Application of Artificial Intelligence Technology in New Energy Vehicles

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Abstract:

Due to environmental pollution caused by excessive exploitation of world resources, countries are now advocating for green travel, which has led to the rapid development of the new energy vehicle industry. Compared to traditional cars, the safety, maneuverability, and convenience of new energy vehicles have made the application of artificial intelligence technology increasingly widespread in this field. Therefore, this article provides a systematic review and analysis of the application of artificial intelligence technology in new energy vehicles. Firstly, the article outlined the main application scenarios of artificial intelligence in the field of new energy vehicles, including autonomous driving, energy management optimization, vehicle intelligent interconnection, and predictive maintenance. On this basis, this paper analyzed the role of artificial intelligence technology in improving the performance, safety, and reliability of new energy vehicles, as well as the technological challenges and development trends it faces. For example, issues such as data privacy protection and real-time performance need to be further addressed. In the future, artificial intelligence and new energy vehicles will further integrate, making important contributions to achieving intelligent, green, and safe future travel.

Keywords: New energy vehicles; Artificial intelligence; Autonomous driving.

1. Introduction

As discussed earlier, the importance of new energy vehicles is rising. With the increasing global attention to environmental protection and sustainable development, new energy vehicles have become an important choice to replace traditional fuel vehicles and are gradually becoming a development trend in the automotive industry. At the same time, the rapid development and widespread application of artificial intelligence technology provide important support for the intelligence and efficiency of new energy vehicles [1]. Artificial intelligence technologies in fields such as autonomous driving, energy management optimization, and vehicle health management are bringing revolutionary changes to the performance, safety, and reliability of new energy vehicles. This article aims to comprehensively analyze the current application status and development trends of artificial intelligence technology in the field of new energy vehicles. Firstly, this article will provide an overview of the main application scenarios of artificial intelligence in the field of new energy vehicles, and compare the specific implementations of different technological methods. Secondly, the role of artificial intelligence technology in improving the performance, safety, and reliability of new energy vehicles was explored,

and the current technological challenges and future development trends were analyzed. Finally, this article comprehensively evaluates the impact and prospects of artificial intelligence technology in the field of new energy vehicles through practical applications and other aspects. Through the review of this article, it aims to provide guidance for the academic and industrial communities to promote research progress and technological innovation in related fields, and to provide useful references and guidance for the integrated development of new energy vehicles and artificial intelligence technology.

2. Application scenarios of artificial intelligence in new energy vehicles

2.1 Autonomous driving technology

Autonomous driving technology refers to the technology that enables vehicles to autonomously sense, make decisions and control driving without human intervention. As shown in Fig. 1, this technology relies on sensors, camera vision analysis, artificial intelligence learning and decision algorithms, so that vehicles can identify roads, traffic signs, obstacles and other vehicles, plan the optimal driving path, and carry out accurate vehicle control [2]. The development of autonomous driving technology is

divided into multiple stages, from the most basic driving

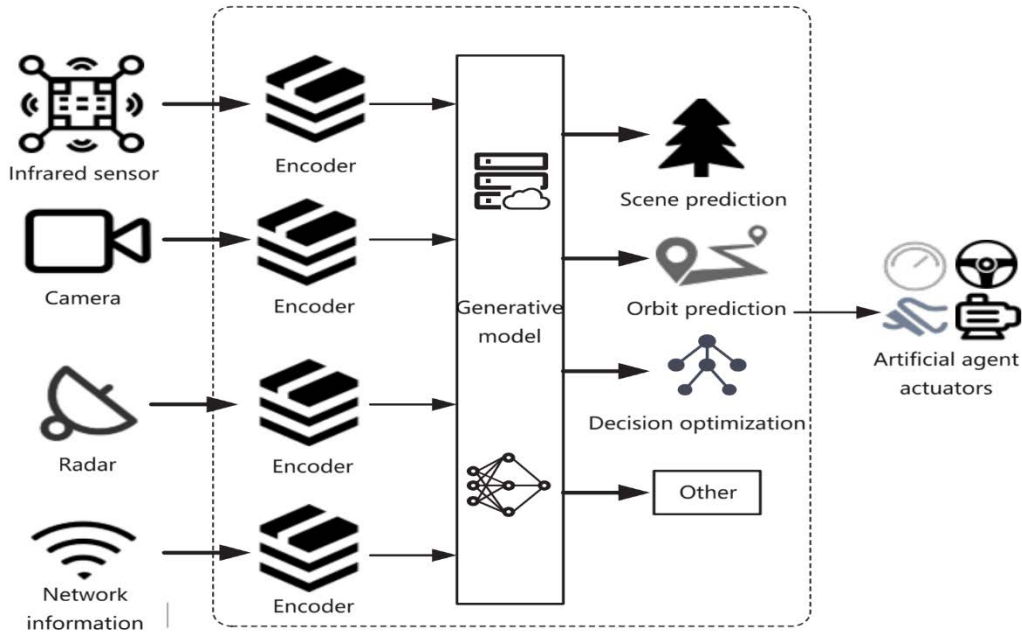assistance function to the current full autonomous driving.

Fig. 1 Autonomous driving technology fusion model [3].

As autonomous driving technology evolves, artificial intelligence technology and new energy vehicles have emerged one after another. At present, some new energy vehicle manufacturers and artificial intelligence technology companies have launched artificial intelligence autonomous driving functions on new energy vehicles. These include features such as autonomous driving and automatic parking. At the same time, people are constantly exploring higher-level autonomous driving technologies [4]. According to the latest research, the majority of traffic accidents in the world are caused by human error. In order to reduce the occurrence of such situations, it is necessary to vigorously develop autonomous driving technology [5]. Drivers always face various issues while driving a car, such as weather conditions, mental state, operational skills, etc. Once there is a situation with the car or driver, there is a high probability of a traffic accident occurring. At this point, the lives of the driver and passengers in the car are also at risk, and artificial intelligence autonomous driving technology can precisely compensate for this disadvantage. Nowadays, many new energy vehicle manufacturers have launched automatic parking systems. When the driver lacks technology or for convenience, the driver can command the artificial intelligence in the car to operate the applications of these systems. These systems can automatically find parking spaces and perform parking operations through onboard sensors and cameras, greatly reducing the pressure on drivers when parking in narrow parking spaces. At the same time, cars parked through

automatic parking systems will be more standardized than those parked by drivers, which can avoid some collision accidents. Even in some cities, autonomous taxis and buses have started pilot operations, which can achieve autonomous driving and passenger services in specific areas. Combined with artificial intelligence autonomous driving technology, new energy vehicles can autonomously adjust their driving speed and mode based on traffic conditions and driver perception, achieving coordinated optimization of energy and driving, improving vehicle energy efficiency, while also avoiding accidents and protecting the safety of car owners. Therefore, strengthening the application of artificial intelligence technology in autonomous driving of automobiles, fully leveraging the advantages of artificial intelligence technology, and upgrading autonomous driving technology can enable vehicles to accurately identify environmental conditions, conduct automatic analysis, and plan driving paths reasonably, effectively avoiding some safety hazards, ensuring the safety and stability of the driving process, and reducing the incidence of traffic accidents [6].

The application of artificial intelligence technology in autonomous driving enables cars to respond more intelligently to complex traffic environments, improving driving safety, comfort, and efficiency [7]. At present, autonomous driving technology has been applied in some cars, and with the continuous advancement of artificial intelligence technology and new energy vehicles. In the future, new energy vehicles will be equipped with more sensors to

enhance their perception of the surrounding environment and improve the reliability and safety of autonomous driving [8]. Autonomous driving technology will usher in greater development space.

2.2 Vehicle intelligent interconnection

Vehicle intelligent interconnection refers to the connection and data exchange between vehicles and the external environment, other vehicles, and charging facilities. This is achieved through wireless communication and artificial intelligence Internet technology, realizing real-time interaction and information exchange. The application of this technology in automobiles can be divided into multiple modules, as shown in Fig. 2. These modules provide remote monitoring, intelligent navigation, intelligent charging, vehicle health management, intelligent driving assistance and other functions for new energy vehicles.
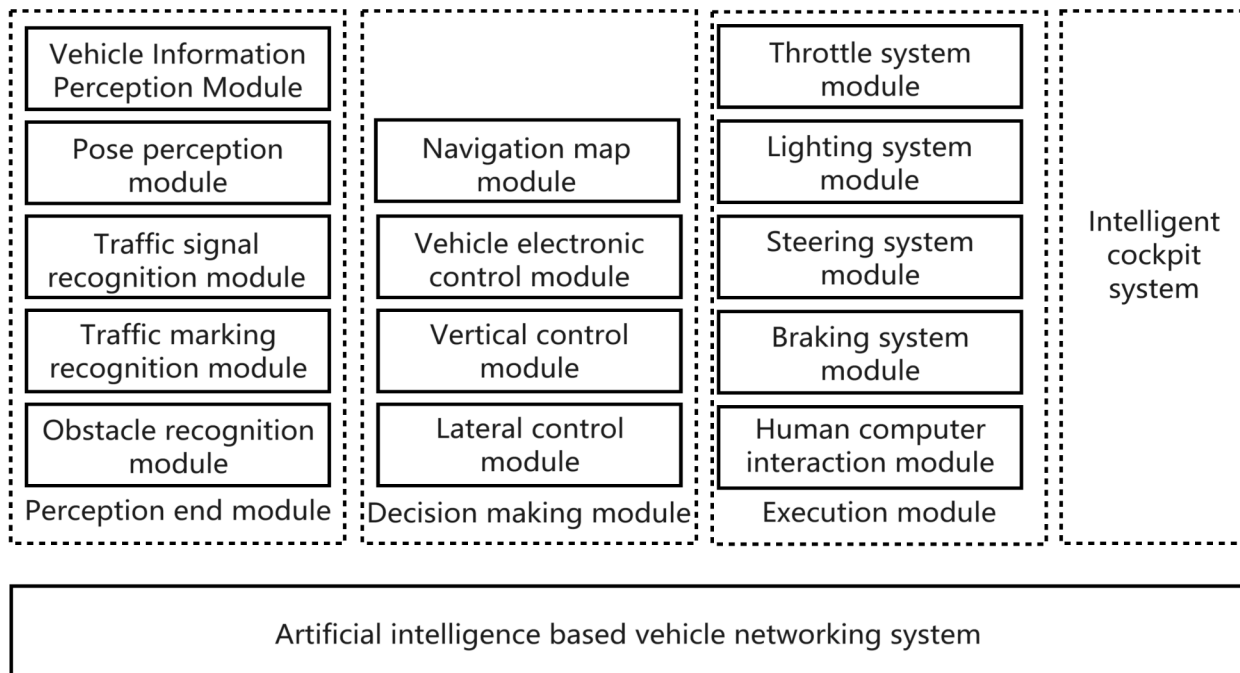

Fig. 2 Artificial intelligence based vehicle networking system (Photo/Picture credit: Original)

In order to better understand vehicle intelligent interconnection technology, this article will introduce its core content. These contents include intelligent charging and charging pile interconnection, vehicle health management, remote monitoring, etc [9]. Intelligent charging and charging station interconnection can enable new energy vehicles to achieve intelligent dialogue with charging stations through vehicle intelligent interconnection technology, including real-time query of charging station status, intelligent planning of charging routes, automatic settlement and other functions, which can improve charging convenience and efficiency. When the energy of a new energy vehicle runs out, the artificial intelligence system will detect and prompt the driver in a timely manner. At the same time, through the vehicle's intelligent interconnection system, the artificial intelligence will recommend the nearest charging location to the driver, and automatically turn on the power-saving mode to reduce energy consumption and improve the vehicle's range. Vehicle health management refers to the real-time feedback of vehicle health status and fault information to drivers or maintenance personnel through vehicle intelligent interconnection technology, achieving intelligent maintenance and preventive repair, thereby improving the durability of vehicle life. Remote monitoring and control refers to the ability of drivers to remotely monitor and control new energy vehicles through smartphones or other terminal devices. This includes viewing vehicle status, real-time positioning, remote activation of air conditioning or heaters, and other functions, improving the convenience of vehicles and the driver's experience [10]. In addition, the intelligent interconnection system also provides road condition diagrams and real-time road condition information services, such as real time traffic updates and traffic accident reminders. The road condition diagram will provide real-time traffic information for the city and its surrounding areas, including main roads, highways, and large commercial districts. When the driver encounters an emergency situation and needs to rush, artificial intelligence can provide the driver with the optimal path selection and update the road con-

ditions in real time, continuously optimizing the route planning based on the road conditions, so that the driver can arrive at the destination in a timely and fast manner [11]. These practical applications in new energy vehicles demonstrate the potential of vehicle intelligent interconnection technology in enhancing driving experience, improving traffic efficiency and safety. And intelligent interconnection technology can solve many transportation system problems, reduce traffic congestion, and improve driving safety [12].

Through vehicle intelligent interconnection technology, new energy vehicles can achieve many practical and convenient intelligent functions, providing users with a more convenient, safe, and efficient travel experience [13]. At the same time, vehicle intelligent interconnection technology also provides more intelligent solutions for vehicle management and maintenance, improving the reliability and safety of vehicles.

2.3 Vehicle safety and risk prevention

The pace of the times is gradually accelerating with the rapid development of the world, and people are becoming increasingly busy in their daily lives. For example, when people drive to work in a hurry, their anxious mentality may cause them to overlook traffic safety, which can result in traffic accidents. However, with the use of artificial intelligence technology, vehicles can be equipped with forward and lateral collision warning systems that identify potential collision risks through cameras, radar, and sensors, and issue warnings or automatically take measures to avoid collisions, reducing the occurrence of fatal accidents [14]. For example, when people drive for business trips, they often drive for long periods of time, which can cause fatigue or distraction for the driver, leading to the car deviating from its original driving route. At this point, artificial intelligence technology can activate the lane departure warning system, monitoring the vehicle's trajectory through cameras and image recognition technology, issuing warnings in a timely manner, and correcting the vehicle's deviation behavior. By addressing these issues, integrating artificial intelligence into vehicles can avoid or reduce the occurrence of traffic accidents.

On new energy vehicles, artificial intelligence can monitor the risks of the vehicle through various aspects, as shown in Fig. 3. While understanding vehicle risks, AI will use various means to protect the safety of the vehicle and the driver in a timely manner. For the driver, through artificial intelligence technology, the vehicle can monitor the driver's behavior in real time. By analyzing indicators such as eye closure frequency, blink frequency, and eye movement patterns, artificial intelligence can determine the driver's level of alertness and fatigue, thereby inferring whether the driver is experiencing fatigue driving. Moreover, artificial intelligence can analyze the driver's voice emotions and speech patterns through speech recognition technology to determine their emotional state and level of distraction. When a car brakes suddenly or oversteers, artificial intelligence will analyze the vehicle's internal sensors and issue warnings or take measures to alert or intervene with the driver, reducing the risk of accidents caused by driver behavior and thus reducing the incidence of traffic accidents. Meanwhile, artificial intelligence can provide drivers with real-time road condition information, traffic congestion alerts, intelligent route planning, and other functions to help drivers avoid traffic accidents [15]. For vehicles, artificial intelligence can monitor road conditions and the surrounding environment in real time through vehicle sensors. When an emergency situation is detected, it automatically applies emergency braking to avoid collision accidents. Moreover, artificial intelligence can analyze vehicle sensors and system data to predict component failures and losses. Through various sensors installed in new energy vehicles, artificial intelligence can timely detect various parameters of the vehicle, such as engine temperature, fuel tank pressure, car speed, etc. If problems are found, artificial intelligence will remind the driver to perform maintenance and replacement in advance, thereby reducing the risk of accidents caused by component failures [16]. These practical applications demonstrate the potential of artificial intelligence technology in improving vehicle safety. With the continuous development and popularization of technology, it is expected that the application of artificial intelligence in vehicle safety will continue to expand and have a positive impact on traffic safety.
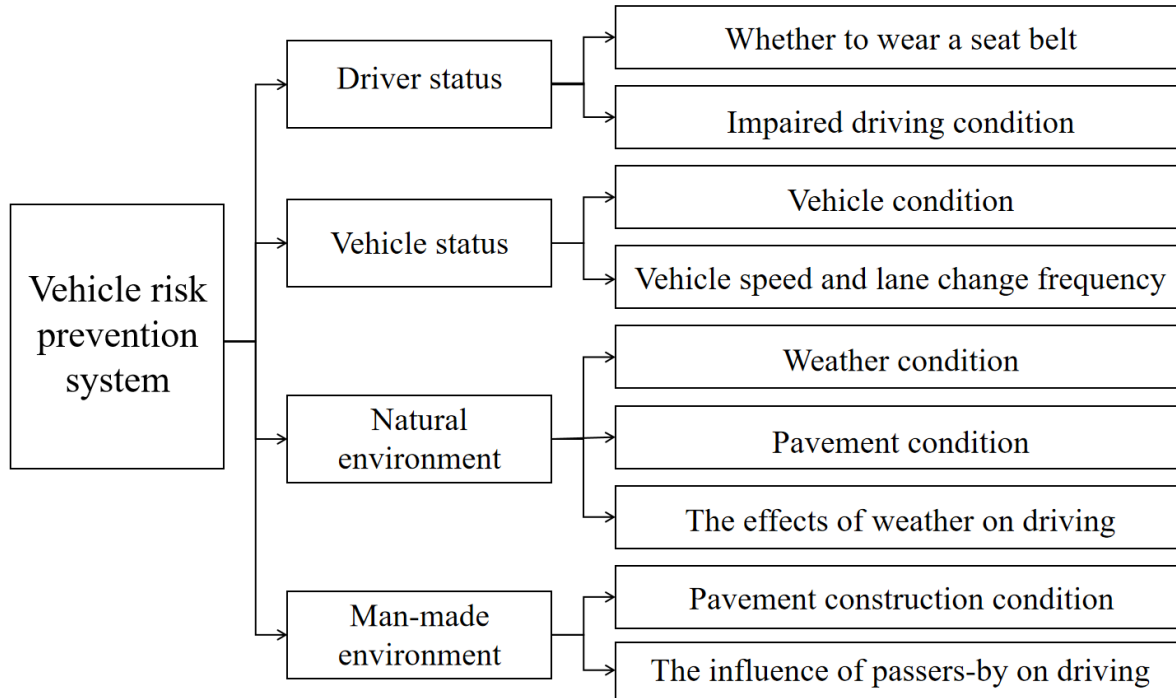
Fig. 3 Vehicle risk prevention system (Photo/Picture credit: Original)

3. Technological challenges and development trends faced

3.1 Technical challenges

Although the application of artificial intelligence technology in new energy vehicles has entered a mature stage, there are still many shortcomings that deserve improvement in this article. The core of new energy vehicles is the battery pack, and battery management is crucial for vehicle performance and safety. Artificial intelligence can be used to develop smarter and more efficient battery management systems, enabling intelligent charging and discharging control, lifespan prediction, and fault diagnosis of batteries [17]. For autonomous driving, which artificial intelligence is most proud of, there are actually many shortcomings in its technology. When artificial intelligence performs environmental perception, it may not be able to fully perceive the surroundings. And after completing perception, the decision planning of artificial intelligence may not be perfect. In this regard, the perception and decision-making capabilities of artificial intelligence should be further enhanced and improved. Additionally, as artificial intelligence technology develops, more and more data will be generated by new energy vehicles. Artificial intelligence also needs to face challenges in data security and privacy protection, such as how to protect the security and privacy of vehicle data, and prevent hacker attacks, which is a huge problem.

Overall, the application of artificial intelligence in the field of new energy vehicles faces many challenges and requires continuous technological innovation and research and development to promote the intelligence and sustainable development of new energy vehicles.

3.2 Future Development Trends and Prospects

Based on the changes of the times and the world environment, new energy vehicles will gradually replace traditional fuel vehicles and become the public transportation tool of the new era. In the future, the application of artificial intelligence in the field of new energy vehicles will be more extensive and in-depth, injecting new vitality into the intelligence and sustainable development of new energy vehicles [18].

With the continuous development of artificial intelligence and automatic driving technology, new energy vehicles will be more integrated into intelligent driving and auto drive system. In the future, artificial intelligence will play a greater role in environmental perception, decision planning, vehicle control, and other aspects, achieving a more intelligent driving experience. At the same time, artificial intelligence will play a greater role in the intelligent diagnosis and predictive maintenance of new energy vehicles. Through further analysis and learning of vehicle system data, real-time monitoring of vehicle status, fault prediction, and maintenance reminders can be achieved, reducing vehicle maintenance costs. The most important

thing is that artificial intelligence will be applied more to the security and privacy protection of vehicle data in the future, including technological innovations in data encryption, secure transmission, and permission management. Through the integration of advanced artificial intelligence and new energy vehicles in the future, people can enhance their reliability and dependence on artificial intelligence, and such combined applications can also bring higher safety and sustainability to people.

Overall, the future prospects of artificial intelligence in the application of new energy vehicles are very broad, which will bring more innovation and breakthroughs to the intelligence and sustainable development of new energy vehicles, and promote the entire automotive industry to develop towards a smarter, safer, and more efficient direction.

4. Conclusion

Artificial intelligence and new energy vehicles complement each other and promote each other's development. Through artificial intelligence technology, autonomous driving technology has been significantly improved. New energy vehicles can use sensors, radar, and cameras to collect data and analyze real-time traffic conditions through artificial intelligence models, thereby achieving autonomous driving. The advancement of autonomous driving technology not only improves driving safety, but also optimizes traffic flow and reduces traffic accidents. Meanwhile, the application of artificial intelligence technology in battery management systems has significantly improved the utilization efficiency of new energy vehicle batteries. Artificial intelligence can monitor the battery status in real-time, optimize the charging and discharging process, and extend the battery life of both vehicles. In addition, the energy recovery system can maximize energy recovery efficiency and increase range through artificial intelligence optimization.

Overall, the application of artificial intelligence technology in new energy vehicles will bring technological innovation and development opportunities to the entire automotive industry. This will drive new energy vehicles towards intelligence, efficiency, and sustainability, and promote the development and popularization of new energy vehicle technology. The application of artificial intelligence technology not only enhances the intelligence level of new energy vehicles, but also brings significant improvements in safety, energy efficiency, and user experience. With the continuous advancement of technology, the application prospects of artificial intelligence technology in new energy vehicles will be even broader, which is expected to promote the development of the automotive

industry towards a more intelligent and sustainable direction. Looking ahead, the deep integration of artificial intelligence technology and new energy vehicles will continue to lead the innovation and progress of automotive technology. This integration will bring more convenience and benefits to society.

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