

Research on Airport Taxi Dispatching based on Probability Model

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Abstract: Aiming at the airport taxi scheduling problem, the taxi driver selection decision-making model and optimization probability model are established. Read the network data through Java program, and then use Matlab to analyze the data. The accuracy and rationality of the model can be judged by fitting the real data. This paper explores the influencing mechanism of factors related to taxi driver's decision-making, and establishes a decision-making model for taxi drivers to choose different schemes. Determine the waiting time of taxi drivers according to flight information, season and time period factors. Under the condition of ensuring the safety of vehicles and passengers, the scheme of putting passengers into two parallel loading zones reasonably is worked out, which makes the total riding efficiency the highest. In order to ensure the revenue balance among taxis, taxi drivers should give priority to the taxi drivers. The probability density function is introduced to establish the probability model, so that the taxi driver can get the same mathematical expectation of the revenue per unit working time whether it is a long-distance guest or a short-distance guest.

1. Introduction

Nowadays, with the rapid development of transportation industry, taxis become one of the main means of transportation for most passengers to go to the urban area after getting off the plane. If there is not a complete management system for airport taxi pick-up, it is easy to lead to low efficiency of taxi reception, taxi drivers refuse to pick up short-distance passengers or take short-circuit illegal pick-up. Therefore, it is urgent to establish a set of reasonable taxi airport pick-up operation and management mechanism.

2. Establishing the model of choice decision

By analyzing the influencing mechanism related to taxi driver & apos; decision-making, it is concluded that the main factors influencing the decision-making are season (low season, peak season) and time period (day and night). The factors that affect the flight are season and time period, and the main factor influencing passengers; taxi preference is time period. Then the objective function of profit loss is as follows:

$$I_A = I_{0A} + I_{1A}$$

$$I_B = I_{0B} + I_{1B}$$

Taxi drivers decide which option to choose by comparing the profit of the two schemes.

(1) Determination of expression

$$t_0 = Nt' + \sum_{i=1}^n g(i)$$

N represents the taxi driver's visual inspection of the number of taxis in front of them. N represents the necessary time for the driver to wait, that is, the time for passengers to get on and the vehicle to leave. The sum formula behind represents the actual waiting time, which can be summed according to the number of Flights n .

(2) Influencing mechanism of relevant factors in taxi driver decision making

The difference in the number of flights is mainly concentrated in the off-season and peak season. The number of flights in the off-season is less than that in the peak season. Another factor affecting the number of flights is the time period. There are more flights during the day and less at night, which can be reflected in the data in our second question. So the driver can first judge whether to pick up passengers at the airport and return to the city through the number of flights. The second is the influencing factor. This variable indicates whether passengers coming out of the airport are willing to take a taxi, which is related to the time period. From a macro point of view, the season of the year for taxi preference changes little. Therefore, taxi drivers can choose whether to pick up passengers at the airport and return to the city.

3. Analysis of rationality and dependence

The real-time changes of taxis in the storage pool of Zhengzhou Xinzheng airport and the arrival flights are searched.

The real-time data of Zhengzhou Xinzheng International Airport are captured by Java, and the images of the number of vehicles in the storage pool and the number of flights entering the port with time are drawn according to the obtained data. The results are shown in the following figure (blue is the same as Figure 1, and orange is the predicted result)

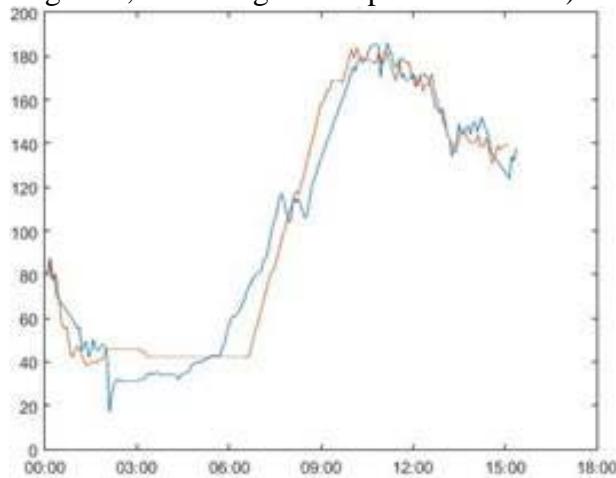


Figure. 1 operation results

According to the overall results, the predicted results are in good agreement with the actual situation, and the overall change trend is basically the same as the actual situation. Taxi preference of passengers:

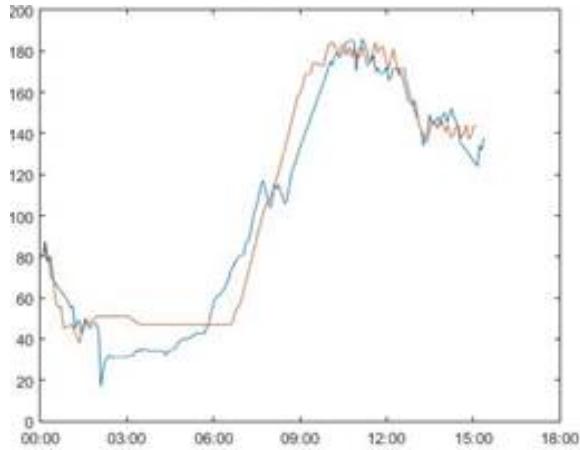


Figure. 2

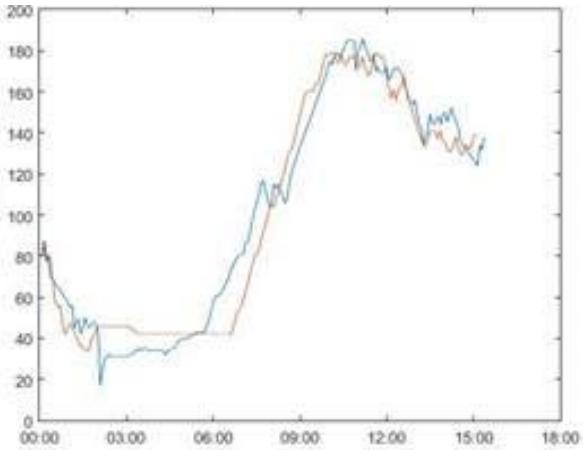


Figure. 3

4. Determine boarding point analysis

In view of the fact that taxis and passengers in the airport often spend a lot of time waiting for each other, this paper puts forward how to arrange passengers to get on the bus when there are two parallel lanes in the "loading area", so as to achieve the highest total efficiency. From simple to complex research methods, this paper first explores the method to make the total efficiency of the vehicle when there is only one lane, studies two extreme situations from the qualitative point of view and draws a general conclusion, and then uses the second mathematical induction method to draw a general conclusion. Finally, the case of two lanes can be deduced from the analogy of one lane.

The number of vehicles that can be accommodated in the loading area is determined. The reason for the difference in riding efficiency is that the number of passengers put into the loading area can be adjusted, resulting in different waiting time of vehicles in the loading area. We can minimize the average waiting time (equivalent to the total waiting time because the number of vehicles is fixed) of each batch of M vehicles by controlling the number of passengers each time, so as to achieve the highest riding efficiency.

Each passenger time from entering the "loading zone" to getting on the train is different. The length of the time depends on the walking speed of the passengers and the weight of the luggage, and the walking speed of the passengers is directly related to the weight of the luggage. Therefore, we may as well assume that this period of time is directly proportional to the weight of the luggage

$$t_{li} = \delta * m_{li}$$

5. Short distance vehicle priority scheme

In view of the big difference in income between taxi drivers who are forced to pull short distance passengers and those who receive long-distance guests after waiting through regular queuing channels, we require us to design a scheme to give taxi drivers who pull short-distance passengers certain "priority" to ensure that the revenue of each taxi is balanced as much as possible.

Determination of:

$$\frac{E(T_{short})}{2E(T_{short}) + E(t_{short})} = \frac{E(T_{long})}{2E(T_{long}) + E(t_{long})} \quad (1)$$

Known conditions:

$$\left\{ \begin{array}{l} E(T_{short}) = \int_0^{s_1} \frac{s}{v} * p_{short} ds \\ E(T_{long}) = \int_{s_1}^{s_2} \frac{s}{v} * p_{long} ds \\ p_{short} = \int_0^{s_1} p(s) ds \\ p_{long} = \int_{s_1}^{s_2} p(s) ds \\ \frac{E(t_{vip})}{E(t_{normal})} = \frac{p_{short}}{p_{long}} \end{array} \right. \quad \begin{array}{l} (2) \\ (3) \\ (4) \\ (5) \\ (6) \end{array}$$

In order to make the income of taxi drivers as balanced as possible, we give priority to taxis who received short-distance passengers last time. Taxi drivers can enter VIP channel by virtue of the mileage shown in the meter of last pick-up passengers, so as to shorten the queuing time. If the mileage is less than or equal to, you can enter the VIP channel; if the mileage is greater than, you can only enter the ordinary channel queue.

6. Results and Prospects

In real life, we often encounter the problem of taking a taxi at the airport. Due to the large passenger flow, sometimes the waiting order is chaotic and the taxi arrangement order is mixed. Therefore, the model can effectively avoid such problems. Not only in airports, but also in railway stations and long-distance bus stations. Therefore, through the data in reality, the parameters can be modified, which can also be applied to different fields. We can also use the same ideas to give a more reasonable solution.

References

- [1] Si Shou kui, sun Zhao liang. Algorithm and application of mathematical modeling (2nd Edition). Beijing: National Defense Industry Press
- [2] Sun Yunlong, et al. Economic model and Matlab application [M]. Sichuan: Southwest University of Finance and Economics Press, 2016
- [3] Jiang Qi yuan, et al. Mathematical model [M]. Beijing: Higher Education Press, 2011