Optimization of Road Safety Assessment Algorithm for Automatic Driving Vehicle

Qiong Long¹, Xian-Li Duan²,*

¹Hunan City University, China, 413000
²Yiyang Communications Planning Survey and Design Institute, China, 413000

*Corresponding author e-mail: 181078953@qq.com

Abstract. Autonomous vehicles (self driving automobile), also known as driverless vehicle, computer-driven vehicle, or wheel mobile robot, is a kind of intelligent vehicle which realizes driverless through computer system. In the 20th century, it has a history of several decades, and in the beginning of the 21st century, it shows a trend of close to practicality. Autonomous Vehicles rely on the cooperation of artificial intelligence, visual computing, radar, monitoring devices and global positioning system, so that computers can automatically and safely operate motor vehicles without any active human operation.

Keywords: Road Safety, Assessment Algorithm, Automatic Driving Vehicle

1. Introduction
In December 2017, Beijing Municipal Transportation Commission, in conjunction with Beijing Municipal Public Security and traffic administration bureau, Beijing Municipal Economic Information Commission and other departments, formulated and issued two documents, i.e. Beijing Municipal Guiding Opinions on accelerating the work related to the road test of automatic driving vehicles (for Trial Implementation) and Beijing Municipal implementation rules for road test management of automatic driving vehicles (for Trial Implementation),

The document specifies the relevant conditions for the application of self driving vehicles for temporary driving on the road.

First: the applicant for on-road test shall be an independent legal entity registered in China. Due to the scientific research and type test related to automatic driving, it can apply for temporary on-road driving [1]. The test vehicle must meet the standard of technical conditions for motor vehicle operation safety (GB7258). The test vehicle has two driving modes, automatic and manual, and can be switched at any time; the test vehicle must be equipped with corresponding supervision devices, which can monitor driving behavior and vehicle position.

Second: the test vehicle must be tested and assessed in the closed test field according to the relevant standards before it is put on the road, and only after the assessment results are reviewed by
experts can it be put on the road for testing.

Third: the number plate and logo shall be hung for the automatic driving test vehicle according to the regulations. Each vehicle shall be equipped with a test driver who has certain driving experience and is familiar with the automatic driving system, and monitor the vehicle at any time to ensure the safe driving of the vehicle. The test vehicles will be tested in the designated area and within the designated time period, so as not to affect the urban traffic as much as possible [2]. The test unit must purchase the traffic accident liability insurance or compensation guarantee. If the test vehicle has an accident during the test, it shall be handled in accordance with the current road traffic safety law and relevant regulations, and the test driver shall bear the relevant legal liabilities.

2. Technical Preparation for Autopilot
Before the appearance of auto driving system, the safety system of automobile has developed most of the necessary technologies. The essence of today's auto driving system is to integrate these technologies.

2.1. Whole vehicle radar system
The whole car radar system is a car safety system developed on the basis of the reversing radar system, that is, a higher precision radar probe is arranged around the car, which can detect the position and speed information of all obstacles around the car.

2.2. Automatic brake system
Volvo's earliest definition of automatic braking system is that under the support of fuzzy control matrix, when the car judges that it will encounter driving risks, it will automatically operate the emergency braking device for emergency braking. This braking operation even supports braking on complex roads such as ice and snow roads and steep roads.

2.3. Video analysis system
Through the binocular data mining system, using the image difference formed by two different cameras, we can judge the position and characteristics of the video control. With the support of the whole vehicle video system similar to the whole vehicle radar, the video analysis system can make judgments on the video information around the vehicle such as control extraction, control position and speed information extraction, driving safety analysis, etc.

2.4. Park assist system
Parking aid is a safety aid device when parking or backing up. At present, the mainstream is the parking aid system composed of reversing camera and on-board display. When backing up, the display in front of the car can display the real-time video of the reversing camera behind the car, so that backing up is safer. The secondary is the ultrasonic sensor (commonly known as probe), controller and display (or buzzer) Etc.

3. The Development Opportunity of Autopilot Car in 5G Era
Only through the radar system, sonar system, video image system, gyroscope system, accelerometer system and other sensing systems to obtain data to judge the road risk, it is faced with the problem of Nash equilibrium of single point decision-making. All vehicles will choose the decision direction which is more in line with their own best interests, and ultimately it is difficult to achieve the highest efficiency of the entire road system [3]. So communication between cars is very important.
Figure 1. General Module Structure of Autopilot Vehicle

While the traditional wireless communication technology runs in 3G / 4G Mobile Internet architecture, its bandwidth is low, and the amount of data is difficult to guarantee. The commercial promotion of 5g network and the resulting cost compression make the extensive data exchange and joint decision-making between cars possible.

That is to say, all vehicles form a decision-making whole according to ant colony algorithm, and plan the running state of the road with the highest efficiency. In the related conceptual design, the utilization rate of highway pavement can be increased from 3-5% today to 50-70%. That is to say, under the running speed of 120-150km/h, the safe car distance within 30cm can be achieved [4]. Today's safe car distance is considered to be more than 100-120m. The operation efficiency of the whole pavement will be substantially improved.

4. Color Sense and Common Sense of Automobile

The vehicle obtains the road information through sonar, radar, video and other comprehensive external senses. For example, the vehicle can conduct a comprehensive control measurement of the road through a stronger operation center, just as the human obtains the external information through the comprehensive senses of hearing, vision, smell and so on. In the traditional understanding, sonar judges the high-precision obstacle information within 50m, radar judges the expected risk information within 20-150m, video makes basic judgments on the control extraction and risk identification within the visible range. But in the color sense organ, the automobile can construct a whole state space for all the information in the whole perceptible range, instead of using the sense organ to obtain the corresponding information and judge separately. The application of large-scale convolution neural network makes the fusion of sensory elements more significant. Even programmers and data engineers can't judge the actual judgment mode of the vehicle on the road in the operation mechanism of large-scale neural network system.

The common sense is to analyze the sensory information of all vehicles on the road through 5g network, which can avoid the dead angle of the sense completely, and form a high-precision risk assessment area covering 2-5km of the vehicle as the center radius and a driving route planning area covering the world. Passengers of the car can view the surrounding images of all the connected cars in the car. When encountering uncontrollable events, the system will automatically discover the location.
and nature of the event, notify the vehicles planned to this route within several kilometers to avoid, and also notify the affected vehicles, so that passengers can understand the progress of the accident. The traffic and traffic police department will also obtain information related to the incident at the first time, so as to facilitate timely handling.

5. Summary
Autonomous vehicle is an integrated system of mature technology. The key technologies of all related systems have been basically mature in the development period of more than ten years. Today, the autonomous driving technology that realizes more than L4, i.e. the autonomous driving technology with no human intervention on the limited road surface, has only left the approval cycle of administrative and laws and regulations. In the future, with the development of Internet, machine learning, artificial intelligence and big data technology, L5 automatic driving, that is, all-weather automatic driving without human intervention, will soon enter into the life of science and technology.

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