Exploring Swarm Optimization of Traffic flow in Cities

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Abstract. With the acceleration of industrialization and urbanization in China, the development of the city is increasingly becoming saturated. There is no doubt that the city's economic development and people's travel life have brought a lot of pressure on the urban road traffic. Many research focus on the optimization of traffic flow in cities. Considering the accident, vehicles can avoid congestion point and change behavior, such as moving path of accidents before the vehicle driving rules in BML model was improved, closer to that of the actual vehicle driving behavior. On the basis of the improved model, the density of road network traffic flow must be respectively, the accident point number changes impact on the average speed of traffic flow; Accident number must be, a road network traffic flow density changes impact on the average speed of traffic flow; Accidents before the vehicle transition probability at each lattice point impact on the average speed of traffic flow; The vehicle before the accident point transfer probability distribution function of each lattice point is different effect the running state of the system simulation research on the four questions such as, the analysis of simulation results, a series of meaningful conclusions.

Introduction

At present, for there are many ways to solve the traffic congestion and scholars put forward from the last century 30 s, use the method of probability theory to study the traffic flow as the traffic flow to become a discipline develop slowly, and have some scholars proposed a method of fluid dynamics and the modeling method of cellular automata. And the traffic flow theory is applied to the case in actual traffic guidance is not many, many countries have not yet developed a corresponding system, at present only in the United States and Germany developed and successfully applied to some developed countries, such as traffic management system software, the system software for the solution of the problem of traffic congestion has played a big role, save national economy the huge wealth, and all countries in the world the rise of the research on traffic flow model of the boom [1].

Current research on traffic congestion, especially the urban traffic congestion has the following some theoretical achievements, in 1992, Biham et al., this paper proposes a new model based on cellular automata rules no. 184 is called the BML model, this model can describe the basic characteristics of the urban traffic network, but it is not combined with urban congestion road traffic to guide the actual [3]. Later, in BML model based on many scholars has made the improvement work, such as two-way lanes factors [4], overpass factors [5] and [6] signal synchronization and so on factors, enables the BML model more to more accurately simulate the real traffic, but they are not combined with the actual traffic, all just stay on the theoretical research. At the end of the twentieth century, based on the BML model and following their shortcomings, Chowdhury [7] and others combine these two kinds of model research, the distance between the grid points on the BML model, makes the grid point between the road is to obey the following rules of the model, but still in the intersection of road to comply with the rules of the BML model, this model makes the model can describe more characteristics of the traffic network, but there is no scholar in the model and real network exist complex problems such as traffic jams and traffic accidents. With the development of the research of cellular automata, scholars and experts have not only confined to one dimensional NaSch model and two-dimensional BML model research, using the basic theory of cellular automata

as Daganzo knowledge research out of the cell transmission model, this model can better describe the vehicles on the road the traffic congestion at the time the phenomenon of queuing [2].

The paper focuses on the basis of the BML model to predict the traffic jams, the BML model was further improvements. And no scholars before using cellular automata model to predict the forecast problem of the urban traffic congestion, and also there are few scholars using the BML model [3] to the actual traffic guidance and control. Innovation point of this article is mapped to the actual transportation network to improve the BML model and improved BML model to predict traffic congestion [4].

The Optimization Method

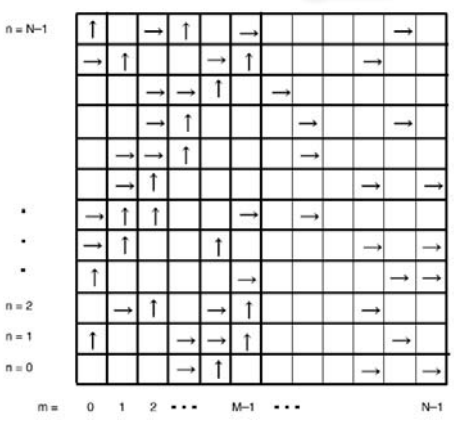

Fig. 1 A two-dimensional traffic network

As shown in Fig. 1, we can see from free flow phase into a jam phase because of increased traffic density rho, when the density of rho exceeds the critical density could happen jam. Linesch and Souza proposed in 2007, however, led to the clogging the BML model is not entirely density factors, but also related with the size of the BML model, but in the end, the cause of the clogging BML model system is not these global factors, but some local traffic interference. In their trial, found that the system is in the intermediate state (i.e., free phase, cycle and jam phase coexistence state), the speed of a few cars in the free stream state changes, discovery system by the intermediate state into a global blocking state.

At present, the global congestion state analysis to the BML model stays on the theoretical research, research by the free flow state to congestion state transformation and theoretical proof. No scholar the BML model is applied to actual traffic guidance, with the limitations of BML model itself has a lot to do. First of all, the BML model of vehicles are driven to a square, does not change during the process of moving direction, the obvious discrepancy with real traffic flow. Then the congestion state in the BML model, the congestion is caused by interference between two direction vehicles, this only shows that BML model description will appear in real traffic congestion state of features, but it can't point out specific is which traffic area occurred in the city, and not solving the traffic problems. Finally the BML model during initialization, adopts the east and north to the same moving vehicles and random distribution, this also is not consistent with the actual urban traffic conditions.

This section mainly describes the basic theory of cellular automata (ca) and based on cellular automata model of traffic flow simulation. Mainly introduced the basic structure of cellular automata (ca) and evolution rules, because of the cellular automaton evolution and transport vehicles drive on road network has a lot of similarities, so use cellular automata to simulate the traffic flow is very reasonable. And then introduces two classical cellular automaton model for traffic simulation, NaSch model is mainly used for the simulation of highway traffic, BML model is mainly used for the simulation of urban traffic network simulations.

The urban traffic road network consists of seven travel sites, nine of intersection and 10 sections. To put such a complex traffic map mapped to the D - BML model, must follow certain rules. (1) From the starting point to destination point there may be multiple routes, do you want to put each route map

to the BML model. We through the analysis of the above according to certain strategic general driving habits (driver) to select routes, to ensure the accuracy and authenticity of the model. (2) In the real city traffic, there are two on a route, the vehicle in the direction of the BML model only east and north to driving route, the route need to be mapped only once. Because in the BML model related scholars prove cause jams as horizontal and vertical direction of traffic flow interference, and parallel lines will not result in a jam. (3) In real urban traffic network, a route is made up of multiple vertical section and horizontal section, so the route map to the BML model is horizontal eastward route or perpendicular to the north of the line. For such a route, the choice in the east and north line map.

The BML model running in the result of the model, the clogging of the intersection point is mapped to a real road network, as shown in figure 4 to 5, according to the scope of the adjustment of the parameter value assumption jam is framed within the area (left). From figure can get these grid point coordinate values, such as the lower left corner of the grid point coordinate values for (12) in 2, explain that point is the intersection of 12 lines and 17 lines, corresponding to the real C5 intersection in traffic network, it can predict the real road network C5 intersection time congestion will happen in the future. But there are some complex grid points, such as coordinate values for the grid point (12, 16), its corresponding to the real network congestion intersection has two C4 and C5 intersection, then the jam is unable to determine C4 or C5, said the grid point for the conflict. And as coordinates (15, 20) of grid points, its response to the real network intersection is empty, call these empty points are fuzzy, in the small circle marks, namely the two route does not exist in the real network intersection.

Experiments and Discussions

With the increase of the threshold choke point number is reduced, the choke point number between 0 and 1000. Because the total number of the total number of intersection of grid, grid size in this chapter, the experiments of 100, the total number of intersections for 10000. Choke point number and the intersection of the total ratio is a more realistic traffic. By changing the incentive factors in the second picture to adjust the choke point number, can be found when the incentive factor is greater than 0.5, choke point number has increased dramatically, this is not conducive to analysis, which is incentive factor to adjust the choke point number is uncontrollable. Want to get, for example, an area in the traffic network choke point number to 500, because the number change reward factor causing choke point change is very big, so it is difficult to get expected results. The third picture can be found in the change of penalty factor caused the choke point number is too big, do not conform to the actual situation.

We mainly focus on M - BML model running results to analyze traffic intersection in the coordinates of the city. Through experimental analysis in this chapter the M - BML model simulation result set to determine the coordinates of the clogging of intersection in the traffic network in the location in the city. First simulate the M - BML model initialization traffic density values under obey uniform distribution and poisson distribution operation, rewarded factor, punishment factor and the threshold and the clogging the relationship between the number of traffic point. The parameters obtained from the reused to analysis in engineering experiment, finally get accurate real the choke point in the traffic network is in line with the actual traffic conditions.

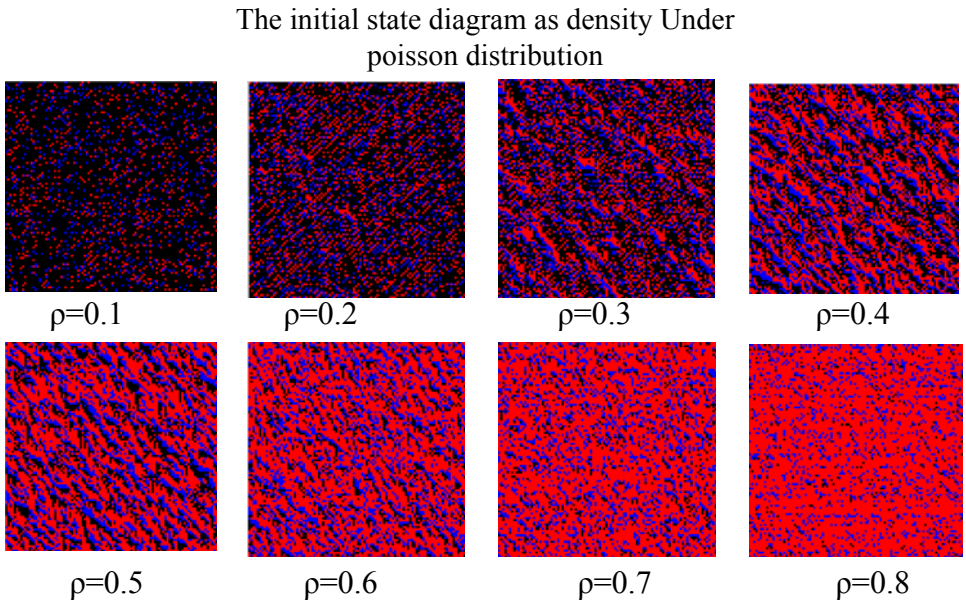

Fig. 2 The initial state diagram as density Under poison distribution

As shown in Fig. 2, through continuous regulator can narrow the scope of the traffic jam more and more, eventually to the concrete intersection can be determined. Began when the threshold is very big, the congestion area is big, can be seen from the diagram congestion occurred in Birmingham city in the northeast area, further regulating valve value, when the valve value variable hours get traffic jams point is becoming more and more precise, eventually can locate to Aston station and Duddeston around the station.

Summary

This paper is mainly based on BML model running results to analyze traffic intersection in the coordinates of the city. First the input data is the urban traffic network on a line of traffic density values, the data must be through the road of the monitoring measurement, the BML model operation rules and basic BML model similar rules. Run the result is model grid coordinates, how to get the coordinate values of the model mapped to the real traffic network is the key of the study of this chapter, the key is to solve the conflict and fuzzy point problem, this chapter also puts forward the corresponding solutions. Finally, the model run, the correctness and validity of the results of evaluation, this paper puts forward three kinds of evaluation scheme, based on region, congested intersections and time step of evaluation scheme, in which congestion intersection as evaluation analysis is the most accord with the purpose of this study.

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