**Computer Vision in Autonomous Cars**

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Artificial intelligence, commonly known as AI, is rapidly integrating into our daily lives, assisting us with a wide range of tasks. This transformation is occurring seamlessly as technology continues to advance at an exponential rate, constantly improving and enhancing our everyday experiences. Computer vision, a branch of artificial intelligence, plays a crucial role in autonomous driving. Exactly what role will be further discussed including the main components of the technology and how it is used to solve a problem or enhance functionality with autonomous driving.

Computer vision is a type of artificial intelligence that enables computers – in this example, autonomous vehicles to interpret their environment. “The main components of computer vision in cars include *Image Recognition and Processing, Object Detection and Recognition, Lane Detection and Tracking, 3D Perception and Mapping, Machine Learning and Artificial Intelligence” (*eNest 2024*).*

Image recognition and processing in autonomous vehicles use advanced image recognition and processing techniques to:

* Identify and classify objects like other vehicles, pedestrians, and road signs *(*eNest 2024*).*
* Analyze digital images capture by onboard cameras *(*eNest 2024*).*
* Detect subtle visual cues such as hand gestures from pedestrians or turn signals from other vehicles *(*eNest 2024*).*

Preventing accidents in self-powered cars is the top priority of automotive companies (Ricard, J. 2022). Even in conventional vehicles, making the assistance systems smart enough to avoid accidents matters the most (Ricard, J. 2022).

Next the algorithms in object detection and recognition allow autonomous vehicles to:

* Detect and classify various objects on the road, including other vehicles, pedestrians, cyclists, traffic signs, and obstacles *(*eNest 2024*).*
* Use deep learning models like convolutional neural networks (CNNs) to identify objects in real-time video streams *(*eNest 2024*).*

There are several challenges with this technology (Tarasiewicz, J. 2023). One of the challenges include accurately detecting and recognizing small objects like distant pedestrians or objects with limited visual information, occlusion and overlapping objects, varying environmental conditions, real time processing, and ethical considerations when making split-second decisions that impact safety (Tarasiewicz, J. 2023).

With lane detection and tracking, vision systems cars can:

* Detect and track lane markings *(*eNest 2024*).*
* Ensure the vehicle stays within its lane *(*eNest 2024*).*
* Enable lane-changing maneuvers when necessary *(*eNest 2024*).*

There are several factors that can influence the performance and reliability of this technology (Waykole, S. 2021). Environmental factors like weather conditions and illumination changes, road conditions like lane quality and occlusions, and technical limitations like camera quality and algorithm limitations, and performance issues like false detections are perfected as to make the technology reliable (Waykole, S. 2021).

**References**

eNest. (2024, April 18). *Driving Efficiency: Computer Vision for Autonomous*

*Vehicles*. [https://enestit.com/driving-efficiency-computer-vision-for-autonomous-](https://enestit.com/driving-efficiency-computer-vision-for-autonomous-vehicles/) vehicles/

Ricard, J. (2022, November 3). *AI-Powered Image Recognition In The Automotive*  *Industry*. <https://klizos.com/image-recognition-in-the-automotive-industry/>

Tarasiewicz, J. (2023, October 6). 7 Problems You Can’t Ignore When Working on Object Detection. *ATL*. [https://www.atltranslate.com/ai/blog/7-problems-in-object-](https://www.atltranslate.com/ai/blog/7-problems-in-object-detection-you-cant-ignore) d etection-you-cant-ignore

Waykole, S. (2021, October 15). Review on Lane Detection and Tracking Algorithms of Advanced Driver Assistance System. *MDPI*, *13*(20). <https://doi.org/https://www.mdpi.com/2071-1050/13/20/11417>