

"Internet +" Configuration Taxi Resource Era

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Abstract

Review Article

This paper mainly studies the problem of the difficulty of taking a taxi, first of all, the degree of matching supply and demand is affected by taxis and passengers, so the indicators can be established from both drivers and passengers. The indicators we established are taxi idling rate, people ownership, passenger waiting time. Then, we take the maximum matching number between driver and passenger and the minimum total waiting time of passengers as the objective function to establish the maximum matching model between passenger and driver. The case analysis shows that this method can achieve better utilization of taxi resources and has strong operability.

Keywords: Resource allocation; matching supply and demand; Maximum matching model; multi-objective optimization model.

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1. INTRODUCTION

As the "Internet +" era comes by, many Companies has launched taxi Software. But it is also difficult to configure a reasonable arrangement taxi Resources. In order to effectively solve the residents, travel difficult problem, so the research of taxis' allocation resources in the Internet age has great significance [1].

At different times, different places, The demand for taxis is different, Peak hours, demand for business-intensive areas people Taxis large, In order to solve internal and external conflicts of the taxi industry, Design reasonable taxi resource allocation scheme, The maximum to meet people's travel needs, Maximize the benefits both sides, reasonable arrangements for taxi allocation of resources, Not only can the full and effective use of resources, but also promote the development of the transport sector, and therefore have great significance [2].

2. MODEL BUILDING

Through analysis, appear irrational allocation of resources is affected by the taxi drivers and pedestrians in two ways [3]. Passengers wait for a long time without a taxi, the driver cannot find nearby passengers. Therefore, the establishment of indicators

from taxi drivers and pedestrians on both sides, according to principles of constructing indicators, load rate indicators finalized, people ownership, passenger waiting time. Finally, according to indicators established computational analysis obtained at different times, in different locations of taxi resources' supply and demand match " degree.

2.1 To determine the indicators

2.1.1 Index 1: taxi-no load rate

Taxi no-load rate represents the percentage of passenger traffic mileage in the entire operation of carrying traffic [4]. From the taxi driver's point of view, the higher the no load rate, indicating that fewer drivers to load passengers, so will damage the interests of drivers. From the passenger's point of view, the lower the load, there will be "taxi difficult", "rejection" problem, so "matching supply and demand" and taxi-load rate are related. research finding, No-load rate of 0.3 to 0.4 is optimal interval taxi service levels. If the load is higher than 0.4, the utilization efficiency of the taxi will be significantly reduced, no-load rate is less than 0.3, a taxi passenger waiting time will rise, cannot meet the needs of residents' travel [5], the definition of the formula:

$$k = 1 - \frac{L}{TV_n} \dots\dots\dots (1)$$

$$L = \frac{W_1}{S_1} + \frac{W_2}{S_2} \dots\dots\dots (2)$$

$$S = \frac{k_1 + 2k_2 + 3k_3 + 4k_4}{k_1 + k_2 + k_3 + k_4} \dots\dots\dots (3)$$

$$W_1 = R_1 A_1 P_1 D_1$$

$$W_2 = R_2 A_2 P_2 D_2 \dots\dots\dots (4)$$

In the above formula, k represents load rate, L represents the total effective downtown taxi mileage; W_1 Resident bear population represents city center taxi trip turnover, W_2 represents the central area of the city Taxi bear migrants traveling turnover; S_1 represents an average effective number of passenger trips when the central area of the city residents to take a taxi (person). S_2 Represents the central area of the city floating population average effective number of passenger trips taxis (person); T represents an average operating time of taxi one day (h). V represents the average operating speed taxi (km/h); R_1 Represents the total number of residents of the city center area; R_2 represents the total number of floating population urban centers; A_1 represents the number of urban residents in the central area of travel per day on average; A_2 floating population in urban centers represent the number of trips per person per day; P_1 represents the proportion of taxi travel urban travel mode is selected; P_2 represents choose to travel by taxi to the proportion of migrants in travel mode; D_1 represents an average distance of city residents travel by taxi ways (km); D_2 represents the average distance of the floating population in taxi mode of travel (km).

2.1.2 Index 2: Ten thousand people ownership

People have a volume represents the number of taxis per 10,000 have, From the passenger's point of view, the more the number of taxis, taxi difficult probability is smaller, so it can be determined that the index, which is defined formula

$$N = \frac{n_c}{n_p} \dots\dots\dots (5)$$

In this formula, n_c represents the total number of vehicles, n_p represents the total number of people.

2.1.3 Index 3: Passengers waiting time

Passengers' waiting time can also reflect the degree of "supply and demand matching". When drivers refuse to take passengers and there is no taxi near passengers, passengers' waiting time will become longer, indicating that local demand may exceed supply or supply may exceed demand. Therefore, passengers' waiting time is taken as an indicator. Its definition is as follows:

$$W_i = t_2 - t_1 \dots\dots\dots (6)$$

In this formula, t_2 represents the moment the taxi passengers; t_1 represents the beginning of time to wait for a taxi.

2.2 Maximum matching model when no subsidy program

2.2.1 Determine the decision variables

According between taxi drivers and passengers can match each other for the decision variables, to simplify the problem, If the two can match, it is denoted as 1; if the two cannot match, it is denoted as 0, there

$$x_{ij} = \begin{cases} 0 & \text{Success Match} \\ 1 & \text{Unsuccessful match} \dots\dots\dots (7) \end{cases}$$

Among them, Represents the i -th taxi drivers and j -th passengers can match.

2.2.2 Determine the objective function

The objective function 1: According to taxi drivers and passengers between the maximum number of matches, there

$$\max Z = \sum_{i=1}^m \sum_{j=1}^n x_{ij}, (i = 1, 2, \dots, m), (j = 1, 2, \dots, n) \dots\dots\dots (8)$$

In this formula, z represents the number of matches, m represents the number of taxis, n represents the number of passengers.

The objective function 2: In order to reduce passenger waiting times and increase revenue taxi drivers, In the case of a defined objective function, The distance to be considered for all matches between the minimum and the objective function, there

$$\min L = \sum_{i=1}^m \sum_{j=1}^n x_{ij} d_{ij}, (i = 1, 2, \dots, m), (j = 1, 2, \dots, n) \dots\dots\dots (9)$$

Where d_{ij} represents the distance between a taxi and its passengers.

2.2.3 Determined constraints

Constraint 1: If a passenger aboard a taxi determined, the passenger cannot take another taxi, there

$$\sum_{i=1}^m x_{ij} \leq 1, (j = 1, 2, \dots, n) \dots\dots\dots (10)$$

Constraint 2: If the taxi has confirmed the passenger to take, the taxi cannot take other passengers, there

$$\sum_{j=1}^n x_{ij} \leq 1, (i = 1, 2, \dots, m) \dots\dots\dots (11)$$

Constraint 3: To reach the passenger seat of a taxi within 3 minutes, The distance between the cab and the passenger should be within, there

$$d_{ij} < 2000 \dots\dots\dots (12)$$

In this formula, d_{ij} represents the distance between the cab and the passenger.

In summary, there is no maximum matching model subsidy program is as follows:

$$\begin{aligned} \max Z &= \sum_{i=1}^m \sum_{j=1}^n x_{ij}, (i = 1, 2, \dots, m), (j = 1, 2, \dots, n) \\ \min L &= \sum_{i=1}^m \sum_{j=1}^n x_{ij} d_{ij}, (i = 1, 2, \dots, m), (j = 1, 2, \dots, n) \\ \text{s.t.} &\begin{cases} x_{ij} \in \{0, 1\} \\ d_{ij} < 2000 \\ \sum_{i=1}^n x_{ij} \leq 1 \\ \sum_{j=1}^m x_{ij} \leq 1 \\ i = 1, 2, \dots, m \\ j = 1, 2, \dots, n \end{cases} \dots\dots\dots (13) \end{aligned}$$

3.1 Calculation results and analysis

Maximum matching model of the target function has multiple, so the first model solution, should be transformed into a single multi-objective goal. Because the first target and the second target just as important, so the weighting coefficients method [6]

should be used. First setting the same weights of the two goals, and then two goals into a goal.

According to latitude and longitude of each point, can be programmed to give each taxi use MATLAB the distance between each passenger. Specific results in Table 1.

Table 1: Distance between each passenger and each taxi

Distance	1th taxi	2nd taxi	3rd taxi	4th taxi	5th taxi	6th taxi	7th taxi	8th taxi	9th taxi	10th taxi	11th taxi	12th taxi	13th taxi
Passengers, 1th	1.02	3.14	4.26	2.96	5.17	1.21	0.55	3.22	1.83	2.59	1.11	4.81	0.63
Passengers, 2nd	5.2	3.08	1.96	3.26	1.06	5.01	5.68	3.01	4.4	3.63	5.11	1.41	5.59
Passengers, 3rd	1.71	0.4	1.53	0.22	2.43	1.53	2.19	0.48	0.91	0.14	1.63	2.07	2.1
Passengers, 4th	2.08	4.2	5.32	4.02	6.22	2.27	1.6	4.27	2.88	3.65	2.17	5.87	1.69
Passengers, 5th	0.49	2.61	3.73	2.43	4.63	0.68	0.01	2.68	1.29	2.06	0.58	4.27	0.1
Passengers, 6th	0.79	1.32	2.45	1.15	3.35	0.6	1.27	1.4	0.01	0.78	0.7	2.99	1.18
Passengers, 7th	3.32	1.2	0.08	1.38	0.82	3.13	3.8	1.12	2.52	1.75	3.23	0.47	3.71

Programmed to calculate taxi and passenger number of matching results, the results are shown in Table 2.

Table 2: The number of matching of taxis and passengers

Passengers Taxis	1	2	3	4	5	6	7
no subsidy scheme	7	5	10	11	13	9	3

The selected data into the model, and calculated the total number of matches between taxis and passengers, analysis of the results of the program, we solved the problem of optimal driver and passenger matching.

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