Research on Optimization of Logistics Vehicle Transportation Path Based on Customer Fuzzy Demand Perspective

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Abstract: The demand market for logistics in China has been increasing year by year with the development of social economy, and the requirements that should be met in the new era background are getting higher and higher. Previously, there were obvious repetitive path problems in the transportation route of logistics vehicles, which seriously affected the transportation efficiency and increased the transportation cost of logistics vehicles. To this end, this paper starts from the perspective of customer fuzzy demand, and applies dynamic programming algorithm and quadratic exponential smoothing method to analyze the logistics vehicle transportation path optimization method in detail, which is expected to promote scanning algorithm and distribution forecast. Further improvement. This paper takes the logistics vehicle transportation of a winery as a reference case, specifically shows the specific application of the above-mentioned algorithm, and shows the result of the final reduction of the delivery mileage.

1. Introduction

Foreign scholars Ramser and Dnating proposed an unprecedented vehicle routing problem in 1959 for the current social situation, and because of the wide coverage of this concept, scholars from many different countries in the industry began to pay attention to it, making follow-up solutions. Algorithms related to vehicle routing problems, such as genetic algorithms, branch and bound algorithms, and heuristic algorithms, have been created. Based on the existing research results, it can be found that the research on the vehicle routing problem is based on the known conditions. It can be seen that the algorithm will be more effective for the vehicle routing problem under certain conditions. However, the number of studies under uncertain conditions is scarce. Even in the case of such cases, most of them focus on related research on vehicle routing problems that can find statistical laws and determine real data.

The problems of demand and supply involved in the problem of reloading and transfer are all ambiguities. In response to this environment, two foreign scholars, Pavkoviv and Teodorovic, began to try to use the Sweeping algorithm to try to deal with the customer's ambiguity-related requirements [1]. Domestic Li Jun and Zhang Jianyong and other applications of hybrid genetic algorithm, Sweeping algorithm, etc. have carried out research in this area [2]. Xie Xiaoliang, who finally achieved optimization, was realized by applying the fuzzy demand distribution path to the planning of fuzzy opportunities.

The optimization of logistics vehicle transportation path based on the perspective of customer fuzzy demand can not only improve the scanning algorithm, but also promote the accuracy of distribution forecasting. However, there are few studies in this field at home and abroad. Therefore, it is very necessary to strengthen the research on logistics vehicle transportation path optimization based on the perspective of customer fuzzy demand, which has strong practical significance.

2. Problem description and model establishment analysis

The problem of fuzzy vehicle routing is mainly that there is a C-capacity vehicle in the service center, which serves N customer groups with fuzzy requirements. The service customer coordinates and quantity are fixed, and the demand quantity D can directly apply the fuzzy number for performance. Determine the number of vehicles traveled by the decision maker and the number of

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vehicles. This represents the number of vehicle travel routes and vehicles that are determined when the delivery demand information is not accurate.

The basic idea of optimization is: the data of the prediction history is obtained by the second exponential smoothing method, and the distribution amount is determined at the same time; in addition, the regional grouping of the distribution is determined on the basis of sufficient consideration of the rated load of the vehicle, and the TSP is the traveling salesman problem. Finally, the dynamic programming algorithm is used to solve the answer.

After considering the path of the fuzzy demand vehicle and its basic ideological characteristics, the following specific countermeasures are obtained:

The second exponential smoothing method is the first step, in order to achieve the predicted distribution [3], which is the basic idea involved in the "Inventory Management Forecast" proposed by the American economist Brown in 1959. The value and the actual value y_1 are respectively calculated by weighting averages with different weights a and 1-a, and then used as the next-stage predicted value y_{t+1}. Replace the exponential smoothing number of the t period with s_1, and replace the smoothing number constant with a(0<a<1). Substituting the exponential smoothing value in the calculation of the second exponential smoothing method with $s^{(1)}_t$, the second exponential smoothing value is represented by $s^{(2)}_t$, and the time series value is represented by y_t, which gives:

$$S^{(1)}_t=ay_1+(1-a)s^{(1)}_{t-i} \quad (1)$$

$$S^{(2)}_t=as^{(1)}_t+(1-a)s^{(2)}_{t-i} \quad (2)$$

In 1974, Miller and Gillett designed a practical algorithm for the purpose of meeting the distribution area of a multi-loop vehicle. It is mainly composed of three points. The starting point is the origin of the coordinate system, the polar coordinate system is constructed in any direction of the polar axis, or the coordinate system is constructed according to the connection between the region where the customer is located and the origin. The second is to express the location of the customers in the network in the form of polar coordinates, and finally group them reasonably. From the smallest angle, the customer starts grouping in a counterclockwise direction, and the total demand of the customer reaches the rated load of the delivery vehicle and stops. This process is repeated later, guiding all customers to successively enter a group to stop, optimize the intra-group lines, optimize the customer points in each group, that is, separate TSP model lines, and optimize the lines by dynamic programming.

3. Research and optimize the vehicle distribution path of a winery based on fuzzy demand algorithm

3.1 Status of distribution routes and distribution of wineries

This winery is distributed to distribution points in eight regions. The previous record requirements for each distribution point are shown in the Table below. The sales and inventory capabilities of the integrated distribution center can be designed as follows: The amount of distribution obtained in each place is multiplied by the experience coefficient of 1.05; in addition, the monthly load of the transported nine-t own vehicle, the remaining amount of the distribution area. According to the above distribution scheme, there are two kinds of distribution routes: one is to distribute each area according to a fixed route every month; the other is to divide 8 distribution points into several distribution areas, which are respectively a delivery area 1, a delivery area 2 Distribution area 3 and delivery area 4.

Table 1 Historical demand for distribution points in 8 regions

area	Qingdao	Yantai	Texas	Jinan	Weifang	Zaozhuang	Taian	Heze
Distribution area 1	98	36	49	54	86	33	32	26
Distribution area 2	92	39	51	53	88	31	36	22
Distribution area 3	86	33	55	58	82	39	39	31
Distribution area 4	81	31	57	56	76	42	42	33
Distribution area 5	83	36	55	53	79	44	44	35

2.2 Application of Fuzzy Demand Algorithm in Distribution Path

Using the second exponential smoothing method to analyze the data in Table 1, we can get the distribution of this winery at each distribution point in May 17 of the winery as shown in Table 2 below:

Table 2 Forecast statistics for the next month (unit: t)

Demand point	Qingdao	Yantai	Texas	Jinan	Weifang	Zaozhuang	Taian	Heze
Predicted amount	79.2	26.9	48.3	55.3	76.1	28.3	33.4	28.9

In order to effectively solve the problem of roundabout transportation and waste transportation in the traditional scheme, the distribution scheme is optimized as follows: first, the vehicle is transported with nine tons of self-loaded vehicles; the second is the use of vehicle pairs with a rated load of fifteen tons. The remaining distribution is carried out for each location. The following grouping results can be obtained by the grouping principle of the scanning algorithm and the reference Table three:

Group 1: Qingdao, Yantai, Weifang

Group 2: Texas, Jinan, Taian

Group 3: Zaozhuang, Heze

Table 3 Remaining delivery volume (unit: t)

Demand point	Qingdao	Yantai	Texas	Jinan	Weifang	Zaozhuang	Taian	Heze
Predicted amount	79.2	26.9	48.3	55.3	76.1	28.3	33.4	28.9

2.3 Distribution mileage data comparison

The dynamic programming and scanning algorithms are used to calculate the distribution design before and after optimization, and the odometers in Tables 4 and 5 below can be obtained:

Table 4 Unoptimized delivery odometer (unit: km)

Demand point	Qingdao	Yantai	Texas	Jinan	Weifang	Zaozhuang	Taian	Heze
Predicted amount	79.2	26.9	48.3	55.3	76.1	28.3	33.4	28.9

Table 5 Optimized delivery odometer (unit: km)

Distribution area	Distribution group 1	Distribution group 2	Distribution group 3
Total shipping mileage	1098	1124	1143

In the old-fashioned distribution plan, the self-owned weight of nine t-cars is up to fifty times, and the remaining mileage is distributed by nine vehicles with the same load capacity, and the total distribution mileage of the remaining distribution is 8,246. Kilometers; after optimization, the vehicle with the same load distribution will be thrown away for 50 times without comparison, and the remaining delivery volume will be replaced by the delivery vehicle with a load capacity of fifteen t. Only three trips can be solved. The total mileage is 3254km. Compared to the previous distribution plan, a total of 5172km was saved.

4. Conclusion

For the original distribution plan, based on the exponential smoothing of the winery in the case set to predict the logistics distribution, which increases the accuracy of the distribution data of the distribution point. With the dynamic programming method and the scanning method, the original vehicle transportation problem is converted into the problem of the traveler, so that the distribution distance before and after is greatly reduced. In the actual solution, although we find that the scanning algorithm has the characteristics of optimization and fastness, there are some problems, so

it can only find a satisfactory solution, not an optimal solution. Although the dynamic programming algorithm can obtain the optimal solution, its applicability is not strong, and it can only be applied to small-scale data solving. If the scale is too large, its drawbacks will be highlighted. These algorithms have a great effect on reducing distribution miles, but there are still areas for improvement. Therefore, it is required to continuously sum up experience and explore new paths in the follow-up transportation process, and also need to actively learn from some advanced ideas from abroad to promote the optimization of logistics vehicle transportation routes.

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