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HOW ARTIFICIAL INTELLIGENCE TRANSFORMS DRIVING: FROM ASSISTANTS TO AUTOPILOTS

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***Summary.** Artificial intelligence (AI) is transforming the automotive industry by enhancing driving safety, comfort, and efficiency. Advanced Driver Assistance Systems (ADAS) like lane-keeping, adaptive cruise control, and emergency braking help reduce driver fatigue and human error. Moving towards fully autonomous vehicles, AI-powered systems are currently at level three, where they can handle driving in specific conditions with human oversight. However, higher levels of automation face challenges, such as adapting to various environments and ensuring reliability under poor conditions. AI's advancements are paving the way for smarter, safer, and fully autonomous road transport in the near future.*

According to the current research, artificial intelligence (AI) has firmly integrated into modern life, impacting various industries, including the automotive sector. Today, AI is reshaping our understanding of driving while significantly enhancing the safety, comfort, and efficiency of road transportation. Technologies that once seemed like science fiction – such as advanced driver-assistance systems (ADAS), autopilot systems, and intelligent information platforms – are actively developing and gradually being integrated into modern vehicles [1]. Let's examine how AI transforms driving and where this path leads.

Undoubtedly, one of the first steps toward smart cars was the development of driver assistance systems, or ADAS (Advanced Driver Assistance Systems). These systems aim to improve the safety and comfort of driving, prevent accidents, and reduce the role of human error in the driving process. AI technologies such as machine learning and computer vision are actively applied in ADAS, allowing the car to "see" the road, "understand" the situation, and make real-time decisions. Common ADAS functions include lane-keeping assistance, automatic emergency braking, adaptive cruise control, and blind-spot monitoring. For example, the lane-keeping system uses cameras and sensors to track the car's position on the road, detecting whether the car is veering out of its lane and helping the driver correct the trajectory. Meanwhile, adaptive cruise control allows the car to automatically adjust its speed to match the traffic ahead, reducing the risk of collisions.

Furthermore, these technologies not only reduce driver fatigue but also improve road safety, as AI can react faster to changes on the road than a human. However, it is important to note that ADAS plays an auxiliary role, with the driver retaining control over the vehicle.

Autonomous driving, or autopilot systems, represents the next stage in the evolution of driving technology. Developers have identified five levels of automation, where the first level involves only basic assistance functions, while the fifth level signifies full AI control over the vehicle without driver intervention [2]. Currently, cars on the market feature automation up to the third level, where AI can temporarily take over driving in specific conditions, such as on highways. However, the driver must be prepared to intervene. At the fourth level of automation, which is still under development, the car will be able to fully operate under AI control in limited conditions (for example, in urban areas or on highways), with driver intervention rarely required. The primary goals of autonomous vehicles are to ensure safety, minimize accidents, and enhance road efficiency. To achieve this, AI analyzes massive amounts of data in real-time, from camera and radar information to weather conditions and road status. Neural networks trained to recognize objects on the road (pedestrians, other vehicles, traffic lights) are based on large data sets, allowing the system to respond swiftly to changes in the environment.

Despite the clear benefits, the full implementation of autopilots faces several serious technical challenges. One of the main obstacles is the need for high precision and reliability in AI systems, as well as stable internet connectivity for data exchange. Poor weather conditions or an unstable internet signal can disrupt system performance, which may pose a potential danger [3]. Additionally, developers face the task of adapting autopilots to various environments: urban and rural traffic, as well as different weather conditions. Solving these issues may take years, but advancements in machine learning and computer vision technologies are gradually bringing us closer to fully autonomous driving.

In short, the development of artificial intelligence technologies in the automotive industry is leading to revolutionary changes, making cars safer and smarter. From driver assistance systems to fully autonomous vehicles, AI is transforming our understanding of driving and road transport step-by-step. In the coming years, we are likely to witness even more significant achievements in this field, leading to the creation of fully autonomous and safe road transportation.

References

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