Research on "Supply and Demand Matching" Degree of taxi resources in "Internet +" Age

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Abstract: In this paper, we will establish a Comprehensive evaluation model[1] of taxi resources, based on TOPSIS method. In the model, we consider several indexes: *taxi no-load ratio*. First, we analyzed the changing curve of each index in different time and space in Nanjing City. Then, the weight coefficient of each index is determined by entropy method. Finally, based on TOPSIS method, we got the changing curve of supply and demand matching relation in different area of Nanjing city. By analysing the changing curves,we draw a conclusion that most of the taxi resources are in the short supply degree, just in some travel peak gas may be in a state of oversupply.

1 Introduction

At present, with a wide range of software applications, Nanjing taxi software orders in the entire taxi industry's market share about 20%[2]. Intelligent Travel Platform of Kuaidi & Didi can be used for real-time online monitoring of taxi supply and demand, most of the data we need can be found on this website[3]. By using these data, we can reasonably analyze the allocation of taxi resources in Nanjing City .

Therefore, based on TOPSIS method, the close degree of the index value of the sample and the ideal solution is compared to analyze the "supply and demand matching" degree of different time and space taxi resources in Nanjing City.

2 Model Assumptions

To simplify the problem, we can make the following assumptions :

- Assuming that all the taxi drivers have been using a taxi software.
- Assuming that the taxi drivers pick a single passenger through a taxi software, and the two sides do not breach of contract. That is, on the way to receive the passenger, the driver is always in a state of empty driving,and the passengers do not transfer to other vehicles.

3 Symbols and Definitions

Table1 Parameters of the Comprehensive evaluation model

Parameter	Meaning
x_{im}	The index value of the evaluated object
x_m^*	The ideal value of the evaluated object
y_i	The degree of difference between the index value and the ideal value of the I evaluation object

c_j	The weight coefficient of index J
f_i^*	The value of the modified queuing indication

4 Comprehensive Evaluation Model

4.1 Function area of Nanjing City

The main factor is the quantity of supply and demand in different time and space. Therefore, we first divided Nanjing into 6 zones as follows:

Fig.1 The Function area of Nanjing City

①Gymnasium; ②Jiangning Scenic Area; ③Zhongshan Scenic Area;
④Xianlin University City; ⑤Administrative area; ⑥Commercial district.

4.2 Changing curves of supply and demand of each zone

In order to analyze the matching degree of supply and demand in different time and space, we get through the Matlab to fit changing curves of *passenger demand,taxi supply quantity,average passenger waiting time* of 6 zones of Nanjing City, 24 hours a day and the Spatial variation of *passenger demand and taxi supply quantity.*

4.2.1 Changing curves of passenger demand

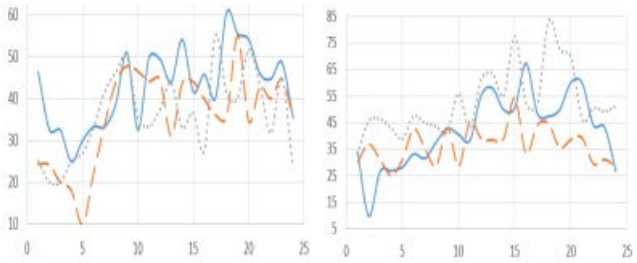

Fig.1 The changing curve of passenger demand over time

As is shown above, passenger taxi demand has a larger fluctuation in the day(the day we seleceted is Saturday), at 9am,14pm and 19pm, there was an extremely obvious peak. The analysis maybe due to the delay of going out in Saturday Morning,resulting the increasing traffic flow in a certain period of time. For other times,the passenger demand is relatively stable, and most people enter a state of sleeping after the wee hours, resulting a sharp reduction in demand.

4.2.2 Changing curves of taxi supply quantity

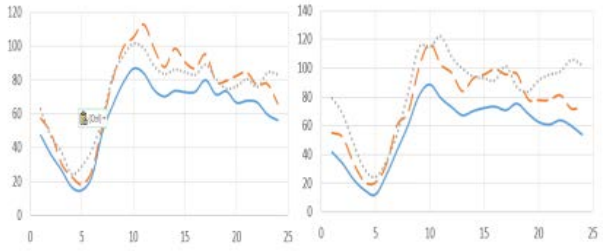

Fig.2 The changing curve of taxi supply quantity over time

According to changes in passenger demand,the supply of taxis will be changed. Because the taxi drivers will choose to avoid the rush hour in order to avoid the occurrence of traffic jams,but choose the time after the rush hour when the passenger demand is still high, to maximize the benefits.

4.2.3 Changing curves of taxi supply quantity

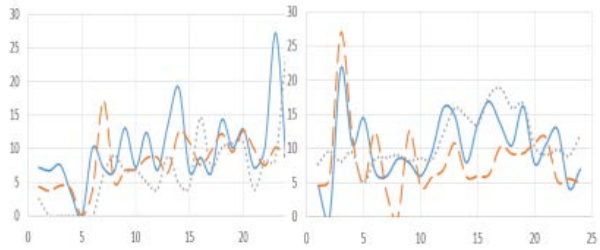

Fig.3 The changing curves of average passenger waiting time

Between wee hours and 6 hours,the average waiting time is long,because most drivers are in the rest time. In addition, due to the larger demand, may appear in short supply, resulting in a longer waiting time to take a taxi.

4.2.4 Spatial variation of passenger demand

Figure 4 shows Spatial variation of passenger demand at 8 am of September 5th:

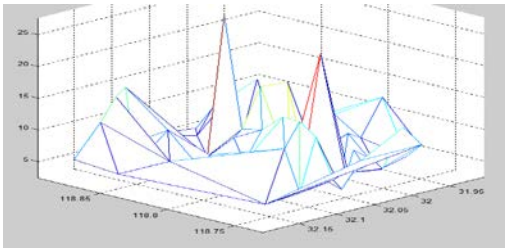

Fig.4 Spatial variation of passenger demand

According to latitude and longitude distribution of Nanjing City, the passenger demand is larger around the city, because most people living in the suburbs, leading to a large amount of travel.

4.2.5 Spatial variation of taxi supply quantity

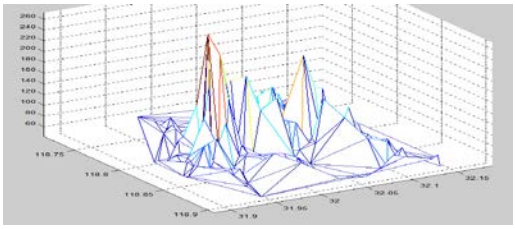

Fig.5 Spatial variation of taxi supply quantity

Drivers will consider people's travel psychology to select the search area. More drivers think people will be more willing to choose to go shopping or travel to relax at Saturday, so the choice of Commercial district and Scenic Area are in the majority.

4.3 The weight coefficient of each index

According to the collected data of Nanjing City, the weight coefficient of each index can be determined by entropy method. Where *taxi supply and demand ratio= taxi supply quantity / p*assenger *demand.*

Through the Matlab, the weight coefficient of each index is obtained as follows:

Table 1 The weight coefficient

taxi supply and demand ratio	the average waiting time	difficulty degree on taking a taxi	no-load ratio
0.1360	0.2246	0.4494	0.1900

4.4 The changing curve of supply and demand matching relation

According to the weight coefficient of each index, based on TOPSIS method, the actual taxi statistic index data is used as the evaluation object, and the best ratio in the whole taxi industry is considered as ‘ideal point’.Then according to f_i^*, we draw the "supply and demand matching" degree curves in each area of Nanjing City as follows:

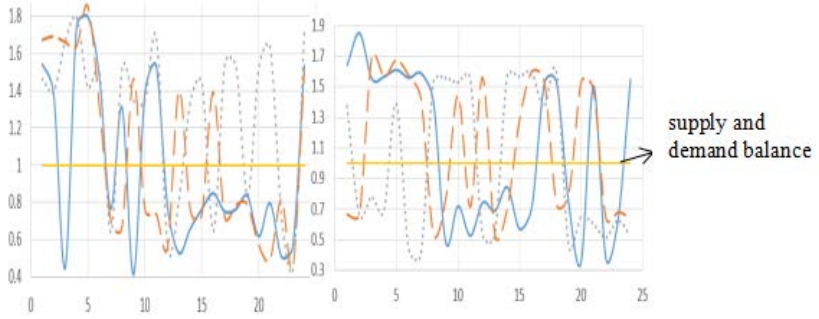

Fig.6 The changing curve of supply and demand matching relation

As is shown in Fig.6, most of the taxi resources are in the short supply degree, just in some travel peak gas may be in a state of oversupply.

5 Conclusion

In this paper, we selected taxi supply and demand ratio,the average waiting time, difficulty degree on taking a taxi, no-load ratio as the criterion of "supply and demand matching”degree.

We concluded that most of the daytime the taxi is in the state of short supply.And in the rush hour, Commercial district, Administrative area, University City, Jiangning scenic area will be significantly in short supply situation.

References

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