

# Chapter 11

## Vision-Based Data-Driven Modeling Vehicle Detection in Videos Using Convolutional Neural Network

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### ABSTRACT

*Object detection is a vital component for autonomous driving, and autonomous cars rely on perception of their surroundings to ensure safe and robust driving performance. It shows how the perception system makes use of object identification algorithms to precisely identify nearby items like pedestrians, cars, traffic signs, and barriers. It goes on to say that detecting and localising these things in real-time depends greatly on deep learning-based object detectors. The most recent object detectors and unresolved issues with their integration into autonomous vehicles are also covered in the essay. It mentions that deep learning visual classification methods have achieved enormous accuracy in classifying visual scenes; it makes use of the convolutional neural network. However, it points out that the visual classifiers face difficulties examining the scenes in dark visible areas, especially during the nighttime, and in identifying the contexts of the scenes.*

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## **1. INTRODUCTION**

Modern civilization now considers traffic monitoring to be essential, and using cameras and computers to accomplish this aim is becoming more and more common. However, in the modern era of advanced technology, manual video analysis is not only time-consuming but also impractical (Khalifa, et al., 2014). In order to create intelligent traffic monitoring and management systems that conserve resources and need the least amount of human interaction, computer-based image processing technology has been created (Mohamed, & Mesbah, 2016). These systems can provide sophisticated and workable monitoring programmes by analysing video pictures, detecting and identifying vehicles, and taking necessary action in the event of unexpected circumstances (Sadek, et al., 2021).

The supervisory department now uses computer connection monitoring methods to accomplish the aim of intelligent traffic monitoring and management (Abbassy, et al., 2020). These systems analyse video from cameras, identify cars, and do standard management activities automatically using computer and image processing technologies. They can also spot anomalous circumstances and respond to them in the best, most secure way possible (Derindere Köseoğlu, et al., 2022). This approach is appealing to academic and corporate circles throughout the world since it saves a sizable amount of labour and material resources. The vehicle that uses vision. The main approaches for object detection include classic machine vision techniques and sophisticated deep learning techniques (Ead & Abbassy, 2018). The former, which may be categorised into three different approaches the technique of backdrop subtraction, the method of continuous video frame difference, and the method of optical flow uses a vehicle's motion to distinguish it from a stationary background picture (Jain, et al., 2022). The moving foreground region is divided by the threshold using the video frame difference approach, which computes the variance based on the pixel values of two or three successive video frames (Arslan, et al., 2021). This technique may also detect the car halting by muzzling sounds (Bhoumik, et al., 2020).

When the video's background image is fixed, background data is used to create a background model, which is then compared to each frame's image to identify moving objects (Gao, et al., 2018). Through the generated optical flow field, the optical flow method can identify the motion region in the video and represent the direction and speed of each moving pixel (Mahesha, et al., 2022). Another way for detecting automobiles is by the use of vehicle characteristics in machine vision, with the widely used Scale Invariant Feature Transform (SIFT) and Speeded Up Robust characteristics (SURF) approaches (Benloucif, et al., 2019). In order to fulfil vehicle recognition and classification tasks, 3D models have also been used (Ogunmola, et al., 2021). Vehicles may be categorised using the correlation curves of 3D ridges on their exterior. In today's culture, keeping an eye on traffic situations has become essential, and using cameras and computers to do so is growing in popularity. Intelligent traffic monitoring and management systems can now analyse video data, recognise and identify cars, and take necessary action in case of abnormal situations, all without the need for human interaction to advancements in computer-based image processing technology (Zannah, et al., 2023). Along with vehicle features like SIFT and SURF, machine vision techniques like background subtraction, continuous video frame difference, and optical flow are frequently used to detect vehicles. Using 3D models can also help with vehicle identification and categorization (Sharma, et al., 2021). These technology developments in traffic monitoring and management have significant academic and economic value, making them desirable choices (Joseph, 2019). Without making a conscious effort, the Human Vision System (HVS) excels in differentiating between various objects (Cirillo, et al., 2023). Recent advances in computer vision (CV) and machine learning (ML) have made it possible for computers to accurately detect, identify, and categorise objects in

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