Classification of Vehicle Classes at Toll Gates Using YOLOv9 and Resnet50

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Abstract
Indonesia's current toll road payment system uses Automatic Vehicle Classification (AVC) technology, which relies on various sensors such as induction sensors, LiDAR, and radar. This approach incurs high operational costs. For this reason, more efficiency is required. Toll roads are vital infrastructure supporting vehicle mobility in Indonesia, and operational efficiency directly impacts overall performance. The existing AVC technology entails high costs and often faces technical challenges, necessitating a solution that enhances efficiency in terms of operational costs, accuracy, and system maintenance. This research combines the You Only Look Once (YOLO) method for detecting vehicle axles, represented by tires, and Residual Network (ResNet) for classifying vehicle categories based on YOLO's detection results. The dataset comprises 1,196 vehicle images across five distinct classes. The proposed system aims to improve accuracy, cost, and system maintenance efficiency. The findings indicate that the system achieves a classification accuracy of 97%, providing a practical solution that contributes to the advancement of toll gate vehicle classification technology with lower operational costs and higher accuracy.

Keywords: toll gate, YOLO, ResNet, classification, object detection.