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| HOUSTON COMMUNITY COLLEGE |
| Exploring Real-World Applications of Computer Vision |
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AI (artificial intelligence) is rapidly changing the world, creating an evolutionary shift within industries and changing the style in which people primarily live and work. AI is impacting a multitude of industries ranging from healthcare to banking by making processes more efficient, making new insights in decision making, and solving complex problems. One industry sector is the transportation sector that artificial intelligence (AI) is significantly impacting. In this sector, AI is enabling the development of automated or self-driving vehicles through object detection and recognition. As AI continues to evolve, AI will become a bigger part of our daily lives and create new opportunities and dilemmas in almost every area of societies.

Utilizing vast information from image recognition systems, alongside machine learning and neural networks, self-driving vehicles rely on the making of detailed maps to analyze their environments and search safe and efficient ways to travel. The vehicle must determine how to appropriately travel within the rules of the road while also taking the safest and most efficient path. Geofencing is using GPS or other location-based services to create virtual boundaries that can ultimately keep the vehicle in specified ranges. Once a pre-defined parameter has been triggered, an automated action or alert can be initiated.

The operation of autonomous (self-driving) vehicles also relies heavily on the cooperative integration of core components within the vehicle to maintain safe and functional self-driving operations. Essential sensors consist of cameras to collect visual information, LiDAR to create 3D models of the environment, radar to detect moving objects that helps aware of their surroundings and eliminates collision risk while driving, and ultrasonic sensors to identify objects in proximity. These sensors collect information about the vehicle's immediate environment, including information relevant to safety and navigation. Next, the processing component consists of an embedded computer that is responsible for processing data from all sensors in real time. It is equipped with artificial intelligence and machine learning algorithms to identify and recognize objects and make decisions regarding those objects. The navigation and mapping components use GPS technology to determine the vehicle's exact position and map technology to provide detailed information about the roadway, allowing for safe navigation.

Then, the control systems component includes algorithms for path planning to help determine the most efficient path, and vehicle control systems that manage acceleration, braking, and steering movements using real-time data from the environment. The communication component, which includes V2X (vehicle-to-everything) technology, facilitates exchanging information between vehicles, roadside infrastructure, and the cloud to improve safety and coordination. The HMI (human-machine interface) informs drivers and/or passengers about driving conditions and provides control options, such as the ability to stop or start the vehicle, if they choose to. Finally, the safety systems component includes redundant and fail-safe systems to ensure reliability and safety of the system even when a component fails. Overall, these components work together to create a fully autonomous self-driving vehicle capable of navigating complex environments and making real-time decision-making driving decisions.

On the first side, autonomous vehicles offer considerable benefits including an increase in safety stemming from a reduction of human error, which accounts for the majority of accidents. Through the use of computer vision and artificial intelligence, vehicles can perceive and assess the world around it. Then it can react to threats while providing other capabilities such as accident avoidance, as an example. With the implementation of artificial intelligence and vehicle-to-everything communication (V2X), traffic patterns can be executed more efficiently through optimized routing, decrease congestion, and reduce fuel consumption. Autonomous vehicles can provide an improved sense of access to mobility for people who cannot drive, which would lead to improved mobility for the elderly or disabled. Likewise, self-driving cars can also produce fewer emissions and even enable environmental sustainability when electric vehicle technology is integrated.

On the other side, autonomous vehicles face several technical challenges while driving in adverse weather conditions. During those conditions, computer vision and sensors have limitations in interpreting the environment, while AI systems may be limited in predicting human behavior effectively. The ethical dilemma of programming an AI to make life or death decisions in a time of crisis is still problematic. This produces ethical dilemmas, questions of priority concerning safety in unavoidable circumstances. Job displacement becomes a pressing issue, given the automation of businesses (i.e., trucking, and ride-hailing jobs) which could result in a rise in unemployment and would require remedies that involve re-training displaced workers. There are also cybersecurity issues that expose shifting vulnerabilities in automated systems that may result in hacking and unauthorized access to sensitive data. This also highlights the need for security standards to be robust and comprehensive.

In summary, artificial intelligence is transforming not just how organizations function, but also the future of human interaction with technology. The utilization of AI in driverless vehicles serves as a prime example of how it improves safety, enhances efficiency, and changes transportation entirely. As AI is increasingly embedded in our lives, the possibility for AI technology to change society and ameliorate quality of life becomes more tangible. At the same time, the extensive use of AI technology has challenges as well, and we must examine the ethical, legal, and social implications. Therefore, the continued evolution of AI will be reshaping the future and affecting our life, work, and movement.

References

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