

# In-Depth Study of Rural E-Commerce Logistics Distribution Model Based on Genetic Algorithm

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**Abstract:** In recent years, driven by the maturity of the Internet and the continuous prosperity of the market economy, the e-commerce logistics industry has developed very well, which also affects the business model and philosophy of the whole society. Of course, there are still many problems in the distribution of e-commerce logistics, especially in the rural logistics industry. Optimizing the distribution path as a difficulty problem, it is only possible to get the optimal solution when the customer and the path are few, and the heuristic algorithm becomes the basic direction to solve the problem. The genetic algorithm is one of the good ones. The tool, which draws on biological natural selection and genetics, and uses a random search method, has almost no restrictions on the search space, and can perform fast searches in complex spaces. In this paper, Houbai Town rural e-commerce logistics is taken as an example, and a more suitable distribution mode is proposed. The genetic algorithm is used to solve the problem of optimization of the distribution path between stations in the distribution mode.

## 1. Introduction

Nowadays, with the increasing popularity of e-commerce, consumers have gradually formed their own consumption habits, networks and concepts in this online shopping environment. Although the e-commerce transaction process has been optimized and improved, such as one-click orders, fast payment, mobile payment and other applications greatly facilitate online transactions, often the last step of the transaction is the key to whether an enterprise can occupy the market.

## 2. E-Commerce in the Establishment of Rural Logistics Distribution Path Model

Arranging multiple trucks from a certain distribution center in rural areas to deliver to multiple demand points (village sites), requiring the location and demand of demand points and the load capacity of each vehicle to be kept constant, and rationally arranging the transportation routes of the vehicles, so that the total The shortest distance.

The operational object of the genetic algorithm is all individuals in the population, and each individual corresponds to a solution. It has three main operations: selection, crossover, and mutation.

The algorithm has the following elements:

(1) Coding. Genetic algorithms cannot process data directly. They are only encoded first to represent gene string data. Commonly used are binary codes.

(2) Generate an initial population. The initial population is randomly generated and corresponds to a solution to the problem.

(3) Assess fitness. In the process of searching, genetic algorithms need to use fitness to assess the quality of individuals and use them as genetic basis.

(4) Elect. According to the principle of survival of the fittest, select the individuals with strong vitality in the population and generate new populations.

(5) Cross. The selected individuals are stored in a paired library and randomly paired to produce a new generation of individuals.

(6) Variation. In order to compensate for some of the data lost during the crossover process, it is necessary to introduce moderate variation and change the chromosomal gene position with a certain probability.

### **3. Research on Rural E-commerce Logistics Distribution Mode--A Case Study of Houbai Town in Jurong City**

Houbai Town is located at the foot of the mountain called Maoshan, which is known as the Taoist holy land. The traffic is very convenient and convenient. There is also a national highway of about 6 kilometers across the north and south. About 40,000 arable land in the town is fertile and fertile, and the water conservancy conditions are also quite superior. There are also nearly 10,000 mu of water surface, of which 8,000 mu can be provided for cultivation; the dryland resources available for development are also nearly 5,000 mu, and the soil is good and the loess layer is deep.

#### **3.1 The status quo of rural logistics distribution in Houbai Town**

Because the individual rural geographical location of Houbai Town is relatively remote, and some even do not completely cover the network communication, making it difficult for local residents to purchase products online, and the density of the end of the goods is particularly high. High, those relatively backward villages that even have a remote location need to be dispatched by humans to deliver goods to consumers, and because Houbai Town's logistics infrastructure is limited, there are few logistics professionals who specialize in researching the most economical savings. Route, so in order to send the product to the consumer as soon as possible, the transportation department can only arrange the vehicle as much as possible, which will inevitably lead to the situation of the car being unloaded. Therefore, the problem of the delivery of the vehicle should be the main thinking. In order to not only complete the distribution task perfectly, but also reduce the transportation cost to a certain level, reduce the return airborne rate, to better complete the service and improve the profit of the enterprise.

#### **3.2 Study on the Distribution Mode of E-commerce Enterprises in Rural Areas of Houbai Town**

Because the rural consumers in Houbai Town are not as compact as the urban residents, if the vehicles are directly arranged from the city Distribution, quality, timeliness and efficiency can not be guaranteed, but also increase transportation costs. Therefore, in order to complete the distribution task more efficiently, with high quality and low cost, most e-commerce companies have adopted "self-operated or third-party transportation + site distribution". When the goods arrive at the site, the staff of the site is responsible for distribution. For the time being, the distribution mode of most e-commerce companies is mainly self-delivery or third-party distribution. After the consumers purchase the goods, the goods are transported from the city to the township service site, and then distributed by the site personnel.

Combining with the existing logistics distribution mode and the current status of logistics distribution in Houbai Town, this paper proposes to adopt the logistics distribution mode of "self-operated or third-party logistics + town site + rural agent point" in the rural area of Houbai Town, and finally by the personnel of the site. Responsible for the final delivery.

#### **3.3 Research on Distribution Mode of Rural Sites in Houbai Town**

E-commerce companies mainly transport goods to the Houbai Town Distribution Center through self-operated distribution or third-party logistics distribution, and then distribute them to various rural sites by the distribution center of Houbai Town. How to distribute goods from rural sites to consumers is still needed. Consider the issue. And because of the special nature of rural residents, the last mile of distribution is particularly complicated. For example, due to different consumer groups, their delivery time is not the same, and the relatively remote areas are relatively difficult to distribute. Therefore, it is relatively suitable for different consumption situations of rural consumers in Houbai Town.

It can be concluded that the distribution mode of e-commerce enterprises in Houbai Town can adopt the following modes:

From the cabinet mode. Because the current self-reporting cabinet has not been introduced to Houbai Town, only the city and the relatively good county towns have developed. Therefore, this model can be used to preempt the market and lay a certain foundation for the development of e-commerce enterprises in Houbai Town. .

Cooperation mode, with the store. In order to facilitate the surrounding residents to sign the courier because of something, cooperation with the surrounding stores can shorten the waiting time of the delivery staff, improve the distribution efficiency, and at the same time, it is also a revenue for the store, and can also increase the passenger flow. After this model, some villages in Baizhen have already begun to use. In the future, Baicun is an example. Currently, the cooperative stores mainly include large pharmacies, Jinke Mobile Hall and furniture factories.

Self-raising mode, At present, many logistics companies have set up sites in rural areas. Consumers can go to the site to take their own express delivery. The time of picking up the goods is flexible and does not delay the farm work. It avoids the timeliness requirements of the express delivery company and has certain development prospects. This model is also the main mode used by various villages in Houbai Town. For example, Ersheng Village has a courier station that cooperates with Shentong and Zhongtong, and has a courier house that cooperates with Yunda and Baishi.

Cooperation mode with the post. Considering some remote and difficult-to-deliver areas, the postal cooperation with a wide range of logistics networks can be selected to complete the distribution, but the delivery time is relatively high.

At present, there are two main modes adopted by Houbai Town: cooperation mode with store and self-raising mode. Both modes have their own advantages, but the shortcomings can not be ignored. Therefore, in order to make the online shopping experience of rural consumers more convenient, the other two or more modes need to be used in the future.

## **4. Empirical Research**

### **4.1 Houbai Town Rural Data Collection and Arrangement**

According to the latest data, there are currently 21 administrative villages in Houbai Town. Due to the conditions, only 8 villages have been field-examined. They are Huagang Village, Lujiang Village, Xiazhuang Village, Houbai Village, Wugangzui and Panjia. Side, Dongfanghong Village and Xicheng Village.

The specific coordinate information of 8 rural stations in Houbai Town is obtained through Baidu's coordinate picking system,.

Because the coordinates between the sites are relatively concentrated, in order to facilitate the calculation of the distance between the stations, the existing coordinates are processed as follows: the average site is the origin coordinates (119.174989, 31.822632), so the site new coordinates = [original site coordinates - Origin coordinates] \* 100. Then according to the distance formula, the distance between the stations is obtained, and the numbers 1, 2, 3, ..., 8 are substituted for Huagang Village, Lujiang Village, Xiazhuang Temple, Houbai Village, Wugangzu, Panjiabian, respectively. Dongfanghong Village and Xicheng Village, and the distribution center is 0, the coordinates are (0, 0).

### **4.2 Function Solution and Result Analysis**

It is known that the coordinates of Houbai Town Distribution Center are (0, 0), and there are two cars that can be used for transportation deployment. Because the demand in rural areas is small, the maximum load of the delivery vehicles is 9 tons, considering the effectiveness of delivery. Therefore, the maximum driving distance of one delivery is 50km, and the distribution is to 8 villages and towns. The demand for goods is  $q(t)$ . By referring to the genetic algorithm and matlab programming, the reference book assumes the crossover probability  $pc$  is 0.65, the probability of

variation. pm was 0.005 and the population size was 20.

From the results of the operation, iterative 100 times, the best result is 16.3km in the 22nd, and there are two optimal routes, which are (1). Distribution Center - Lujiang Village - Dongfanghong Village - Panjiabian - Wugang Tsui-Distribution Center; (2). Distribution Center - Huagang Village - Houbai Village - Xicheng Village - Xiazhuang Village - Distribution Center.

In fact, in daily distribution, the driver often arranges the transportation route according to his own experience, that is, the place where he approaches first, then goes all the way to the neighboring village, or only walks the route he is familiar with, regardless of the weight of the goods. And whether there will be an empty truck. The path optimized by the algorithm is compared with the path that the driver exercises according to experience. As shown in Table 1, the path optimized by the genetic algorithm is obviously more economical than the path taken by the driver's master according to his own experience, and the use of the vehicle is also reduced. Not only saves time but also reduces transportation costs. It can be seen that the optimization path is not an optional step. Although the data in the above table does not clearly show the advantages, it is mainly because the demand in various rural areas in Baizhen is not high, but If you encounter a shopping spree like "Double Eleven" and "Black Friday", the demand will definitely be several times more than usual, so that the advantage can be reflected.

Table 1 Genetic algorithm optimization path

Optimized path mode	Experience path	Algorithm optimization path
Number of vehicles	3	2
Vehicle path	[0-8-7-0], [0-4-3-6-0] [0-1-2-5-0]	[0-2-6-7-5-0] [0-1-4-8-3-0]
Total distance	19.6	16.3

## 5. Conclusions and Recommendations

By comparing the development of e-commerce enterprises in urban and rural areas and the distribution model, it can be found that e-commerce is relatively easy to distribute in cities. Consumers can choose the appropriate distribution method. In rural areas, it is not because of various factors. It is easy, the villages are relatively scattered, the consumers are scattered accordingly, the roads are rugged and difficult, and even some roads cannot pass because of construction. Therefore, vehicles should plan routes before traveling to avoid traffic jams and affect distribution and increase costs. According to the specific situation of Houbai Town, the main research conclusions are as follows.

(1) The rural consumers in Houbai Town are not dense and the basic logistics facilities are lacking. Therefore, in the distribution process, it is necessary to adjust the distribution mode for different consumer groups and try some high-tech to carry out smart logistics. This paper proposes a logistics distribution model suitable for Houbai Town by referring to some common models and considering the current development status of Houbai Town - "self-operated or third-party logistics + town site + rural agent point".

(2) Through the genetic algorithm to simulate the rural logistics problem in Houbai Town, and finally calculate the optimal route of the site distribution under the distribution mode.

Although the demand in the villages of Houbai Town is not high at present, in the future, with the development of Houbai Town's economy, there will be more and more cargo flow, so the research on distribution mode and path optimization is more and more necessary. Although this paper only studies the path optimization problem of inter-site distribution, the end distribution can also use this method to obtain the optimal path. Therefore, with the help of this algorithm, the rural logistics distribution mode is more stable and feasible. In-depth research provides advice and

support for the development of rural e-commerce.

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