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Artificial intelligence in the field of driving

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Abstract. The advent of the electrification of cars has made it possible to use a large number of electronic components in cars, and the intelligent car industry is developing rapidly because of the growing maturity of automotive electronics. Smart driving is safer, more comfortable, and more efficient than traditional driving, and it has great prospects for development in terms of brain-controlled car technology, intelligent internet interaction technology, and deep learning technology. It is undeniable that the development of smart driving technology is accompanied by challenges in terms of technology networks, policies and regulations, and economic conditions.

Keywords: Artificial Intelligence, Smart Cars, Automotive Development, Driverless Cars.

1. Introduction

With the increasing maturity of artificial intelligence technology, the number of scientific achievements in different fields has increased. The rising economic development has led to an increase in people's living standards and more and more people are choosing to buy cars as their main means of travel [1]. As the number of cars purchased and owned increases year on year, the issue of driving safety has become more of a concern. In order to further improve the intelligence and safety of car driving, the automotive industry can conduct in-depth research on the application of artificial intelligence in driving by interacting with artificial intelligence technology. This will not only provide better prospects for the automotive industry but also reduce a large number of traffic problems.

This paper examines and analyses three aspects of smart driving, namely its technology, importance, and future prospects. The application of artificial intelligence in the field of driving sets the direction of development and lays the foundation for intelligent and electronic automobiles.

2. Technology applications of artificial intelligence in the field of car driving

2.1. Environmental perception and recognition technologies

An efficient and stable sensor is a prerequisite for an intelligent vehicle. Intelligent vehicles mainly identify and collect information about the vehicle's surroundings and the vehicle itself through three components: image recognition technology, radar, and sensors. Radar systems can judge the environment around the vehicle at a close range and identify obstacles. They can also form relevant data and transmit the data to the vehicle computer. Image recognition systems can precisely recognize road information at relatively long distances by means of special cameras. For instance, it can achieve the recognition of lanes and automatically determine whether a vehicle has deviated from its lane; it can

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also achieve the recognition of traffic lights and transmit the collected data to the vehicle computer. The vehicle sensors can collect the vehicle's driving data such as the vehicle speed, tire pressure, positioning information, and gear information.

2.2. Decision making and learning systems

While traditional driving is judged by humans and the corresponding mechanical devices, intelligent driving relies on the programming of the computer to help or replace humans in the corresponding control. The computer analyses the information collected by the various sensors and makes optimal judgement and decisions about the safe operation of the vehicle based on a series of reference data such as the movement of the vehicle, the requirements of the passengers, or the driver and the mechanical properties of the vehicle itself. It must be mentioned that the more intelligent the electronic equipment is, the more demanding the working environment is, as the car will be accompanied by a series of vibrations, braking, acceleration, crash, and other harsh working conditions for the computer. Because of these complex working conditions, the computer in the car needs to have a high level of shock resistance and stability to meet the safe operation of the car. For example, the electronic components of a vehicle need to be tested for Electro Magnetic Compatibility (EMC) (resistance to static electricity, short power cuts, lightning strikes, strong signal interference and other tests to simulate a complex driving environment) to ensure that these electronic devices remain stable during the car's journey and thus ensuring the safety of the car [1]. Because of the complex driving environment and conditions, the car's software also needs to monitor all kinds of information from the outside world at all times, for example, when the software detects changes in the terrain, it will automatically adjust the vehicle mode and driving speed to ensure that the performance is stable. Besides, it can also judge whether the current driving scheme is optimal through the monitored data [2]. Making artificial intelligence process deep learning through various driving cases is also essential for the development of the car intelligent driving. A vehicle can analyze and learn its own driving data and finally achieve the best driving mode. Through the cooperation of hardware and software, the decision-making and driving-assistance capabilities of the intelligent vehicle terminal can be strengthened.

2.3. Information sharing and intelligent driving networks

Through the intelligent networking terminal, the current vehicle information collected such as weather, traffic conditions, and road conditions is shared on the Internet platform in real time to other intelligent vehicles. Other intelligent vehicle terminals make intelligent calculations and decisions according to updated information, thus ensuring the efficiency and safety of driving. For example, on the highway, the driving network intelligent vehicle terminal will update the vehicle location information in real time, and the highway server can intelligently adjust the order of the vehicle to carry out safe unmanned driving. In addition, the establishment of intelligent driving networks allows for the most efficient vehicle deployment, enabling vehicles to plan their routes and adjust their driving data in the most rational way. The creation of a big data platform for vehicles will also allow for the most efficient driving for all.

3. The importance of AI applications in driving

3.1. Safety of intelligent driving

Smart driving has two unique advantages over traditional driving where the driver observes the road and then the human brain makes the decision. Smart cars have a large number of sensors that help the on-board computer to generate a 3D model of the surroundings, allowing for maximum awareness of the environment and ensuring that all directions and corners are under the driver's control. At the same time, AI can also make judgement and give advice to help the driver make decisions based on the current driving conditions. Moreover, when applied to driverless driving, AI technology can reduce the fatigue caused by long periods of concentration and thus increasing the driver's experience and comfort. For example, when there are few cars, the on-board computer replaces the human brain and becomes the

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judgement terminal to carry out all aspects of control, thus achieving the Level 5 of driverlessness as indicated by the SAE Driver Automation Classification, which is truly driverless. In complex road conditions, the on-board computer assists the driver in driving based on the information collected, which also greatly reduces the driver's driving stress [3].

3.2. Comfort of intelligent driving

Different drivers have different driving habits and different passengers have different riding habits. As smart driving becomes more widespread, the vehicle experience will be enhanced in every way. In terms of the outside of the car, people can input relevant information into the smart car terminal to adjust the vehicle's acceleration time, stopping time, and other vehicle driving conditions to directly control the car's operation, thus avoiding motion sickness caused by aggressive driving. In terms of the interior of the car, the face recognition system captures the appropriate driving preferences and transmits them to the central control system to regulate the interior environment, including the interior temperature and interior ventilation speed [4]. Additionally, the body monitoring system monitors a driver's heartbeat, head, and eyes to analyse whether the driver's condition is normal [5]. For those who love to drive, smarter computers can provide the most appropriate power for the vehicle based on the driver's driving habits and help the driver to avoid many risks through assisted driving systems. This not only helps to maximise the driver's driving pleasure, but also significantly reduces driver fatigue [6].

3.3. Efficiency of intelligent driving

Traffic congestion is a serious problem in many cities and some people think that travelling by car is a waste of time. Artificial intelligence technology can update the best routes in real time through connected big data to avoid delays due to congestion. It can also form a network of corresponding driving data based on daily traffic data so that people can better plan their travel time and mode. Artificial intelligence technology can also make the vehicle become another networked mobile terminal. People can use the app on mobile phones or computers to carry out remote car searching, positioning and navigation, automatic parking, automatic pick-up and drop-off, etc. These functions can save a lot of time for travelling, greatly improving the efficiency of driving [7].

4. The future of intelligent driving

4.1. Brain control technology

Brain Control is a cutting-edge technology that captures the driver's driving intentions through brainwave changes caused by changes in attention during the driving process. Compared to previous driving, this technology overturns the traditional way of driving a car through the hands and feet and provides driving intentions directly to the car's computer through brainwave signals. Ten years ago, the Red Flag Motor Company was already conducting relevant tests, including detailed testing of lane information, body posture change information, driver perception and other aspects of real-time information. From multiple perspectives such as the current actual smart driving technology perspective, safety perspective, and technical time difficulty, the development of brain-controlled cars may be easier and in line with the laws of automotive development compared to the technology required for unmanned cars. The way the human brain thinks about problems and makes decisions is complex because the current driverless car's driving computer system is not yet able to achieve a highly intelligent brain-like computer system, so it is difficult for the driving system to deal with a variety of unexpected problems during driving and some problems that the machine cannot identify as obstacles or even direct damage to the car. However, it is undeniable that brain control technology is a new interpretation of intelligent cars and artificial intelligence cars, with superb development prospects.

4.2. Intelligent internet interaction technology

With the advent of the 5G era, near-zero latency network connections provide a strong basis for the reform of intelligent driving technology, and many emerging Internet technologies point to new

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directions for the development of car driving technology [8]. The newer and more intelligent electronic devices in cars can collect data about the driver and even the passengers from a variety of angles and thus directly facilitate people's lives. In the case of intelligent voice systems, this advanced model can rely on intelligent language recognition and control systems that can interact directly with the driver or passenger for the purpose of information and feedback. At high internet speeds, the system is able to recognise messages and quickly obtain the best possible answers based on big data platforms and self data. This voice system can be used not only for traditional call-taking and location navigation, but even for more intelligent interaction such as controlling the car and accessing entertainment directly through the system. In terms of intelligent image recognition systems, the system can not only directly analyse the driver's biological movements such as gestures and expressions through mathematical algorithms and biological principles, but can also achieve a high level of human-computer interaction by having the car computer understand the driver's behavioural intentions and driving status [9]. This system is capable of recognising the face and body of the driver for the purpose of theft prevention. It is also capable of diagnosing the physical condition of the driver and passenger based on the data collected and even alerting the police or seeking medical attention.

4.3. Complete and intelligent housekeeping

The application of brain-like computers and 5G Internet technology can make the car more intelligent and smart, and the deep learning system can combine the first two to form a truly intelligent housekeeper to take care of all the things in daily travel. Brain-like computers can accurately think and judge people's intentions and instructions and give the corresponding instructions, 5G Internet technology can analyse the best solutions to various problems in real time according to the instructions given and generate corresponding data models for the deep learning system to learn. The deep learning system will analyse and learn according to one model to finally achieve the most suitable system for people's needs [9]. For example, some company bosses in the future may no longer need a driver to drive but directly let the vehicle itself plan the trip and deal with some trivial issues such as refuelling; commuters who go to work every day can directly hand over their driving to the intelligent system, which can not only get themselves more rest time but also make the whole transportation system network more smooth and efficient. The intelligent housekeeper can also be directly connected to people's intelligent houses, thereby judging the user's physical and even mental conditions from the driving data and truly achieving a comprehensive intelligent life. This intelligent housekeeping is irreplaceable and convenient. It is also a future trend of artificial intelligence.

5. The hidden dangers of smart driving

5.1. Challenges posed by technology

At this stage, AI technology is still at a low level of intelligence, i.e. 'weak AI' that only focuses on specific tasks. The current AI technology is mostly used for specific problems and is still far from a fully intelligent human brain [10]. In terms of perception, there are significant differences in the level of traffic environment and conditions due to the uneven level of economic development in different regions. The inaccuracy of basic road conditions and road signs may lead to incorrect recognition of AI and consequently result in driving errors. In terms of planning, inadequate driving systems including computer systems and processing systems may cause problems of poor coordination, and this aspect still requires extensive road trials to test the stability of the driving system as well as the planning system. In terms of decision-making, the first thing to be determined is that all decisions are legally and ethically compliant. There are risks and complexities when driving with artificial intelligence, and many decisions may have unknown pitfalls, which also require further testing to complete the trust in the technology.

5.2. Challenges posed by the network

Artificial intelligence technology must be the framework of an intelligent car through data transmission and information interaction. A variety of network information accesses brought by the 5G era will

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certainly bring a lot of useful information, but at the same time, how to ensure the security of information is also becoming particularly important for intelligent driving. The current cyber security situation is not ideal for smart cars, with numerous cyber attacks posing a huge challenge for the future of smart network interaction technology in cars. If information is not handled properly, on the one side, it can lead to the disclosure of personal information such as addresses, daily activity ranges, and route preferences, which can lead to the commission of related crimes by criminals. On the other side, as trust in intelligent cars grows, hackers may be able to attack the car's computer directly via the internet to manipulate the car's movement or even commit crimes such as murder. These issues could lead to prejudice and resistance to AI technology.

5.3. Challenges posed by policy and law

There is currently no existing body of law on autonomous driving to be based on. The issue of the legal constraints on self-driving cars is not yet well resolved, and there is still a great deal of controversy, especially regarding the allocation of liability in the event of an accident [11]. The issues such as how to determine whether a fully self-aware driving mastermind would be considered a civil subject and who would be liable for an accident in the event of damage to the driving computer, as well as the new "human-machine relationship" are worthy of further consideration and legislation. The legal issue of liability for driverless vehicles involves not only the legal relationship among design companies, manufacturing plants, and users, but also a series of liability relationships that need to be repeatedly thought through and argued about, such as contractual and tort liability. The introduction of relevant policies can help motivate more people to participate in the involvement of autonomous driving, and can also promote the enthusiasm of researchers to research, thus making autonomous driving develop more rapidly. In a random interview with passers-by, some people thought that driverless driving might be less safe than traditional driving and even lead to more threats on the road [12].

5.4. Challenges posed by economic issues

Smart cars will certainly be equipped with a large number of electronic devices such as sensors, radar, high-definition cameras and a range of other electronic devices. High design costs or research and development costs will make it impossible to produce them in volume. Highly accurate sensors may have poor stability while the sample equipment and facilities required for experimental stability will also consume a large amount of experimental funding. Long-term heavy investment may result in companies not having sufficient research funds to develop projects, which may lead to a reduction in the pace and speed of development.

6. Conclusion

The application of artificial intelligence technology in driving has many advantages and can use emerging technologies to provide drivers and passengers with a more solid safety, more comfortable driving and riding experience, and greater efficiency [13]. However, there are also technical, legal, and economic drawbacks that require the cooperation of researchers, governments, and businesses to address. It is undeniable that autonomous driving has become a trend in the future development of the automotive industry and is gradually becoming a new growth point for revitalising the economy. Relevant laws and regulations will also be introduced to match the development of technology and create a positive development environment. This paper provides an overview and analysis of the overall development of artificial intelligence from the application of autonomous driving and the results and prospects of its application, defining the direction of development for the application of artificial intelligence in the field of driving and describing the basic theory for the gradual realisation of intelligent electronic vehicles.

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