The Application of Order Scheduling Algorithm for Food Delivery Logistics Based on Historical Data

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Abstract. With the improvement of China's social and economic development, the requirements for delivery efficiency of foreign logistics orders are becoming more and more stringent. Big data technology is the current direction of vigorous development. With the development of the Chinese era, in order to better promote the development of China's urbanization. With the continuous innovation of big data technology, various industries are undergoing industrial upgrading and format conversion. This article mainly discusses the order scheduling algorithm of takeaway logistics based on historical data. Through in-depth research and analysis of the algorithm, the researched scheduling algorithm is reasonably applied to the delivery industry of takeaway logistics, and the scheduling algorithm of big data technology is used for accurate calculation. The supply-demand relationship between food delivery and customers in historical data and the optimal path of actual logistics delivery provide algorithmic support for the selection of time and path of food delivery. Making good use of big data technology can not only accurately predict customers' habits of ordering food, but also play a role in optimizing delivery. With this technology, the automation level of food delivery can be effectively improved, and foreign media can be delivered to customers in a more timely manner. In its hands, it highlights the application value of big data technology and promotes the development of China's modern logistics industry, making it possible to develop in the direction of intelligence and automation. The experimental results show that the food delivery industry has great convenience and higher efficiency for ordering and transportation of food delivery under the condition of combining big data technology.

Keywords: Historical Data, Food Delivery Logistics, Order Scheduling, Algorithm Research

1. Introduction
With the development of the social economy and the acceleration of people's lives, the new way of ordering food online is also being affected. In fact, hotels can receive a large number of logistics jobs every day, and use their own transportation tools to move this groceries. If there are free cars they will start immediately, otherwise they will wait for the car to return to the restaurant; In this case the sales
force is usually divided by order or distance [1]. If the customer scale is large, this allocation method is not fully applicable. This will not only delay the service time of some customers, but also the travel and sales time of delivery staff and increase the running costs of the restaurant. In this question, customer orders are dynamically influenced by route planning or route execution. When they appear, the new customer information is fully determined [2]. Therefore, the problem is a dynamic vehicle routing problem, and the cycle re-optimization method has been used to address the pick-up logistics order problem. Hotels to solve. Then, when new customer requirements arise, the optimization process is called finding new solutions. The input data remains unchanged during the optimization process. Therefore, the temporary solution of the static road problem corresponding to the current condition also solves the problem of disposition logistics order planning [3].

In recent years, with the rise of e-commerce, a new online ordering method has also emerged. Due to its unique convenience and intuition, online ordering has been recognized and accepted by more and more people, and has become more and more popular [4]. In real life, restaurants may receive a large number of logistics orders every day and use their own delivery tools to deliver these orders, but when the customer base is large, this distribution method is completely inapplicable. This will not only delay the service time of some customers, but also greatly increase the travel distance and sales time of the delivery personnel, increase the operating cost of the restaurant, thereby reduce the operating cost of the restaurant, and meet the service demand of the restaurant [5]. The takeaway logistics industry combines big data technology with great convenience for ordering and distribution of takeaway, and it has higher efficiency than traditional takeaway distribution [6]. Based on the background of the rapid development of big data technology, we can see the rapid development and disruptive changes in the food delivery logistics industry. People prefer to order food online, and they can get the fast food they ordered immediately after get off work [7].

For the entire take-out logistics industry, because many take-out merchants and riders still work as simple merchants to provide good takeaways ordered by customers, riders will take orders and deliver them within a certain period of time. The information management used in this traditional way of food delivery is relatively backward, and there is no more advanced management of logistics information. However, in China's huge population base, the most widely used and most popular is still this traditional logistics model [8]. In the traditional take-out logistics system, there are a series of problems in all aspects of take-out distribution, such as the inevitable risks in the take-out distribution process, as well as related transportation links and business operations, etc., which will all be taken out. Through the application of artificial intelligence technology, many problems encountered in the process of logistics transportation can be solved [9]. Through big data technology to analyze historical data, you can choose the location according to the selection criteria, choose the most suitable location, including the selection of the geographical location of customers, suppliers and manufacturers, and the economic considerations of transportation, which can greatly reduce logistics costs while also being able to Speed up the efficiency of rider distribution [10].

2. Algorithm establishment
The Xgboost algorithm pointed out in the official document given on Github that it can be used on Windows, Linux, OS and other platforms. Its development is written in C++. The basic principle of the Xgboost algorithm is the same as that of GBDT, and its goal is The function is shown in formula (1):

$$\text{obj}(t) = \sum_{i=1}^{n} L(y_i, \hat{y}_i^{t-1} + f_i(x_i)) + \Omega(f_i) + c \quad (1)$$

Equation (1) is the loss function, which is a regular term, and c is a constant.

$$f(x + \Delta x) \approx f(x) + f'(x) + \frac{1}{2}f''(x) \Delta x^2 \quad (2)$$

After performing Taylor expansion, the objective function obtained becomes equation (3):
4. Integration

In formula (3):

\[ g_i = \hat{f}(x) = \frac{\partial L(y_i, y^{*-1})}{\partial y^{*-1}} \quad (4) \]

\[ h_i = \hat{f}(x) = \frac{\partial^2 L(y_i, y^{*-1})}{\partial y^{*-1}} \quad (5) \]

The positive term in formula (3) is:

\[ \Omega(f_i) = \gamma T + \frac{\lambda}{T} \sum_{i=1}^{T} w_j^2 \quad (6) \]

Equation (6) can be called known so that it can be fused to the constant expression and treated as a constant, then continue to simplify the objective function to:

\[ \text{obj}(t) = \sum_{i=1}^{n} \{g_if_i(x_i) + \frac{1}{2}h_i^2f_i^2(x_i)\} + \Omega(f_i) + c \quad (7) \]

At the same time, formula (6) is incorporated into the objective function formula (7) to obtain formula (8):

\[ \text{obj}(t) = \sum_{i=1}^{n} \{g_if_i(x_i) + \frac{1}{2}h_i^2f_i^2(x_i)\} + \gamma T + \frac{\lambda}{T} \sum_{i=1}^{T} w_j^2 + c \quad (8) \]

3. Takeaway delivery model

Based on the analysis of historical data, this document establishes a new model for assessing logistics recovery capacity and uses the quantitative recursive analysis method based on data model analysis to correctly assess logistics. This document introduces the combination of large data technology and traditional logistics order mechanism algorithm, both of which have good results. Logistics order capacity is converted to evaluation of reduction of cycle efficiency:

\[ \{z(t)\} = [U] \{Y(t)\} \]

The response is:

\[ \{Y(t)\} = \int_0^t \{h(t-\tau)\} \{F(\tau)\} d\tau \quad (9) \]

Given the eigenvector for the evaluation of the order capacity of takeaway logistics:

\[ Y_i(t) = -m^t \int_0^{\lambda} e^{\lambda(t-\tau)} \{V_j\}^T \{f(\tau)\} d\tau \quad (10) \]

In order to ensure the validity of the weights, the verification of the sequence of the estimation algorithm is compared and (k) is obtained. The set of subcategories of the k-th category, from this can be expressed the degree of use of the allocation of resources from logistics orders for assignment as:

\[ x_{ob} = \sum_{j=1}^{5} u_{bj} Y_j(t) \]

Combining the method for linear correlation characteristic, it realizes the structuring and integration of the index parameters for assessment of the ability to take logistics orders.

4. Results

This paper analyzes the historical data takeaway logistics orders based on big data technology, and studies the use of related scheduling algorithms in takeaway logistics orders. According to the results, the data gap between before and after the use of the scheduling algorithm in the food delivery logistics industry is carried out. From the perspectives of the rider’s delivery time, delivery distance, delivery
number, and business turnover, the advantages and disadvantages of the scheduling algorithm model proposed in this paper for takeaway logistics orders are analyzed.

**Table 1.** How the scheduling algorithm improves the efficiency of takeaway delivery

|                | 1      | 2      | 3      |
|----------------|--------|--------|--------|
| Time/day       |        |        |        |
| Delivery time/h| 8      | 8      | 8      |
| Delivery distance/km | 64    | 68    | 75    |
| Delivery number | 33    | 40    | 52    |
| Delivery error | 0      | 1      | 0      |

According to the information in Table 1, it can be known that the delivery of food to the same rider in the same area for three consecutive days. In the same period of time, the three-day delivery distance is increasing, the number of orders sent is also gradually increasing, and the number of orders with delivery is growing rapidly. Among them, there are very few takeaways delivered wrong, and only one order went wrong the next day. It can be seen that the use of electroplating algorithms in take-out logistics orders can greatly promote the delivery of take-out by riders.

**Figure 1.** Whether merchants and riders are satisfied with the dispatch algorithm after being used in takeaway logistics

From the analysis of the data results in Figure 1, it can be seen that before the scheduling algorithm is used, merchants and riders are rarely satisfied with the current industry status. Most of them feel that there are certain problems, and even almost ordinary merchants and riders are not satisfied with the current environment. After using the scheduling algorithm, the attitudes of merchants and riders have undergone a major change. The vast majority of merchant riders believe that electroplating algorithms can be a great help to their work.
Figure 2. Does the utilization of the scheduling algorithm have an impact on the income of merchants and riders?

The data shown in Figure 2 is a survey of merchants and rider merchants in the region. From the data in the figure, it can be seen that the utilization of scheduling algorithms still has a very large impact on the income of merchants and riders. The mainstream ideology of the income of merchants and riders has had a certain degree of influence. 83.87% of merchants and riders believe that the use of scheduling algorithms has a great impact on the revenue of merchants and riders. 8.60% of merchants and riders believe that the use of scheduling algorithms has a greater impact on the revenue of merchants and riders. 5.38% of merchants and riders believe that the utilization of scheduling algorithm has little effect on the income of merchants and riders. 1.10% of the merchants and riders believe that the utilization of scheduling algorithm has no effect on the income of merchants and riders. According to the results of this survey, the utilization of the scheduling algorithm has a great impact on the income of merchants and riders. With the support of the scheduling algorithm, merchants and riders have reduced a lot of burdens in the process of work, and at the same time it is also a great deal. Especially after the continuous development of big data technology and some breakthrough progress, it gradually began to receive the attention of relevant groups. The use of big data technology in the field of logistics and distribution has brought great changes to the work of merchants and riders. Through the use of big data technology, it is of great significance to the development of the industry.

The world's information technology has paid more attention to the integration of information technology in the development process. Big data has gradually entered the public eye during the continuous development of the Internet. Reasonable use of cloud accounting services can bring more guidance to development and provide a clearer direction for development. It can not only improve work efficiency, but also reduce the costs incurred in the accounting process. Nowadays, the development of enterprises has moved in the direction of network data management. In this context, the scale of the data source and the data itself has reached a very complex level. In this mode, the corresponding data will be backed up to ensure the reuse of billing data.

5. Conclusion
In the era of big data, the rapid development of distribution logistics will be a major change. This is because big information technology is also widely used in various fields of food distribution and logistics, and all aspects need support. Data and big data technology will analyze the development of existing historical data. For today's market competition, it is very important to analyze big data to meet the growing needs of individual customers. Combined with the rich knowledge of deepening reforms, innovation will also have a significant impact in many aspects. Faster logistics behavior will integrate microdata and big data in the area of food delivery logistics. The experimental results of this paper rule out that the on the Terminal algorithm based on historical data analysis has a tremendous impact on the order planning problem of food delivery logistics. At the same time, we are looking forward to
more and more innovations and applications to promote the progress of our overseas logistics industry and make better use of big data for society and the public.

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