

Research on deep learning and its application in recognizing moving vehicles on a road segment

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Abstract: This study investigates the application of deep learning techniques for the real-time identification and classification of moving vehicles on a roadway segment. Leveraging convolutional neural networks (CNNs), the research develops a robust model capable of detecting various vehicle types, including cars, buses, trucks, and motorcycles, under diverse environmental conditions such as varying lighting and weather. A custom dataset was constructed from traffic surveillance footage, annotated for supervised learning. The proposed architecture, based on a modified YOLO framework, was optimized for both accuracy and computational efficiency to enable deployment on edge devices. Experimental results demonstrate a mean average precision (mAP) exceeding 92%, with a detection speed suitable for real-time traffic monitoring. The findings highlight the model's effectiveness in handling occlusions and high-density traffic flows. This work contributes to intelligent transportation systems by providing a scalable solution for traffic flow analysis, congestion management, and automated surveillance, offering significant potential for smart city infrastructure development.

Keywords: deep learning, vehicle recognition, traffic monitoring, road detection