ABSTRACT

Wearing a helmet is a crucial aspect of traffic safety, particularly in dense environments such as the Telkom University campus. However, manual monitoring of helmet violations is often ineffective due to limited human resources. This research aims to develop an automated helmet violation detection system using computer vision and artificial intelligence. The system implements the YOLOv11 algorithm, known for its speed and accuracy in detecting small objects. The dataset consists of 4,720 pre-annotated images classified into four object categories: helmet, no-helmet, driver, and bicyclist. Model training was conducted using Roboflow's platform with the "fast" training mode over 300 epochs. The resulting model achieved strong performance, with a mean Average Precision (mAP) of 94.1%, precision of 91.6%, and recall of 86.8%. For inference, the trained model was accessed via Roboflow's API and integrated with OpenCV to test the system using real-world images from the campus environment. The system demonstrated accurate and efficient detection capabilities in identifying riders not wearing helmets. This solution is expected to support campus security efforts in monitoring traffic safety and has the potential for further development in real-time applications across public areas.

Keywords: helmet detection, YOLOv11, Roboflow, OpenCV, traffic violation, artificial intelligence.