized information collection, processing and feedback system [7]. Copyright operation system can technically ensure that the creative intelligence resources of the Internet copyright industry in a specific way and circulation system to achieve parallel, each has its own channels, to ensure that it can control each active cell in the life body timely and accurately, just like the transmission of substances of the various circulatory systems. It is of significance and value for each cell and tissue.

(3) The creative intelligence resource system and other affiliated organizations form a highly closed independent dissipative structure that enables all participants in the Internet copyright industry value chain with life characteristics to be highly independent of the external environment, so that the living body can complete its own life activities through this system, and communicate energy, material, information and communication networks with the external environment safely and effectively.

(4) Creative intelligence resource system has a specific external environment, which needs to guarantee its specific life characteristics by providing sufficient living conditions and materials.

Meta IP needs to be under the circumstances such as the further exploration of professional teams [8] [9], specific plot settings and other conditions, therefore further develop a storyline of film or television works and game products.

3 Analysis of the ecological model of creative intellectual resources in the Internet copyright industry

The core competition of Internet copyright operation is brand competition. As the operator of IP publishing, we should rely on the processing ability of high-quality original works and subsequent series of works, play a natural resource advantage in brand building, and then integrate the distribution, marketing, dissemination, derivative development and other links of cooperation of internet copyright industry value chain, to achieve economic value and social value as well. In this paper, we do the research in the perspective of organizational ecology on the value chain of Internet copyright industry and investigate the ecological mechanism of creative intellectual resources. It should be emphasized in the following research of population competition, the population corresponds to different meta IP, and in the population symbiosis model, the population corresponds to meta IP and meta Internet copyright developers.

3.1 Population competitive relationship model

The population competition model describes the process by which two or more populations compete for the same resource and living space, and analyzes the conditions for producing various outcomes. The results prove, the less competitive party gradually decreases until extinction, and the competitive party reaches the maximum capacity allowed by the environment.

The population competition model corresponds to the system of Internet copyright creative intelligence resources, meta IP can be regarded as a population, the competitive relationship between the populations comes from the competition of different meta IP for attention resources. Meta IP can survive mainly because it has enough audience attention resources, and thus provide basic guarantee for the subsequent development of copyright resources and derivative value creation. It can be assumed that there are two populations (two meta IP), when they live alone the change of quantity is subject to the logistic law:

$$\frac{dx}{dt} = r_1 x(1 - \frac{x}{N_1}) \tag{1}$$

$$\frac{dy}{dt} = r_2 y(1 - \frac{y}{N_2}) \tag{2}$$

When two meta IP of A and B live together, they share the same space and resource, and the blocking effect of B to A growth is proportional to the quantity of B; It can be revealed that the change of each population quantity is not only restricted by the law of its own population, but also influenced by other populations.

$$\frac{dx}{dt} = r_1 x(1 - \frac{x}{N_1} - s_1 \frac{y}{N_2}) \tag{3}$$

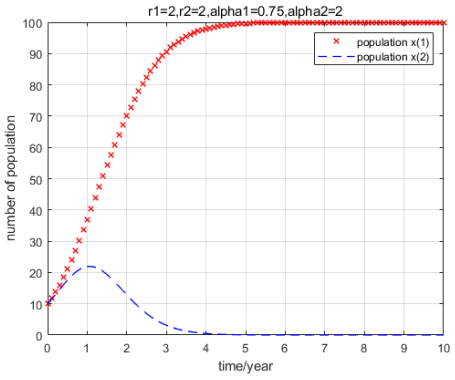
$$\frac{dy}{dt} = r_2 y(1 - \frac{y}{N_2} - s_2 \frac{x}{N_1}) \quad (4)$$

x(t) is the number of population A, *y(t)* is the number of population B, r_1, r_2 is the fixed growth rate, n_1, n_2 is the maximum capacity. N_i is the maximum environmental capacity of the species. Here s_1 and s_2 act as a proportional factor, reflecting the size of consumption. Compared to the resources for A to support the same number of units of B to consume s_1 times the resources, s_2 is the same.

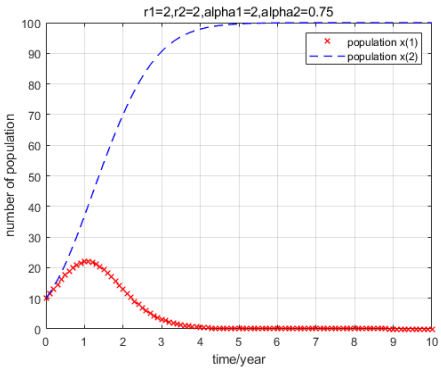
As can be seen from formulas (3) and (4), the two populations are equally represented in the same conditions of inherent growth rate, maximum capacity and relative consumption factors. As shown in Figures 1 (a) and (b). Figures 1(b)、(c)、and (d) that, under the parameters indicated, population *x(2)* has a competitive advantage and has the largest population over a certain period of time; However, population *x(1)* tends to perish over a certain period of time.

Figure 1(b) shows that, with the same inherent growth rate, population *x(2)* has a greater competitive advantage due to the smaller s_1. Which indicates, other meta IP cannot obtain sufficient resources through competition.

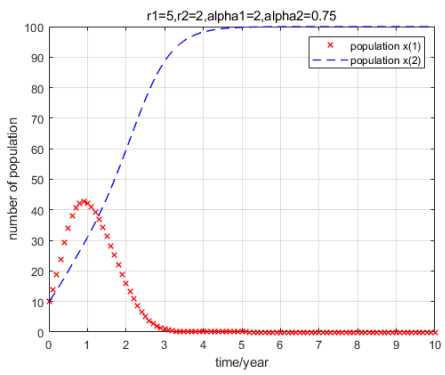
By comparing figures 1(b)、(c)、and (d), it shows, in the condition of the maximum capacity and relative consumption factors remaining the same, the growth rate of population *x(2)* is accelerating with the increase of r_2's relatively inherent growth rate (r_2/r_1). It reveals that we should continuously improve the quality of meta IP and maintain a relatively high level of the growth rate r_2, and then can occupy the leading position in the creative intellectual resource system of the Internet copyright industry.



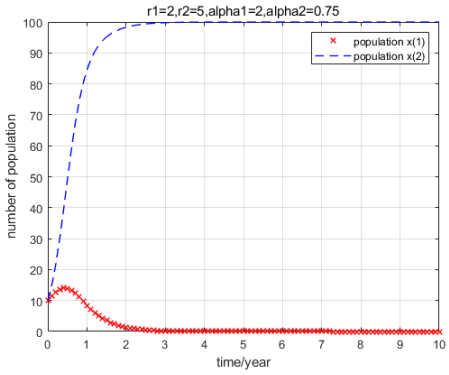
(a) r_1=2, r_2=2, s_1=0.75, s_2=2



(b) r_1=2, r_2=2, s_1=2, s_2=0.75



(c) r_1=5, r_2=2, s_1=2, s_2=0.75



(d) r_1=2, r_2=5, s_1=2, s_2=0.75

Figure 1 Simulation Results of the Population Competition Model

3.2 Population symbiotic relationship model

Here the population A corresponds to the meta IP, population B corresponds to the Internet copyright developers.

If the meta-IP A exists independently, it will grow according to the Logistic law [10]. If Internet copyright developer B provides attention resources for A, it will promote A's growth.

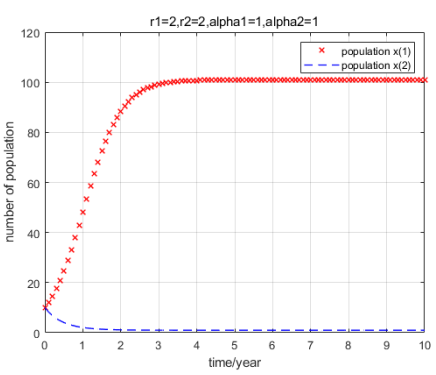
$$\frac{dx}{dt} = r_1 x(1 - \frac{x}{n_1} + \alpha_1 \frac{y}{n_2}) \tag{5}$$

Population B (Internet copyright developer) will extinct without A (meta-IP), set its extinction rate to r_2, then when B exists alone we have

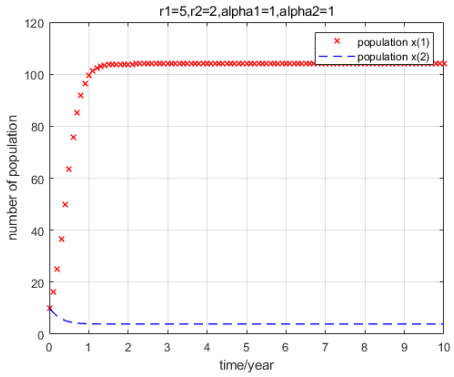
$$\frac{dy}{dt} = -r_2 y \tag{6}$$

A provides attention resources for B and promotes B's growth, and consider B's own obstruction, there is the following formula:

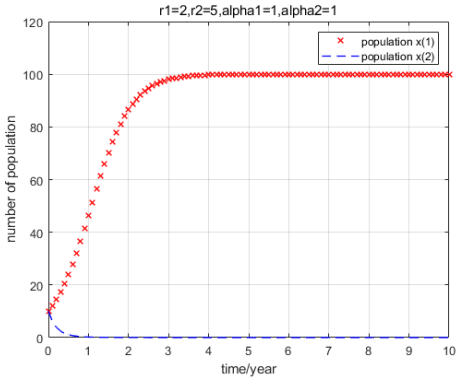
$$\frac{dy}{dt} = r_2 y(-1 - \frac{y}{n_2} + \alpha_2 \frac{x}{n_1}) \tag{7}$$



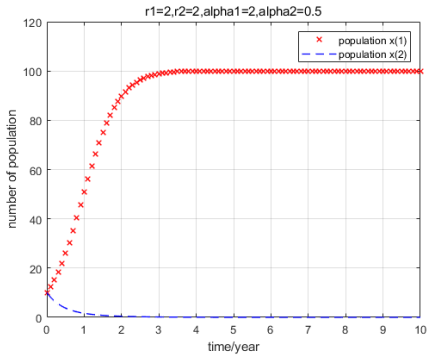
(a) r_1=2, r_2=2, α_1=1, α_2=1



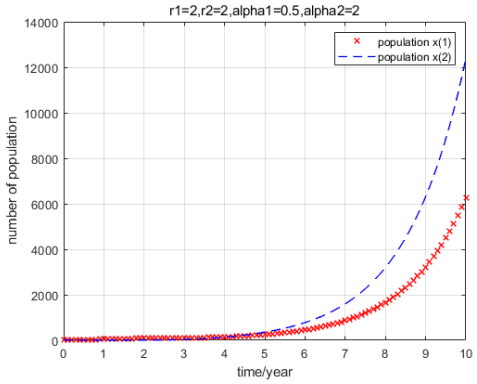
(b) r_1=5, r_2=2, α_1=1, α_2=1



(c) r_1=2, r_2=5, α_1=1, α_2=1



(d) r_1=2, r_2=2, α_1=2, α_2=0.5



(e) r_1=2, r_2=2, α_1=0.5, α_2=2

Figure 2 Simulation Results of the Population Symbiotic Model

In the formula, α_1 indicates that the amount of attention resources provided by the unit number of Internet copyright developers (relative to n_2) to support the meta IP is α_1 times the amount of attention resources consumed by the unit number of meta IP (relative to n_1) to support the

Internet copyright developers.

It can be shown from formulas (5) and (7) that the status of the two populations varies in the condition of same inherent growth rate, extinction rate and relative supply consumption factor. In this case, $n_1=n_2=100$. Figures 2(a), (b) and (c) show that, with the same coefficient of relative supply consumption, the relatively larger inherent growth rate of r_1 will make a greater growth rate when it eventually reaches the maximum population. It also reveals r_1 reflects the growth rate of the meta IP itself.

Figures 2(a), (d), and (e) show that when the relative supply consumption factor α_2 exceeds a certain number, population x_2 is inversely scaled in quantity and finally reach symbiosis. It means, when the attention resources provided by meta IP reach a certain number, the win-win situation between meta IP and Internet copyright developers can be realized.

The result also suggests that increasing α_2/α_1, which is crucial to choose a good content for further development, thus can achieve positive promotion of Internet copyright developer. Based on the IP content of network literature, the copyright buyer can develop derivative products in other fields to the maximum extent, develop a single network literature IP into a copyright resource matrix, and fully explore the commercial value of various fields.

4 An evolutionary analysis of the ecological symbiotic system of creative intellectual resources in the Internet copyright industry

From the macro perspective, if consider the whole Internet copyright industry intellectual resources symbiotic system as a whole, its evolution will be affected by its own and environment, follow the Logistic growth mechanism. The detailed following is listed:

$$\begin{cases} \frac{dX(t)}{dt} = rX(t)\left[1-\frac{X(t)}{K}\right] \\ X(0) = X_0 \end{cases} \tag{8}$$

In Formula (8), X(t) and $\frac{dX(t)}{dt}$ represent the efficiency output (the combined value of the output of the Internet copyright industry) and the growth rate of the symbiotic system of intellectual resources in the Internet copyright industry respectively at t moment; *r* represents the inherent natural growth rate of the efficiency output of the symbiotic system of intellectual resources of the Internet copyright industry, which is not subject to external environment constraints (i.e., without regard to the relevant regulations and constraints of the media market), which is mainly determined by the ability of each unit within the system and the competitive synergy; *K* represents the highest efficiency output of the symbiotic system of intellectual resources in the Internet copyright industry.

Among them, X(t) and $\left[1-\frac{X(t)}{K}\right]$ reflect the positive and negative feedback mechanisms of symbiotic system evolution respectively.

It should be pointed out that, taking the reality into account, the efficiency output of the symbiotic system of intellectual resources in the Internet copyright industry is positive, $r>0$, $K>0$。

Solve formula (8), the benefit output evolution equation of the state of symbiotic system can be obtained.

$$X(t) = \frac{K}{1+\left(\frac{K}{x_0}-1\right)e^{-rt}} = \frac{K}{1+ce^{-rt}} \tag{9}$$

$c = \frac{K}{x_0} - 1$, It is determined by the initial state x_0 of the system

In the mathematical model (8) of the evolution trajectory of the symbiotic system of intellectual resources in the Internet copyright industry, parameter r represents the natural growth rate of the benefit output of the symbiotic system of intellectual resources. In this study, the internal operation efficiency of the Internet copyright industry value chain is taken as the actual data value of parameter r, which is taken as 0.9, 0.3 and 0.02 respectively. Considering that the actual values of the initial value X_0 and the maximum benefit output K are not easy to determine, it is assumed that the ratio is $Y_0 = \frac{X_0}{K} = 0.01$

Combined with the above formula and parameters, the evolution of the symbiotic system of intellectual resources in the Internet copyright industry is simulated, as shown in Figure 3.

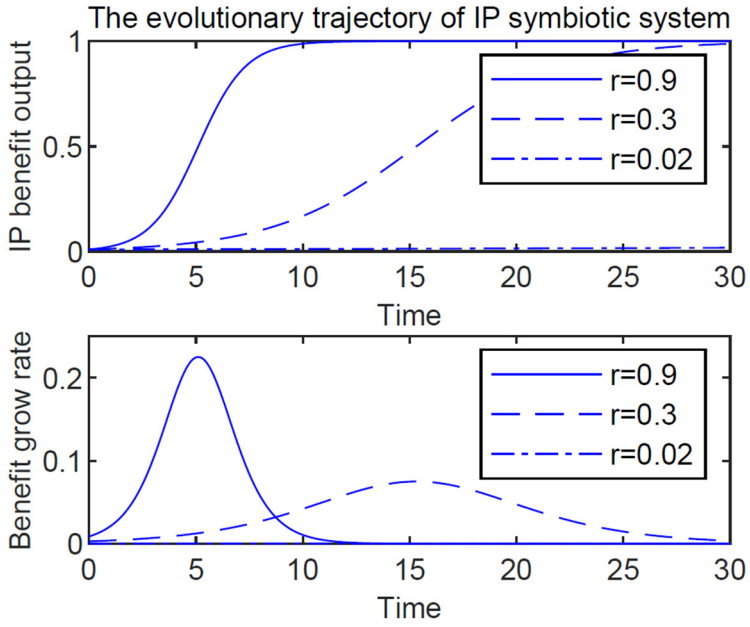


Figure 3 Simulation of the Evolution Trajectory of the Symbiotic System of Intellectual Resources in the Internet Copyright Industry

It can be concluded from the evolution trajectory of the symbiotic system of intellectual resources in the Internet copyright industry in Figure 3, because the natural growth rate parameters are taken differently, the speed and acceleration of evolution are different

accordingly. In Figure 3, the below figure shows the slope of the figure above, which indicates that as r increases, the time to reach the highest output level decreases (from 10 to 30 to infinity). The maximum rate reaches at 5 and 15 respectively, which also verifies the symmetry of the S-curve, and the evolutionary trajectory presents the S-shaped trajectory. In addition, which should be pointed out is that r reflects the overall coordination ability of symbiotic systems, corresponding to the actual different driving methods, which also reminds us that in real practice, we should put coordination on the priority list, in order to achieve the best output as quickly as possible.

5 Simulation of the evolution of symbiotic systems based on chaos theory

As can be seen above, the trajectory of Logistic, which grows and evolves in the intellectual resource symbiosis system of the Internet copyright industry, will change with the changes of K and r in different evolution cycles, and may produce chaotic phenomena. Chaos theory emphasizes the role of tiny initial values and disturbances in system deviation and evolutionary direction. One of its classic models is the standard Logistic equation. And r is an inherent growth rate free from outside interference here, and in order to ensure that the output of $Y \in [0, 1]$, we need $r \in [0, 4]$.

$$\frac{dY(t)}{dt} = \frac{1dX(t)}{Kdt} = \frac{1}{K} rKY(t)[1 - Y(t)] = rY(t)[1 - Y(t)] \qquad 0 < Y(t) < 1 \tag{10}$$

Discrete processing of the upper formula:

$$\begin{gathered} \mathrm{Y(t+1))} = \mathrm{rY(t)[1-Y(t)]} \qquad 0 < Y(\mathrm{t}) < 1, 0 < r < 4 \\ \mathrm{Y(t)} = \frac{\mathrm{X(t)}}{\mathrm{K}} \qquad\qquad 0 < X(\mathrm{t}) < K \\ t \to \infty, Y \to 0 \end{gathered} \tag{11}$$

In this symbiotic system, assuming that the benefit output threshold K of intellectual resources in the Internet copyright industry is determined, the final state of system evolution depends on the natural growth rate r value inherent in the system benefit. The range of r is studied in different stages.

1) When 0<r<3, take the median value of 0 to 3 segments, r=0.75, 2.25, the simulation results of evolution process are shown in Figure 4(a), regardless of r value, the system evolution of the final stability point is unique, output tends to a fixed value.

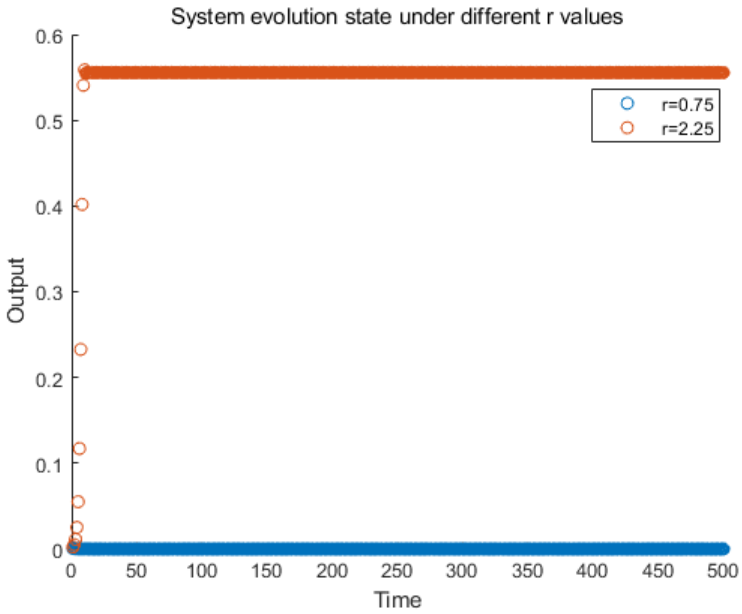


Figure 4(a) r=0.75/2.25，y0=0.001，n=100

2) When 3<r<4, the evolution of the symbiotic system of intellectual resources in the Internet copyright industry will produce forks and chaos.

a) When 3<r<3.83, the evolutionary trajectory is unstable. The simulation results are shown in Figures 4(b) and 4(c) with outputs of 2 and 4 cycles, when taking r=3.1, 3.45 respectively. With the increase of t, the output is beating between 2 or 4 values, indicating the strong evolution ability of the symbiotic system of intellectual resources of the Internet copyright industry and is in the stage of growing evolutionary. At this stage, both the environment and policy support of the meta-IP have increased.

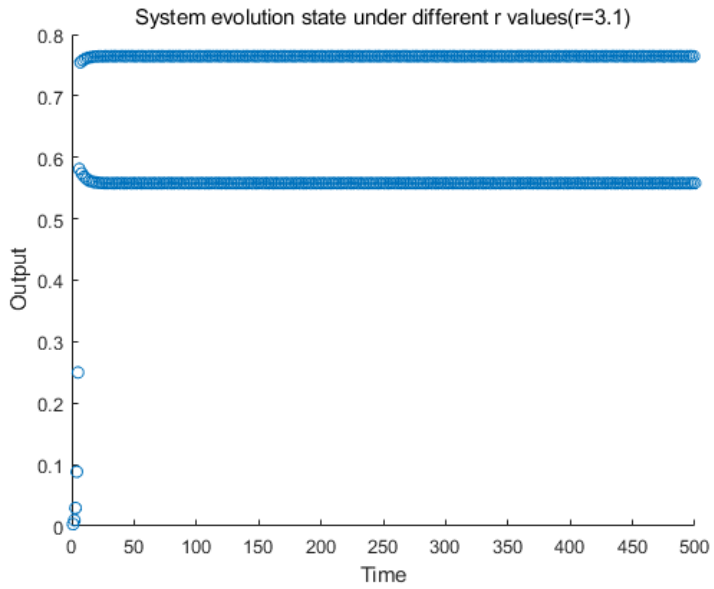


Figure 4(b) r=3.1，y0=0.001，n=100

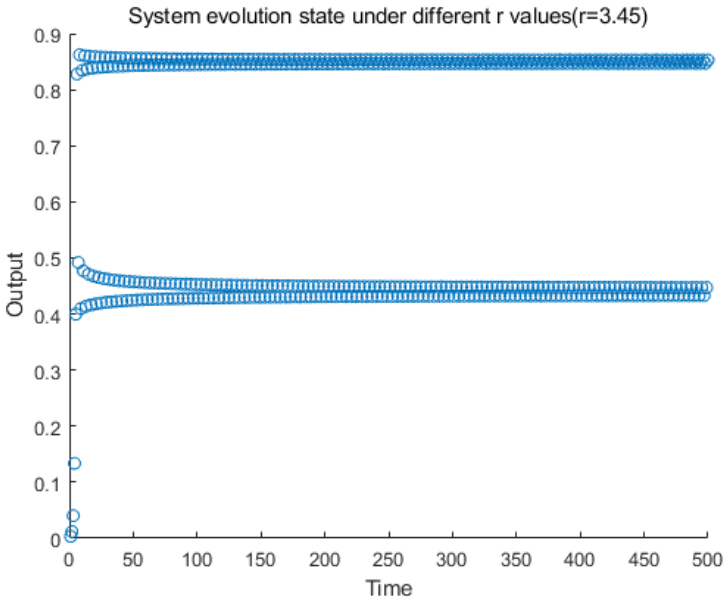


Figure 4(c) r=3.45，y0=0.001，n=100

b) When 3.83 ≤r<3.87, take r=3.85, the simulation results are shown in Figure 4(d). there are 3 cycles, and the system is doing circular motion at 3 points and begins to fork until the emergence

of chaotic phenomena. Currently, the uncertainty of the entire Internet copyright industry system is increasing.

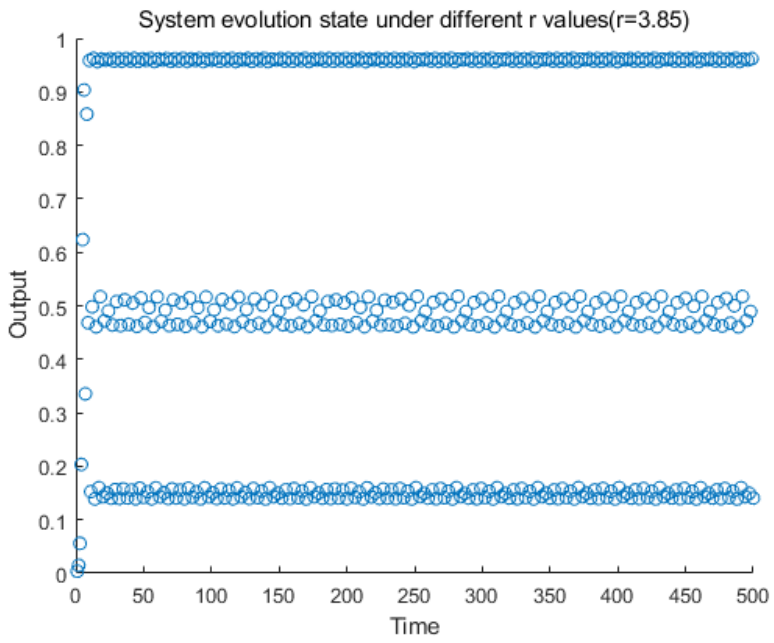


Figure 4(d) r=3.85，y0=0.001，n=100

c) Chaos occurs when 3.87<r<4. Take r=3.92, and the simulation results are shown in Figure 4(e). As time goes on, the system becomes more uncertain, and output tends to correspond to attractors, mainly reflected in the mutation stage.

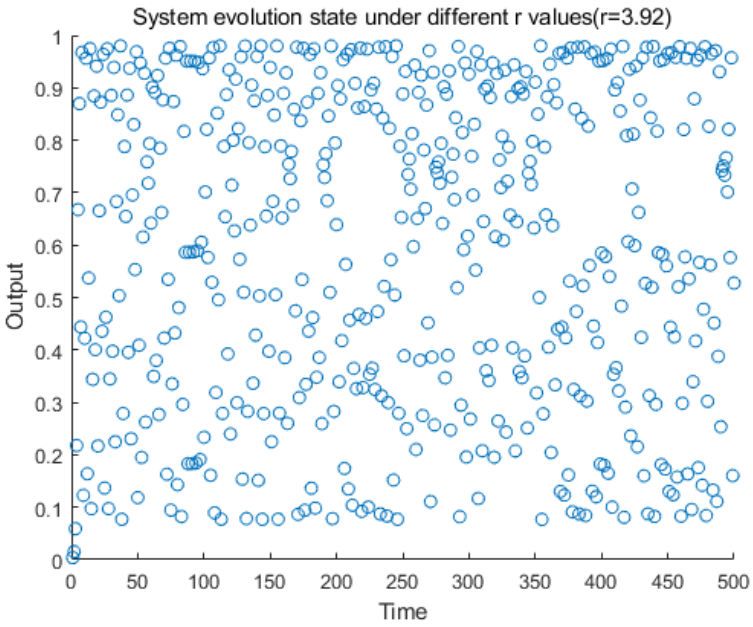


Figure 4(e) r=3.92，y0=0.001，n=100

During the mutation phase, the result of the symbiotic system of intellectual resources in the Internet copyright industry may be the demise of the recession or the leap to another higher level. In this case, increasing demand calls for more policy support. Through policy guidance and mechanism optimization, support the system will be supported with more power to achieve a better level of state, and a higher starting point for further development.

6 Conclusion

This paper analyzes the mechanism allocation of intellectual resources in the Internet copyright industry from the perspective of organizational ecology, and discusses the effect of each influence factor on the stable result and the changing trend of the evolution path of the symbiotic system of intellectual resources in the Internet copyright industry through numerical simulation. Through discussion on different possible values of influence factors, the evolution trajectory of the symbiotic system of intellectual resources in the Internet copyright industry is simulated and verified by modeling tools. The results show that the evolution process of the symbiotic system of intellectual resources in the Internet copyright industry can be described in detail and explained rationally by the Logistic growth curve equation. Meanwhile, the evolution process of the symbiotic system of intellectual resources is simulated by using chaos theory. The analysis of conclusion provides effective optimizing suggestions.

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