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Retraction

Retracted: Design and Optimization of E-Commerce Logistics Distribution System Based on Multiobjective Function

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] H. Wen, "Design and Optimization of E-Commerce Logistics Distribution System Based on Multiobjective Function," *Journal of Control Science and Engineering*, vol. 2022, Article ID 6564615, 7 pages, 2022.

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Research Article

Design and Optimization of E-Commerce Logistics Distribution System Based on Multiobjective Function

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To reduce the complexity and multiple constraints of logistics distribution routing problems, the author proposes an improved genetic algorithm, adaptive immune genetic algorithm (AIGA). The algorithm utilizes a new immune vaccine selection strategy and immune operation method, the optimization process is adaptively changed with the evolutionary algebra, combined with the parallel selection method to optimize the multiobjective logistics distribution path, and the specific steps to solve the multiobjective logistics distribution path problem are given. The experimental results show that the optimal path is calculated as 0—2—8—5—3—1—0; 0—4—7—6—0. AIGA not only efficiently converges to the optimal solution but also stabilizes to a fitness value of 66.5, reflecting better precision than IGA. The computational efficiency and convergence of the algorithm are significantly improved, which verifies the practicability and effectiveness of the algorithm. The adaptive immune genetic algorithm realizes the path optimization of complex logistics distribution, which can better change the global search performance of the original immune genetic algorithm, greatly improve the algorithm convergence speed, and achieve good results in practical applications.

1. Introduction

With the growth and prosperity of people, today's life has entered the Internet age, large B2C e-commerce platforms such as Tmall and JD.com are becoming more and more perfect, and restaurants such as Tmall Double Eleven and December are very popular, people can hear the convenience and benefits of online shopping anytime and anywhere in the process of daily meals, and they are more confident in online shopping [1]. Under the current economic downturn, many industries are in a critical period of reducing production and destocking, and the scale of the online shopping market is still expanding. Global and JD.com overseas acquisitions), with the expansion of business and continuous improvement of services, gradually began to develop and expand to small and medium-sized cities and even rural stores, the scale of China's online shopping market will continue to maintain a high compound growth rate.

At the same time, the state is also promoting the integration of traditional industries and the Internet. The concept of "Internet +" was first proposed by Premier Li Keqiang in a government letter on advertising. The law also affects online businesses. Most items in the centralized procurement catalog of central government agencies have also implemented online procurement, at the current stage, how to attract consumers to consume online is not the biggest problem faced by e-commerce, how to improve the logistics system and bring fast and convenient logistics services to consumers, ensuring the safety of consumers' personal information and the protection of their legitimate rights and interests has become the biggest challenge for e-commerce companies. With the rise of e-commerce, the types and quantities of consumers' online shopping are constantly expanding, the number of items delivered has increased significantly, and consumers have higher requirements for the mode and efficiency of delivery services [2]. Therefore, while doing a good job in the overall scheduling of logistics and improving efficiency, the logistics end link also needs to take corresponding methods and measures to adapt to consumers' requirements for distribution mode and efficiency, and further improve consumers' satisfaction with online shopping activities. Logistics distribution cost is an important part of distribution cost management, which runs through the entire distribution process. Logistics distribution cost can organically combine advanced distribution cost budget and daily distribution cost control, and is an important means to strengthen distribution cost management and improve distribution efficiency.

2. Literature Review

Iranian Manesh, et al. There has been good research, to study the terminal structure of e-commerce logistics terminal distribution network, how to organize personal content is very important [3]. By comparing the similarities and differences between the e-commerce logistics distribution network and telephone communication, Wu, et al. designed a method for constructing an e-commerce logistics terminal distribution network and developed an e-commerce logistics terminal distribution network optimization model [4]. Sun, et al. analyzed the vehicle usage and distribution route planning model with time windows based on the door-to-door distribution model, and proposed methods to improve the quality of distribution services [5]. Son et al. studied the delivery model of home delivery and believed that the home delivery model could be widely used in online retail [6]. Xie, et al. studied B2C e-commerce enterprises and decided that enterprises should adopt a comprehensive analysis of the business scope, financial status, profit model, future planning, main customer types, and geographical division of B2C e-commerce enterprises. Which mode to carry out logistics and distribution business [7]. Chen, et al. took Taobao and Jingdong Mall as examples to study the distribution modes adopted by them, and then analyzed the different characteristics of the self-built logistics mode and the "outsourcing" mode of B2C e-commerce in turn, and proved that the AHP method is effective in studying this problem is used to determine the influencing factors of mode selection, which is a reasonable and effective method [8]. Cao et al. used the SWOT analysis method to study the advantages, disadvantages, opportunities, and threats of cross-border commercial logistics in my countr, and proposed that the use of the 4PL model can effectively improve the operation level and service quality of cross-border e-commerce logistics [9]. Duan, Li, and others proposed that e-commerce enterprises should be customer-oriented, for customers according to the type of demand, consumption habits, and geographical area, it is recommended to set up self-pickup cabinets in customer-intensive areas, at the same time, various modes such as door-to-door delivery are used to jointly provide delivery services. On the other hand, the problems in China's e-commerce logistics and distribution are classified and summarized and compared with the advanced models in developed countries, it is believed that the indirect distribution model is the future development trend [10].

The purpose of the Vehicle Routing Problem (VRP) study in logistics distribution is to create a suitable way for consumers to obtain details so that each customer can work together, to achieve certain optimization goals. Due to the limitations of vehicle capacity and mileage, logistics and distribution requirements must achieve a short total vehicle mileage, and high vehicle utilization, therefore, the logistics distribution vehicle routing optimization problem is a multi-objective constrained optimization problem. The methods used by countries to solve optimization are mainly divided into the following four categories: exact algorithms, heuristic algorithms, simulation methods, and interactive optimization methods. Among, the heuristic algorithm, the immune genetic algorithm has a strong ability to seek optimization, moreover, it has the advantages of self-adjustment and self-memory, in recent years, it has been widely used to solve the VRP problem, and has also been rapidly applied and promoted in engineering, but in the application, it also avoids the shortcomings of the immune genetic algorithm, such as precociousness and slow convergence speed. Based on this, the author proposes a multi-objective logistics distribution vehicle routing optimization scheme based on the Adaptive Immune Genetic Algorithm (AIGA) and parallel selection method. As the basis of the modernization of logistics management, logistics informatization refers to a series of processing activities that enterprises use modern information technology to collect, classify, transmit, summarize, identify, track and query all or part of the information generated in the logistics process to achieve The control of the flow of goods, thereby reducing the cost and improving the efficiency of management activities.

3. Research Methods

3.1. Genetic Algorithm. A genetic algorithm is mainly to simulate the process of inheritance and evolution of organisms in the natural environment, and the formation of a global optimization search algorithm, its core idea is to use equipment to simulate human beings and organisms and solve complex optimization problems in the process of genetic evolution. It has obvious advantages, its essence is a parallel, efficient and global search method, it has been achieved in neural networks, graphics processing, adaptive control, model optimization, pattern recognition, natural and social sciences, etc. a very good application.

In the development and evolution of our nature, human beings and organisms adjust themselves to adapt to changes in the external environment through heredity and mutation, through the crossover and mutation from generation to generation, through the means of survival of the fittest, the purpose of adapting to the environment is achieved. The genetic algorithm simulates this evolutionary mutation process, when we solve the problem, in reality, we map the solution space of the problem to be solved to the genetic space, and we correspond to each solution as a chromosome, and then we evaluate the chromosome according to the objective function defined by ourselves, and then according to the calculation, we get an appropriate fitness value [11]. In the process of evolution, organisms select, cross and mutate chromosomes according to the fitness value we give to adapt to changes in the external environment, to retain outstanding individual members. Genetic algorithms simulate these processes and describe genetic functions such as selection, mutation, and mutation. Through our work, the benefits of survival of the fittest are realized. The Genetic Algorithm consists of five simple coding procedures, First

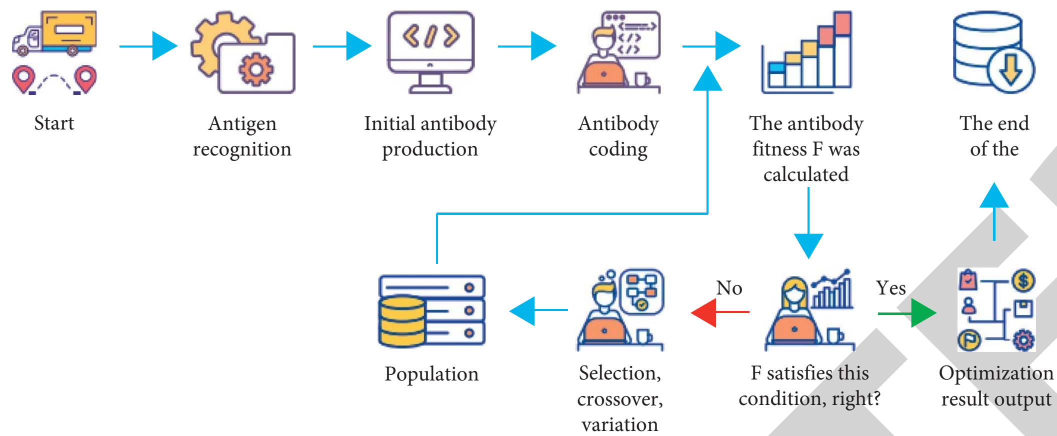

Figure 1: Flowchart of genetic algorithm.

Public Selection, Exercise Design, Genetic Selection, Crossover, Transformation, and Final Control. These five processes will not be described in detail here but will be introduced in later chapters. The flowchart of its genetic algorithm is shown in Figure 1.

3.2. AIGA in Multiobjective Logistics Distribution Path Optimization. Adaptive immune genetic algorithm is an advanced algorithm developed by a combination of various disciplines in recent years, it is developed based on immune genetics and genetic algorithm, it is an improved genetic algorithm based on biological immune mechanism. The idea of an artificial immune system mainly comes from the theory of biological immunity, and its research results have been widely used in many fields, such as data processing, optimization learning, machine control, and other fields, the research of artificial immune system has been another new research hotspot of artificial intelligence [12].

Based on the genetic algorithm, the immune system algorithm adds antigen recognition, memory, and control functions. Through cell division and differentiation, the immune system can produce many vaccines against various antigens, at the same time, the immune system has a mechanism to maintain immune balance, through the inhibition and promotion of antibodies, it can self-regulate to produce an appropriate amount of necessary antibodies.

A modified version of the immune system (AIGA) has been proposed due to the introduction of new immune selections and immunization programs, which takes into account rapid search, international research, and local search capabilities [13].

3.2.1. Antibody Coding and Population Initialization. Suppose the logistics center has k delivery vehicles, each with a load of$Q_k\ (k = 1, 2, \ldots, k)$, delivering goods to L customers. The demand of customer i is $q_i\ (i = 1, 2, \ldots, L)$, and n_k is the number of customers delivered by the k-th vehicle ($n_k = 0$ means that the k-th vehicle is not used). The set R_k represents the k-th path, and the element r_k represents that the order of the customer r_k in path k is i (excluding the logistics center).

For the multi-objective path optimization (MVRP) problem, the natural number encoding method is chosen to solve the MVRP problem. Each locus is represented by a natural number for a customer point, when initializing the population, the number of the initial population that meets the requirements is generated by random methods, and every time a car is full, the next car is replaced, that is, when $\sum_{i=1}^{n_k} q_i \geq Q_k$ is satisfied, insert an O ($r_{k_0} = 0$ representing the logistics center) at the position of i—1 , that is, the number of 0s in a chromosome is $\sum_{k=1}^{k} \text{sign} n_k - 1$, at the same time, both ends of each line are 0 after decoding, and the generated random loci should be different from each other, otherwise it is an infeasible chromosome [14].

3.2.2. Fitness Function Selection and Multiobjective Optimization. The three sub-objective functions are linearly weighted by the weight transformation method, as the evaluation function of vaccine selection, let the weight of the total delivery mileage be α, and the weight of the number of delivery vehicles to be β, the weights of the total utilization rate of delivery vehicles are γ, α, β, and γ, the value of each weight depends on the degree of influence of each weight on the specific problem, and meets $\alpha + \beta + \gamma = 1$ and individual fitness $f(t) = \alpha(1/Z_1) + \beta(1/Z_2) + \gamma Z_3$.

The parallel selection method solves the multi-objective optimization problem, as shown in Figure 2.

3.3. Genetic Operator

3.3.1. Selection Operator

The roulette strategy selection method is used.

3.3.2. Crossover Operator. Humans crossover by using continuous improvement, consisting of two regions of random points i, j, i, and j from the parent chromosome as the exchange region, and additionally a substring in the exchange region of another third party. As a prefix in front of its chromosome, and then the gene sequence number with the same prefix in the chromosome is deleted, that is, the crossover is completed [15].

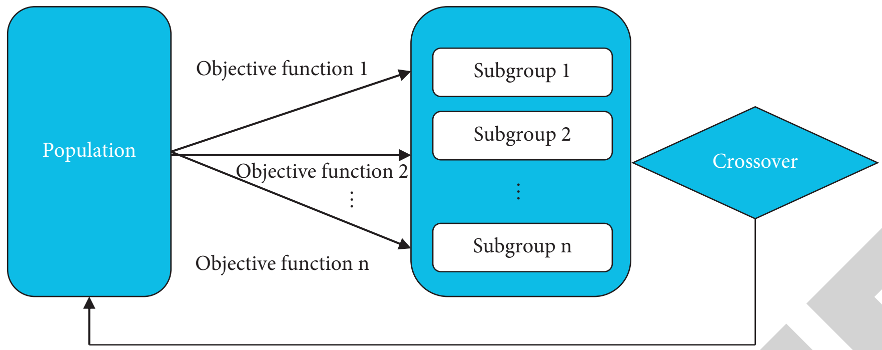

FIGURE 2: Schematic diagram of the parallel selection method.

3.3.3. Mutation Operator. Randomly generate two random points i and j on the selected mutated individual $X = (x_1, x_2, \ldots, x_i, \ldots, x_j, \ldots, x_n)$, and replace the original path between x_i and x_j with another path with x_i as the starting point and x_j as the endpoint, at the same time, to avoid the occurrence of loops, the repeated loci that may be generated in the chromosome after mutation should be eliminated to ensure the feasibility of new individuals, at the same time, to maintain the diversity of the population, the adaptive mutation rate of the following formula is designed:

$$p_m(t) = p_m + \frac{f(t-1)}{f(t)} n_e. \quad (1)$$

In formula (1), t represents the current algebra; p_m represents the preset mutation rate, generally between 0.01 and 0.1; $f(t-1)$ represents the best fitness value of the previous generation population; $f(t)$ represents the best fitness value of the contemporary population; ne represents the continuous unevolved generation since the last evolution to the current generation, that is, when $f(t-1) = f(t)$, $n_e = n_e + 1$.

3.4. Selection of AIGA Vaccine. Since individuals with the same fitness or little difference may contain very different patterns, in general, only contemporary optimal individuals are selected for vaccines, while guiding the evolution direction of the population, it will bring misleading effects with a large probability, and it is easy to make the population search fall into the local optimal solution [16]. Given its shortcomings, it is proposed to select two better individuals in the contemporary population as injection vaccines, it can make the vaccinated individual, that is, the antibody, contain useful patterns, and make it move closer to the direction of the excellent individual, which has a certain guiding effect on the search, thereby accelerating the convergence speed and effectively suppressing the error caused by a single vaccine, evolution provides multiple directions, the specific steps are as follows:

(1) Calculate the fitness $f(x_i(t))$ of an individual $x_i(t)$ in the population $X(t) = (x_1(t), x_2(t), \ldots, x_n(t))$;

(2) Let the subscript of the optimal individual in $X(t)$ be k_1, that is, $f(x_{k_1}(t))$ achieves the maximum value;

(3) Traverse the entire population $X(t)$, let $p = f[x_{k_1}(t)] - f[x_i(t)]$, and mark the individual whose value of p is the smallest and not 0 as k_2, then $x_{k_2}(t)$ is the suboptimal solution in the population $X(t)$;

(4) Select $x_{k_1}(t)$ and $x_{k_2}(t)$ as two vaccines.

3.5. AIGA Immune Manipulation. The immunization operation will inoculate the individuals in the population with the selected excellent vaccine, to enhance the overall performance of the population, it is divided into full immunity and target immunity. The author chooses target immunity, that is, considering the local optimal adjustment, the immune response occurs in one or several places [17].

(1) The individual fitness $f[x_i(t)]$ in the population $X(t)$ is sorted, the average fitness $\overline{f} = \sum_{i=1}^{n} f[x_i(t)]/n$ of the population is calculated, and the individuals with lower than average fitness are randomly selected as the inoculated individuals, and the number is determined by the formula (2).

(2) Selection of the number of inoculated individuals and inoculation points.

The number of inoculated individuals is as follows:

$$s(t) = \frac{N}{1 + \ln\left(1 + Ne^{-t}\right)}. \quad (2)$$

In formula (2), t represents the current generation number, and N represents the number of individuals in the current generation population.

The number of inoculation points is as follows:

$$p(t) = Le^{-t}. \quad (3)$$

In formula (3), t represents the current algebra, and L represents the individual code length. Both formulas (2) and (3) meet the requirements of self-adaptation and can change with the change of evolutionary algebra [18].

4. Method of Selection of Antibodies after Vaccination

In Section 3.2.4, $x_{k_1}(t)$ and $x_{k_2}(t)$ are selected as two vaccines, and the selected individual to be vaccinated is $x_m(t)$,

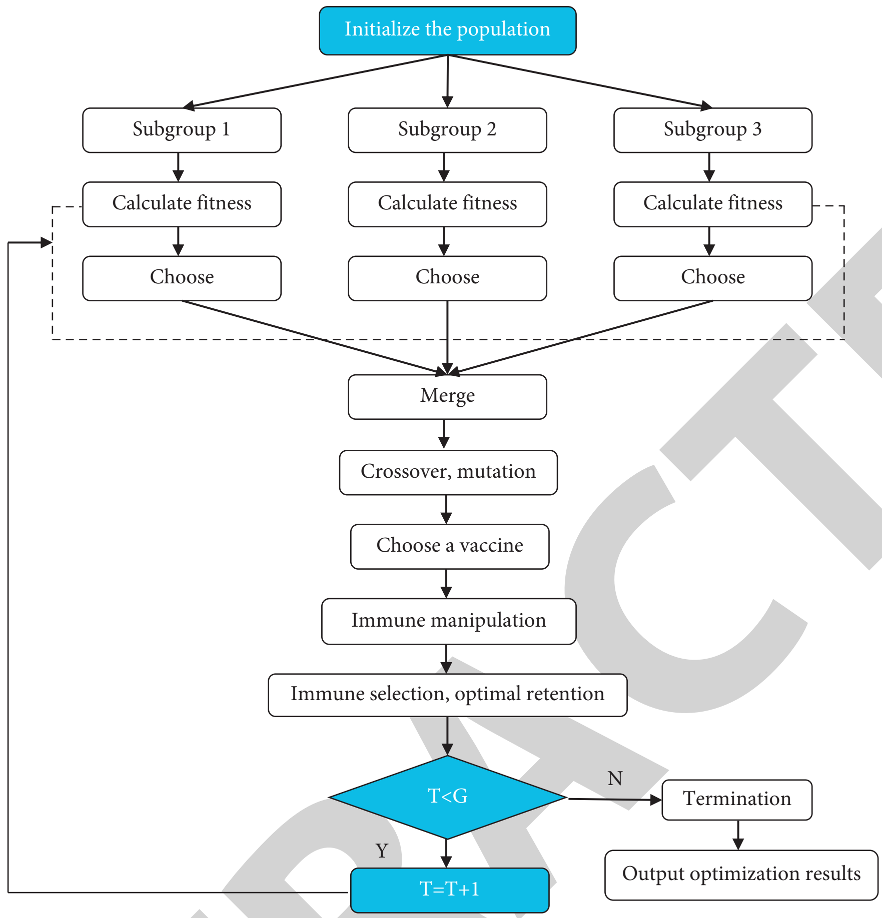

Figure 3: AIGA multiobjective optimization flowchart.

inject with the vaccine by selecting the closest point on the path around the inoculation point, two antibodies are produced after inoculation, $x_{mk_0}(t)$ and $x_{mk_1}(t)$, respectively, and the larger of $f[x_m(t)]$, $f[x_{mk_0}(t)]$, and $f[x_{mk_1}(t)]$ is the antibody.

4.1. The Realization Process of AIGA in VRP Multiobjective Optimization. The AIGA algorithm steps are as follows:

(1) Take the evolutionary algebra $t = 1$, generate the initial population according to the method in Section 3.2.1, and input the control parameters (crossover probability P_c, mutation probability P_v, population size N, maximum running algebra G, etc.), the termination condition of the algorithm is that the evolutionary algebra is equal to the maximum running algebra;

(2) Calculate the individual fitness, and select an individual according to the roulette strategy;

(3) For the selected M individuals, perform crossover and mutation operations according to the crossover and mutation method in Section 3.2.3;

(4) Select two vaccines according to the vaccine selection method in section 3.1.4, select the number of individuals to be vaccinated and the number of inoculation points according to formula (2) and formula (3) for immunization operation, and make the immunization selection after vaccination, at the same time, the optimal individual retention strategy is adopted for the inoculated population;

(5) $t < G, t = t + l$, otherwise go to step (2); Otherwise, the algorithm terminates and the optimization result is output [19].

The flowchart of AIGA in VRP multiobjective optimization is shown in Figure 3.

5. Analysis of Results

Under the Windows XP operating system, visual C++ 6.0 understands the experimental version of modifying the immune system algorithm. In the process of multi-purpose logistics distribution optimization, it is proved that the algorithm is efficient and stable in path optimization. The distance of customer points and the demand of each customer point are shown in Table 1, the results of adaptive immune genetic algorithm (IAGA) and immune genetic algorithm (IGA) are shown in Table 2, Figure 4 shows the result comparison between adaptive immune genetic algorithm and immune genetic algorithm [20].

The experimental results calculate the optimal path as 0—2—8—5—3—1—0; 0—4—7—6—0. The parameters used

Table 1: Customer point distance and demand of each customer point [15].

d_{ij}	0	1	2	3	4	5	6	7	8
0	0	4	6	7.5	9	20	10	16	8
1	4	0	6.5	4	10	5	7.5	11	10
2	6	6.5	0	7.5	10	10	7.5	7.5	7.5
3	7.5	4	7.5	0	10	5	9	9	15
4	9	10	10	10	0	10	7.5	7.5	10
5	20	5	10	5	10	0	7	9	7.5
6	10	7.5	7.5	9	7.5	7	0	7	10
7	16	11	7.5	9	7.5	9	7	0	10
8	8	10	7.5	15	10	7.5	10	10	0
Demand		1	2	1	2	1	4	2	2

Table 2: Results of immune genetic algorithm and adaptive immune genetic algorithm.

Evolutionary algebra	10	20	30	40	50	60	70
IGA	70.2	69.6	68.1	68	67.5	67.4	67.6
IAGA	68.6	67.8	67.4	67.4	67.1	66.5	66.5

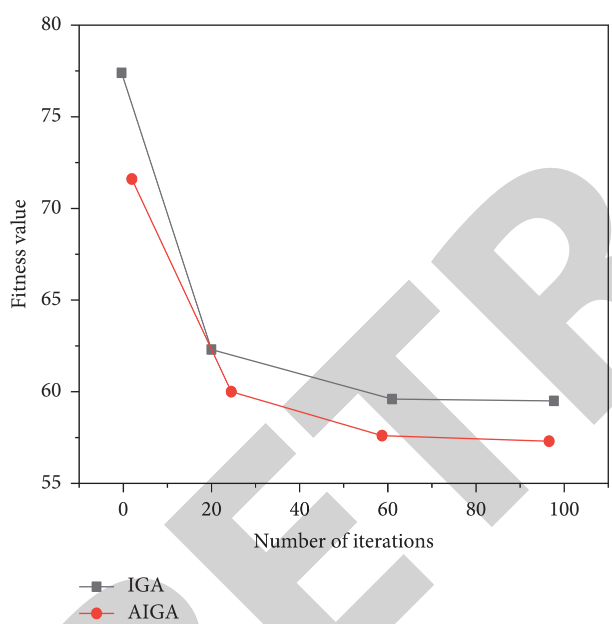

Figure 4: Comparison of IGA and AIGA.

in the experiment are Maximum evolutionary generation $G = 100$, population size $N = 30$, crossover probability = 0.95, mutation probability = 0.05, and fitness weight factor $\alpha = \beta = \gamma = 1/3$ [15]. The advantages of AIGA can be seen in Figure 4, it not only efficiently converges to the optimal solution, but also stabilizes to a fitness value of 66.5, reflecting that the fineness is better than IGA [21].

6. Conclusion

A genetic algorithm is an evolutionary algorithm based on random search technology based on natural genetic rules, but with the large-scale and complex actual structure, it tends to converge prematurely. After studying the coding method, control parameters, and operator operation of the algorithm, a dynamic adaptive strategy is proposed to improve its performance given the lack of global convergence. Based on the basic genetic operator, the immune genetic operator, and the optimal strategy. The immune operator can prevent individual degradation in the crossover mutation, and the adaptive strategy maintains the diversity of the population, to ensure that the genetic algorithm converges to the global optimal solution as soon as possible, which is called the adaptive immune genetic algorithm. The results of this paper show that the adaptive immune genetic algorithm is computationally efficient and reliable in stochastic structure optimization.

By combining mutation of immunization algorithms with multiple goal-setting alternatives, a new vaccine selection and immunization procedure have shown that the optimization process is interchangeable with evolutionary algebra to address multiple delivery goals. By comparing the solutions of the adaptive immune genetic algorithm and the general immune genetic algorithm, the following conclusions are drawn: the adaptive immune genetic algorithm realizes the optimization of complex logistics distribution, and will better correct the global research performance of the original immune genetic algorithm. It greatly improves the convergence speed of the algorithm and can achieve good results in this field.

From the perspective of market orientation, we can find that market demand often determines the development direction of a certain industry, and the logistics industry is no exception. After the development in recent years, the two factors of consumption upgrade and the Internet revolution have greatly promoted the further development of the new retail industry, and the development of new retail has also promoted the rapid change of the logistics industry, and the logistics industry has begun to appear individualized. Fragmented logistics respond quickly and rapidly to the market. In terms of the trend of logistics development, the future development direction of logistics has also begun to take shape, showing three major trends.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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