International Journal of Science and Engineering Applications
Volume 15-Issue 12, 17 – 18, 2026, ISSN:- 2319 - 7560
DOI: 10.7753/IJSEA1512.1005

Precision Clock-Based Driver Decision Optimization Model

Song Yiqing
Zibo Polytechnic University
Zibo, Shandong, China

Abstract:Road traffic system is a man-involved complex system. Human, especially the driver's behavior decides considerable parts of its properties. Driving behavior is an information processing course going on unceasingly, and study on information processing pattern of the drivers forms the key foundation of road traffic safety and automobile safety design, as well as the basic of the study about transportation systems simulation. Beforetime, method of clocked scan is used in the microcosmic simulation study of driving behavior and the step length is 1s. The lag which caused by driving decision-making reaction time is ignored because the information is fused within 1s. At the same time, because of the non-accuracy, the simulation ability about driving behavior in stimulation of dynamic scene is reduced. The scanning step length is dropped to 0.1s in order to scan and analyze the dynamic (static) information which influences driving behavior exactly. Moreover, the most excellent decision-making is gained through fusing the information with fuzzy optimization. It is feasible to fuse the information with fuzzy optimization. Decision-making optimized process can be described more fine through precision clocked scan.

Keywords: decision-making optimization; precision clocked scan; fuzzy optimization;driving behavior

1. INTRODUCTION

Road traffic system is a complex system fused four elements of people, traffic, road and environment, and the non-coordination or confliction among these elements is the essential reason of traffic accident or traffic delay[1]. The vehicles are driven by people and the road is also used by people, and the vehicle and road are objective and unconscious, but people are active and conscious[2]. As a complex individual that thoughtful, experience summarized, and has the subjectivity changed unceasingly, the driver is the core factor of the system and the leading role in the coordination and control of the four elements of transportation system, and decides quite a part of system performance. The multi-source information from Driving environment consist of external environment information, vehicles' own information, the combined space information in the vehicle, and the response of driver to the multiple source information etc.. These information are handled depending on the driver's individual subjective characteristic. Therefore, if the transportation system is intended to be developed and researched, the complex procedure and behavior characteristics that the drivers handle the information need to be researched firstly.

The characteristics of the multi-information stimulation, the task concentration of the driver, and the cooperation reaction behavior in the traffic environment are needed to be considered in microscopic traffic simulation model. Wang lei[3-4] who attempts to establish the model that can reveal the driver's task concentration and the concerted reaction mechanism by using the methods of Bayes on multiple source information fusion, the fuzzy integral method, and the non-parameter statistical method; Yang Xinyue[5-8] constructs the model of comprehensive cognition sequential activity model and applies to the highway traffic lane control simulation system on the base of promoting the above achievement. Besides considering the different vehicles' information stimulation in "the interest induced zone" (the same traffic lane and neighboring traffic lane) of the target vehicle, she has also attempted and developed the message channel about vehicle's control signal, and has attempted to study the influence of the multichannel information with the multiple source information fusions and the coordination control theory. However, the simulation steps of these researches are generally decided as 1 second. The more microscopic lag problem caused by drivers' decision-making response time is ignored by such time slicing, and the accuracy of driving behavior simulation is also affected. Simultaneously, for the non-accuracy of clock scans, the ability of the driver behavior is reduced under the dynamic stimulation of simulation model. This is also the reason that the former simulation research which only considered the macroscopic stimulation information of the transportation environment, but not compounded stimulation information, only considered the influence of the relatively static traffic signal, but not influencing reason of dynamic stimulation (for example bicycle). Therefore, to enhance the simulation accuracy of the driver behavior research, one must reduce the scans clock.

2. DRIVER DECISION-MAKING PROCESS

Driver's decision-making process is in fact the results of driver's carrying on the analysis decision-making using the outside multi-source information, such as the external environment information, vehicles own information (including speed, driver's temperamental characteristics, driving characteristic, driving task etc.), the compound spatial information in the vehicle etc.. The decision-making process is quite complex, and it is divided into four stages: perception stage, cognition stage, judgment stage and execution stage. Decision-making process can be described roughly as: in the driving process, the driver gains multi-source information about person, vehicle, road and environment through receptor (main vision, sense of hearing and sense of touch and so on) from outside the vehicle , the traffic environment, the complex information spaces in the vehicle, and transmits these information to the information processing center-central nervous system, and they have been transmitted, selected, features extracted, information fused, and saved, then comparing them to the established driving behavior pattern in the memory, and then makes decision related to driving behavior pattern and vehicle operation pattern by many times thinking, judgment and evaluation, and transmits the decision to the effectors (motion organs such as the hand, the foot

etc.), then automobile starts to be operated. Obviously, reaction cannot be sent out exactly from the organism while receive the stimulation information, for the driver passing through a section of reaction time, during which there also will be other stimulation information appeared. And the multi-source information should be fused by driver, and the information of mistake and redundance need to be modified and filtrated etc.

3. EXPERIMENT DESIGNING

Camera method is used to test the effectiveness of driving decision-making optimization model based on fuzzy optimization. Camera method can continuously display a process in the form of pictures, which gives intuitive judgment to the surveyors.

Experimental conditions: 1. Equipments: three digital cameras with photography function, a tripod, measuring tape(measuring the distance between the markers). 2. Weather: fairness with no gale weather is chosen to avoid effects on the drivers' traffic behavior and psychology; avoiding abnormal weather such as rain, snow, hail, gale etc.. 3. Place: choosing the typical section with high-larger buildings of no special geography factors and convenient for camera shooting. 4. Markers: before shooting, investigating the shoot place preliminarily. After determining the place of cameras, choosing some markers and measuring required distance for analysis data later.

Experimental design: one of the three cameras is posted on the high-larger building of the roadside, one is put into the vehicle shooting the driver and comparing to the exterior through vehicle window, another one is used to shoot the action of driver's hands and feet to the steering wheel, throttle, and braking pedal etc.

4. MODEL VERIFICATION

In simulation process, the information such as vehicle, flying, itching on face etc. is generated as following: for the random of the traffic phenomenon, the random of the vehicle flow should be considered in the part of vehicle generated. The speed generally obeys normal distribution describe the vehicle speed and the shifted negative exponential model describe the headway distribution can well describe the headway distribution in the situation of a few traffic flow. The bicycle enter into the road section of simulation with random fashion, and the arrival quantity obey negative binomial distribution; Fly, itching on face are generated by random with small probability event. Uniform random number is produced: recursion equation is used for linearity consistent method to produce a series of random integer.

5. CONCLUSIONS

Two-clock scanning is used in this paper, and the simulation step length is reduced to 0.1s. Considering the lag caused by driver's decision-making reaction time, the information which needs to be fused in the scanning time 1s is given a more exquisite analysis, and the precision of the simulation is improved with more accurate reaction of drivers. Driving decision-making model based on non-structural system fuzzy optimization theory is introduced in this paper, and it effectively solved the difficulty of drivers' decision-making influencing factors being quantized and reduced the man-made influencing factors in the process of decision-making with simple operation. The simulation module flowchart is given in the paper, and the models are verified with effectiveness and feasibility with providing theoretical basis for deeply studying the drivers' collaborative behavior under the stimulation of multivariate information.

6. REFERENCES

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