Research on Blocking Time Problem Based on Fuzzy Comprehensive Evaluation Method

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Abstract. In this paper, we use the first-level fuzzy comprehensive evaluation, entropy method and other algorithms to establish a correction optimization theory based on GPS measurement speed inaccuracy, which is aimed at the problem of inaccurate estimation of vehicle speed when GPS speed is slow. A first-level comprehensive fuzzy evaluation model, an entropy value estimation weight model and a modified optimization model for calculating the maximum traffic volume are constructed. The relationship between the evaluation index data is skillfully used to solve the problem, and the blocking time at different peak periods is obtained. The relationship between the four factors affecting the evaluation criteria, the weighting value of each factor in the degree of congestion and the actual time of the model after optimization, and finally the perfect prediction of the GPS to measure the speed of the vehicle is too slow. The deviation rate of the predicted value will give the relationship between the actual predicted value and the predicted value.

Keywords: Entropy method; first-level comprehensive fuzzy evaluation; traffic flow; correction factor.

1. Introduction

1.1. Problem introduction
First of all, with the improvement of people's material life, every household has at least one car. Driving instead of walking is the main way for people to travel, so the planning of travel time becomes more and more important. There are now a lot of navigation software installed on the car to get real-time GPS data to determine the current road conditions, but GPS also has a malfunction. In the case of a serious traffic jam in the current situation, the speed may be slow or fast, that is, the estimation of the speed is not accurate. This leads to poor accuracy of GPS measurement data, and the actual time required sometimes even the actual prediction time is very different, which seriously affects people's experience of travel experience. Therefore, finding an optimization model to solve the blockage time is of great significance to people's travel.

Second, this question is how to predict the actual time of traffic congestion Collect current data and build a more accurate and perfect model to solve this problem.
**Question 1:** Select an appropriate evaluation index system, such as traffic flow, traffic flow speed, etc; evaluate the impact of these factors on the surrounding road congestion time, and divide the road congestion.

2. Restatement Of the Problem

2.1. *The overall analysis of the problem and the solution to the problem*

This paper is aimed at studying the effect of predicting the blockage time when the GPS measurement speed of the car is not accurate, and find a more accurate model to calculate the actual blockage time. For this issue, we will divide it into two steps to solve. The first step is to select a suitable evaluation crowding degree system, and establish the evaluation system. The first-level fuzzy comprehensive evaluation model is used to evaluate the traffic congestion degree in different situations, and finally the evaluation result, that is, the congestion situation scores. The second step: Define the score level according to the congestion of the road, and put the score into the table. Different scores correspond to different grades, and then divide the categories. The score should be the score interval clustered by your congestion score. According to the above table, a good evaluation of the road congestion situation can be made. Then, according to the historical congestion situation, the future can be predicted more accurately. Because the daily average congestion situation is monotonous, the gray prediction model is used to solve the actual congestion time.

According to the research ideas of this paper, the overall idea flow chart is made, as shown in Figure 1.

![Figure 1 overall idea block diagram](image)

2.2. *Model assumption*

1. Assume that the road surface condition is good, and the external factors such as weather are good.
2. Assume that the road is in good condition, and there are no traffic accidents, restricted traffic and occupation of traffic.
3. It is assumed that the influence of pedestrian traffic flow and bicycle traffic around the road on traffic traffic can be neglected.
4. Assume that the driver strictly abides by the traffic rules during the driving process and does not violate the traffic regulations.

3. Analysis Of the Problem

3.1. *The first step in problem analysis and solving*

1. Analysis of the problem

This question requires us to select a suitable evaluation index system. First, we select four evaluation indicators: traffic flow, traffic flow rate, traffic flow density, and number of traffic vehicles. Evaluate the impact of the four indicators on traffic congestion. In response to this problem, we are divided into two steps to solve. First, we collect city-related vehicle traffic data. Secondly, we use the
road congestion degree as the evaluation target, and use the above four indicators to evaluate the road congestion degree, and construct a first-level fuzzy comprehensive evaluation index system about traffic congestion degree. A strong demonstration of the accuracy of the level of congestion on the road.

2. Solving the problem
   Model I——First-level fuzzy comprehensive evaluation model
   (1) Preparation of the model
   The first-level fuzzy comprehensive evaluation model is applicable to the evaluation target and is subject to various factors. It is necessary to make an evaluation of the target overall. Its model results are clear and clear, have a strong systematic evaluation, will not be biased by a single factor, and can solve abstract and difficult to quantify problems. A number of uncertainties are concatenated to build an evaluation system to solve the problem.

4. Model Establishment and Solution
   Modeling ideas:
   We will use the flow chart to illustrate the idea of this model, as shown in Figure 2.

   ![Figure 2 Model I diagram](image)

(2) Model establishment
   ① Set of factors
   According to the query data, the judgment of the degree of congestion is determined by the weighting of various factors. We enumerate four evaluation indicators: traffic flow (vehicles/hour), traffic flow rate (m/s), traffic flow density (vehicle/km), the number of vehicles (vehicles). You can do a collection of factors:
   ② Create a collection of reviews
   In order to clearly distinguish the congestion level of the road evaluation interval, it is assumed that there are five levels, and the evaluation levels are very congested, congested, generally congested, unobstructed, and very unobstructed.
   The same can be done as a collection:
   ③ Determine the weight of each factor
   The discrete model is integrated by the factors of the evaluation model. It is impossible to quantitatively analyze and need to calculate the correlation of each factor. This step uses the entropy method to distinguish the weight of the factors in the above factors, so that a more accurate weight percentage can be obtained.

   First of all, we know that there are four weight coefficients (traffic flow, traffic flow rate, traffic flow density, number of traffic vehicles) that need to be analyzed, and should be reasonably distributed in the four peak situations we consider (Morning peak, evening peak, holiday peak and activity held daily peak). This is where the advantages of the entropy method are. No factor can be biased by the different environmental conditions.

   The steps to find the early peak factor weights are as follows:
1. According to the pre-processed data, there are n samples and m influencing factors of the early morning peak of the street in Shenzhen from 7:00 to 9:00 in the morning, so that an initial factor indicator matrix can be obtained, then it can be assumed Then the value of the jth influencing factor indicator of the ith sample. (i=1,2..., n; j=1, 2..., m)

2. Standardized processing of indicator data: homogeneity of heterogeneous indicators, that is, all factors are unified. Here is a concept: positive and negative influence factors. It can be imagined that the number of traffic vehicles in the four factor indicators selected in this paper, when other conditions are constant, the larger the number, the larger the congestion index, and the smaller the number, the smaller the congestion index. We can call it It is a positive factor. Similarly, the greater the traffic flow rate, the more vehicles pass in a unit of time, the smaller the congestion index can be considered, and the smaller the traffic flow speed, the larger the congestion index. Then the traffic flow velocity is divided into negative influencing factors. The remaining two indicators are: the traffic flow is the positive influencing factor and the traffic flow density is the negative influencing factor. Now we will select a standard evaluation system to promote the positive and negative, so there will be no negative impact factors on the degree of congestion comprehensive judgment weight ratio decline. The difficulty is that because the units of each index factor are not uniform, it is not meaningful that we cannot directly multiply the matrix multiplied by the weight matrix to accumulate the value. So, at this time, before we calculate the comprehensive evaluation, we need to convert all the data units into reference values. It can be considered that the absolute value of the index is converted into the relative value that can be evaluated by the system. For the preprocessed data, I will use entropy. The value method calculates the reference value of the evaluation of the positive and negative indicators that are not easy to evaluate, thereby further improving the standardization processing of the indicator data.

4.1. The second step of problem analysis and solution
Establishing a modified optimization model based on GPS measurement of inaccurate speed.

The principle of the model has been explained above. Now is the beginning of building the model. First, our main goal is to reduce the deviation between predicted time and actual time. We need to find the factors that affect the blocking time. The reason for the error is that we did not accurately analyze the variable analysis of the factors, which led to errors in some cases that were inaccurate and could not be applied to all situations. The first step is the occlusion time is obtained based on the GPS speed data. Then we need to correct the process of increasing the speed of the car.

Correction step:
According to the conservation of traffic flow per unit time, the equation can be listed:

\[ p_1 V_1 + p_2 V_2 = \frac{G}{t}. \]

\[ G = lbpV \]

Combine the first and second formulas to get:

\[ P = \frac{(p_1 V_1 + p_2 V_2)t}{lbpV} \]

For the work of the car, we can also draw:

\[ F(l - l_1) = \frac{1}{2} mV_2^2 \]

\[ F(l_1) = \frac{1}{2} mV_1^2 \]

Using the correction factor of the speed of the car we will re-update the model:
\[ F(PS \cdot \sum_{i=1}^{n} f_i V_n^2 + G) \]

\[ t = \frac{PV}{1} \]

And the modified model of the passing vehicle:

\[ Q_f = P_f V_f + f_1 \]

It is obvious that the value of the maximum traffic flow is constant.

\[ Q_{\text{max}} = 1500 \left( \frac{t_1}{7} + kV + \frac{l_1}{S} \right) \]

Assuming that there is a car accident on the road, the vehicle behind the car accident will decelerate, and the driving force of the car will decrease, and the road capacity will be weakened. At this time, our correction factor is 1, the correction ability is equivalent, and the GPS is perfectly reduced. Predicting the complexity of the speed greatly improves the prediction time efficiency.

Calculate the estimated time when GPS measures inaccurate vehicle speed and the deviation rate of the above optimization model is \( \Delta E \):

In Equation 8, we can get the value of the maximum traffic flow from the time when the car enters the road with a length of \( l_1 \), and the maximum traffic flow within the time \( t_1 \), then the deviation of the maximum traffic flow \( Q_{\text{max}} \) in the same time can be identified to replace the clogging time deviation rate. Advantageously, the cumbersome calculations are avoided. Assuming a cycle time of \( \Delta t \), the equation can be listed:

\[ \Delta E = \frac{1500 \left( \frac{t_1}{7} + kV + \frac{l_1}{S} \right) \left( t_1 V(t_1 - \Delta t) + \left[ PS + \frac{FV}{V_1 + V_2} \right] \right) \}

In the first step we have found the blockage time series

\[ R = \{ R_1, R_2, R_3, R_4 \} = \{ 3.825, 3.7, 5.1, 5.5 \} \]

Then the precise time series is:

\[ R_1 = \Delta E \times R \]
5. Error Analysis

5.1. Error Analysis
1. In the data preprocessing for different vehicle accumulation, we use the fuzzy neural network method to estimate the overall value with the average value. Since the evaluation index becomes discrete, the difference in the correlation of each factor, the average value may reduce the error caused by the mutual influence.

2. The specific values of the four impact congestion degree indicators corresponding to different peak periods in the first step of the model correspond to the congestion degree and the congestion time interval. We cannot judge the specific value, and use the linear relationship for the value corresponding to the difference value in the area. For complex and variable logarithmic equations, the predicted values may produce errors.

6. Evaluation and Promotion of Models

6.1. The evaluation of the model
Advantages of the model:
1. Fuzzy comprehensive evaluation is applicable to the evaluation of multiple factors. There are many influencing factors of road congestion. Considering the different weights of different influencing factors, the entropy method is introduced to determine the weight of different time periods. It is very convincing, making the model more realistic.

2. The conditions and influencing factors of this model are in line with the real situation, and the analysis is comprehensive, suitable for most roads, and the congestion situation is carefully classified, which can be widely spread.

Model shortcoming:
1. Our method of dealing with big data may be a bit rough, causing data deviations. The reason is that we use sampling selection for big data processing, which may cause errors in factor weights.

6.2. The promotion of the model
1. Our model is to solve the problem of inaccurate time prediction of GPS congestion problem. It can be applied to the accurate prediction of major GPS and the prediction system of major traffic command centers, which can make people more reasonable to arrange travel plans. At the same time, it has improved the efficiency of urban traffic operations, which in turn accelerated the pace of urban development.

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