Retraction

Retraction: Intelligent traffic strategy based on 5G auto Autonomous driving (J. Phys.: Conf. Ser. 1732 012037)

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The authors of the article have been given opportunity to present evidence that they were the original and genuine creators of the work, however at the time of publication of this notice, IOP Publishing has not received any response. IOP Publishing has analysed the article and agrees there are enough indicators to cause serious doubts over the legitimacy of the work and agree this article should be retracted. The authors are encouraged to contact IOP Publishing Limited if they have any comments on this retraction.

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Intelligent traffic strategy based on 5G autonomous driving

Bihui Cheng*
School of Yunnan University of Nationalities, Kunming 650500, China

*Corresponding author e-mail: 383302216@qq.com

Abstract. In this paper, a complete mathematical model is established for the traffic efficiency of autonomous vehicles under high traffic light. Under the background of the mature automatic driving technology, a model to calculate the traffic efficiency is established to calculate the time consumed by passing a certain vehicle. In the case of setting traffic lights, we first block off intersections that interfere with the operation of fire trucks, and then make dynamic planning for the traffic lights after the fire trucks pass, so as to finally restore traffic order. Based on the tabu search algorithm scheduling strategy under traffic lights, the scheduling mechanism of special vehicles under general conditions is obtained.

1. Problem Description:
With the improvement of living standards and the improvement of road transport facilities, more and more people choose public transport or private cars as the means of travel. However, population explosion or growth also indirectly leads to the characteristics of explosive growth of automobiles. Although it promotes the rapid development of automobile industry to a certain extent, it is faced with many problems such as road traffic congestion, frequent road traffic accidents and limited resources. In particular, it is an important node of the road traffic network to connect the road in different directions at the intersection to ensure that the vehicles in the road traffic network can turn freely. However, traffic flows from different directions converge here, which is easy to cause conflicts between different traffic flows. It is also a place where vehicle collision accidents happen frequently in the road network. A large amount of traffic interference and conflict at the intersection will lead to a decrease in the traffic efficiency of the intersection, and then affect the safety level and traffic efficiency of the entire road traffic network.

The introduction of 5G technology in the application of vehicle-connected road can improve the performance of vehicle-connected network and bring great challenges to the reliability research of transmission link. With the continuous development of artificial intelligence, autonomous driving technology under the Internet of vehicles has become one of the hot topics. Intersection passage refers to the safe behavior of vehicles entering the intersection area and safely leaving the intersection. One of the most important causes of urban traffic congestion is the slow-moving of vehicles at intersections. In essence, traffic-light controlled intersections are typical scenarios of vehicle trajectory height conflict. Therefore, it is of prospective significance to study motion problems in traffic-light intersections.
2. Problem analysis:
To know whether it is possible to cancel traffic lights at intersections during automatic driving, a mathematical model should be established to calculate the traffic efficiency of vehicles for comparison, and then whether the traffic efficiency of vehicles will be improved when there are traffic lights.

To calculate the traffic efficiency of vehicles with traffic lights and at the green light, first calculate the green time, then calculate the time for each vehicle to pass, and then randomly select the same number of vehicles to figure out the total time for them to pass through the intersection.

3. Model assumptions:
(1) Automatic driving in the context of Internet of vehicles has been fully realized. When vehicles are driving in the intersection area, the information interaction mode can be divided into the information sent by vehicles to the intersection control center and the information sent by the intersection control center to vehicles (including the information between vehicles). When the vehicle is running, there is no delay or loss of information interaction, and the signal of each vehicle is normal in all time periods without interference.
(2) Each vehicle will not have illegal driving behavior.
(3) Pedestrians and traffic accidents are not considered.
(4) Ignore the impact of yellow lights and only consider red and green lights.
(5) Before the fire truck does not pass, the vehicle runs normally and there is no congestion at the intersection.
(6) The north-south capacity is basically the same as the east-west capacity.

4. Establishment and solution of the model:
4.1 Algorithm Introduction
Tabu search algorithm, it is a kind of heuristic random search algorithm, which based on a feasible initial solution, to a particular search seek to meet the objective function in the direction of the feasible solution, tabu search process with memory function, namely the search will be to keep a record of all the optimization process are to have the local optimal solution and the solving process, and avoid these in the iterative solution and process, which in turn can search more area, and to avoid repeated or stalled in the local search. Finally, the algorithm compares all the optimization processes to obtain the optimal solution. Tabu search algorithm is introduced to solve special vehicle scheduling problem and the optimal solution of special vehicle crossing intersection is obtained.

As shown in Fig. 1, a special vehicle scheduling case in the standard intersection area is presented, which can be divided into various situations: For simplicity, only one of the vehicles is a special vehicle, which is a fire engine. For a special vehicle, due to the intersection area control center can obtain information of vehicle, therefore, when the system detects that the special vehicle request, the system can give special vehicle right-of-way, the system will reject the reserved or other vehicle information processing, but at the moment because of the intersection area traffic vehicles, so blind refused to set aside all information of the vehicle is not safe, so the system will ensure that special vehicles lane where all the reserved information, Therefore, the adoption system can accept the maximum objective function of the requested vehicle set element \( f = \max R_n \)

![Fig. 1 Vehicle running track at the intersection](image)
4.2 Construct conflict matrix

First, the initial matrix of vehicle conflict is established according to the geometry of the intersection area and the vehicle trajectory $C_i, C_j$. Represents the conflict relationship between $j$ vehicles, that is:

$$C(i, j) = \begin{cases} l, & v_i, v_j \text{there is a conflict if } i \neq j \\ 0, & \text{else} \end{cases}$$

As shown in the figure, there are 16 conflict points in the intersection area. $V_1$ and $V_3$, $V_5$, $V_6$, the potential conflict points are respectively $C_1$, $C_3$, $C_{10}$. By analogy, the conflict matrix between vehicles is obtained as shown in the table 1:

| parameter | $V_1$ | $V_2$ | $V_3$ | $C_1$ | $C_3$ | $C_{10}$ |
|-----------|-------|-------|-------|-------|-------|----------|
| $V_1$     | 0     | 0     | 1     | 0     | 1     | 1        |
| $V_2$     | 0     | 0     | 1     | 1     | 0     | 1        |
| $V_3$     | 1     | 1     | 0     | 0     | 0     | 1        |
| $V_4$     | 0     | 1     | 0     | 0     | 1     | 1        |
| $V_5$     | 1     | 0     | 0     | 1     | 0     | 1        |
| $V_6$     | 1     | 1     | 1     | 1     | 0     | 0        |

Since the system can know the speed and position of each particular vehicle, its above conflict points can further simplify the definition of vehicle $V_i$, the number of matrix conflicts for reservation requests is $nc(r_i)$

$$nc(r_i) = \sum_{j=1}^{n} C(i, j)$$

$C(i, j)$ is the maximum number of matrix conflict rows $nc(C(i, j))_{\text{max}}$, so:

$$0 \leq nc(r_i) \leq nc(C(i, j))_{\text{max}} \leq n - 1$$

Then:

$$nc(C(i, j))_{\text{max}} = \max \{ nc(r_i) \mid 1 \leq i \leq n, r_i \in R_n \}$$

Now the first reduction of the conflict matrix, the core idea is, every time from $C(i, j)$ in reducing the current maximum matrix row conflict $V_i$ matrix rows satisfy $nc(r_i) = nc(C(i, j))_{\text{max}}$

Each time, one row of the matrix is selected for reduction, and then the conflict relation of the matrix is updated and repeated until a row or several rows no longer have any conflict relation, that is, for any $C(i, j) = C_{\text{min}}$, so $C(i, j) = 0$. The actual conflict points of each vehicle are obtained, and the simplified conflict matrix is shown as follows:

$C_{\text{initial}} = \begin{bmatrix} 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 \end{bmatrix} \quad C_{\text{simplified}} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
Here is the initial solution, the system center chooses to accept $R = \{v_5\}$ is the initial solution. Obviously, this is not the optimal scheduling scheme. Therefore, tabu search algorithm is used to optimize the scheme and seek for the optimal scheme.

4.3 Reduce conflict matrix

At this time, tabu search is used for the second reduction of conflict matrix, and the possible solution set is sought by transforming the matrix. Find the row with the most element 0 in the matrix, and start the search from this row, because the maximum element 0 indicates the least conflict, and accordingly has less influence on other vehicle scheduling. Then, the row is moved to the top of the matrix through matrix transformation, and the corresponding position 1 in the matrix is changed to 0. At the same time, the request of the vehicle that has a conflict with the corresponding special vehicle of the row is rejected. The loop processing is carried out according to the above steps until all the row elements in the matrix are processed and the reduction matrix of the conflict matrix is obtained. In this matrix, the initial solution is $v_5$, 0 is the behavior with the most elements, $v_1$, $v_3$, $v_4$, $v_6$ in the row, select $v_1$, Accept the request, then $v_6$ is rejected, move the $v_6$ row up and the corresponding 1 element becomes 0. If you accept $v_3$, you will be rejected $v_2$. At this time, move the line of 6 up and the corresponding element of 1 will become 0. Meanwhile, perform the same operation on the row, and finally return the order to the conflict matrix to obtain the conflict matrix of the final reduction.

|   | $v_1$ | $v_2$ | $v_3$ | $v_4$ | $v_5$ | $v_6$ |
|---|------|------|------|------|------|------|
| $v_1$ | 0    | 0    | 0    | 0    | 0    | 0    |
| $v_2$ | 0    | 0    | 1    | 1    | 0    | 0    |
| $v_3$ | 0    | 0    | 0    | 0    | 0    | 0    |
| $v_4$ | 0    | 0    | 0    | 0    | 0    | 0    |
| $v_5$ | 0    | 0    | 0    | 0    | 0    | 0    |
| $v_6$ | 1    | 0    | 0    | 0    | 0    | 0    |

At this point, to get a solution of the tabu search algorithm $R_n = \{v_5,v_1,v_3,v_4\}$, therefore, the algorithm optimization, there are more vehicles request can be accepted, namely in the fire by quickly $v_5$, and $v_1,v_3,v_4$ can be normal, only $v_5,v_6$ need to give way in the conflict, there are more vehicles can be with the fire area through the intersection at the same time, as a result, at the same time of special vehicle collision avoidance, intersection traffic efficiency will not significantly reduced.

5. Conclusion

Based on the tabu search algorithm scheduling strategy under traffic lights, the scheduling mechanism of special vehicles under general conditions is obtained. Advantages: It simplifies some related variables in real life problems, fixes the uncertain factors (such as average speed) in real problems according to the model, and lists relevant data in the model through tables, so as to visually and clearly see the changes of related variables in the model. We use basic mathematical ideas, mathematical methods, mathematical tables to solve our practical problems. Disadvantages: Our model is built in an ideal state, ignoring the impact of some objective factors on the model (such as pedestrians, emergencies, etc.), and the quasi-value and fixed value methods we adopted have limitations. The data collected from a single intersection is limited, so the results may not be
In the future research, it is suggested to consider these problems: add different factor variables, so as to establish each model, and then conduct data analysis on these models to find common points and differences, and draw a broad conclusion based on the above results. Collect data to each intersection, analyze and process the data to obtain generality and generality, so as to make the data more accurate and representative. To specific problem, want to undertake specific analysis, get exact result.

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