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SELF-DRIVING CARS AND ARTIFICIAL INTELLIGENCE ON THE ROADS

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Annotation. This article provides an overview of self-driving vehicles and associated artificial intelligence technologies. It examines sensor systems and AI algorithms used in autonomous cars, discusses the benefits of driverless vehicles, such as improved road safety and enhanced accessibility, and considers the technical, legal and societal challenges that affect the future development of automated transport.

Keywords. autonomous vehicles, artificial intelligence, machine learning, sensor fusion, LiDAR, road safety, ethics.

***Introduction*.** Road traffic accidents are one of the leading causes of death worldwide. The World Health Organization estimates that 1.19 million lives are lost per annum as a result of road traffic crashes [1].

Concurrently, rapid progress in the field of artificial intelligence has seen the emergence of autonomous vehicle technology from a concept reserved for science fiction toa reality. Also known as driverless cars, autonomous vehicles are one of the most revolutionary inventions of the 21st century andcouldseethousandsontheroadsby2030.

With this in mind, there is an ever-pressing need to evaluate the safety, legislation and societal effect of autonomous vehicles.

This paper aims to examine and present an overview of the infrastructure and AI used by an autonomous vehicle, the advantages, limitations, legislative concerns and ethical dilemmas associated with autonomous cars.

Main part. A self-driving car is an autonomous motor vehicle that is capable of understanding the conditions on the road around it and making driving decisions independently [1]. With the help of an onboard computer the vehicle will be able to detect the conditions, take decisions, and respond.

SAE International have defined the 6 levels of autonomous driving,0through5[2]. 0 and 1 are forms driving assistance where the human remains in full control of the car while levels 3 to 5 assign responsibility for driving to the vehicle, reaching full responsibility in level5.

Safe autonomy necessitates that the vehicle be capable of sensing and understanding its surroundings.

Contemporary AVs use suite of integrated, overlapping sensors to achieve this: cameras detect road signs and markings, radar effectively provides accurate distances and relative velocities even in poor weather conditions, LiDAR builds precise 3Drepresentations of the environment, and GPS data aligns all sensor inputs with high-definition, stored maps [3].Combining these sensors creates a complete, fault-tolerant, redundancy of world representation.

The second aspect of safe autonomy requires four steps from the AI once sensory data is captured. The four steps in order are:

1 Perception – which detects object classifications, pedestrian identification, lane detection etc.

2 Prediction – predicting behavior of others and vehicles in the surrounding environment.

3 Planning – calculating a desired path.

4 Control – which manipulates the steering wheel and accelerator/brake to implement the calculated path [4].

While the Perception and Prediction steps generally use deep learning (i.e. Convolutional Neural Networks) which has been trained on many billions of driving scenarios, path planning often uses reinforcement learning.

Safety remains the strongest driving force behind autonomous vehicles, as over 90% of traffic accidents are the result of human error (e.g. distracted driving, drowsy driving, driving under the influence). With the introduction of autonomous vehicles as a substitute and/or supplement to human drivers, crashes are expected to decrease.

Beyond safety considerations, accessibility represents a critical benefit to the older adults and individuals with physical disabilities, allowing them independence of travel. Through vehicle-to-vehicle communication congestion is reduced and occupants have the ability to be productive. Fuel efficiency gains are also predicted to decrease fuel use and pollution levels due to more optimized driving.

Despite their enormous potential, technical and societal hurdles abound for AVs. While currently, sensor performance plummets under weather conditions such as snow, fog and rain, edge cases – infrequently occurring circumstances that are disproportionately rare in an AI system's training set – remain a significant challenge for even sophisticated AVs.

A major technical hurdle for autonomous vehicles is the increased risk of cyber-attack, since the highly connected nature of Avs presents more points-of-entry through which attacks could occur to cause accidents or bringdown systems.

Although prices are expected to decrease considerably due to scaling in hardware, components such as LiDAR are still prohibitively expensive to purchase for individual consumers. High profile accidents have also damaged public perception of AV technology.

The ethical questions associated with autonomous vehicles go much further than those relating to the technologies used.

One of the most significant ethical dilemmas to overcome in relation to autonomous vehicles relates to the question of moral responsibility. If an accident involving an autonomous vehicle occurs, and it is impossible to avoid, who should be blamed: the manufacturer, the programmers, the vehicle owner or the autonomous system itself?

An experiment conducted by Bonnefon, Shariff and Rahwan showed that there are paradoxes in people's moral views regarding the programming of autonomous vehicles; whilst most people seem to agree with Utilitarianism and would choose an a decision-making system that minimises the overall number of deaths, no one seems willing to buy the car if its algorithm prioritizes an algorithm to kill its occupants [5].

This disparity in attitudes regarding self-interest versus the interests of others creates a substantial regulatory dilemma. There are very few established legal frameworks that outline liability for autonomous systems in any country; and international standards regulation, as well as transparency for autonomous algorithms have yet to be formed.

Conclusion. Transportation is being radically changed by artificial intelligence. Machine learning, sensing and computing advances are gradually bringing self-driving cars within the realm of possibility. These vehicles could have a transformative impact in making transport safer, more efficient and accessible. But realizing their full potential will require addressing tough technical, ethical, legal and social issues. Forward planning must involve governments, engineers, ethicists and society – to ensure a fair development and adoption of autonomous vehicles.

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