

ABSTRACT

Access security at the Data Center of Telkom University is a top priority; however, the existing conventional Closed-Circuit Television (CCTV) system remains limited in its ability to automatically identify and classify individuals. This study aims to develop a real-time object detection and classification model based on You Only Look Once version 8 (YOLOv8) to enhance access monitoring effectiveness. The custom YOLOv8 model was trained using a dedicated dataset consisting of 350 images with a total of 605 annotated objects, categorized into two person-based labels: students and lecturers/staff. To improve accuracy and generalization, Hyperparameter Optimization (HPO) was applied using the Tree-structured Parzen Estimator (TPE) algorithm through the Optuna framework. The proposed system integrates two synergistic models: a custom-trained YOLOv8 model for person classification and a pretrained YOLOv8 COCO-based model for detecting general objects such as vehicles. The system is implemented on an edge device—Raspberry Pi 5—using a webcam as the real-time input source. Experimental results show that the HPO-optimized model achieved optimal performance, with a precision of 0.902, recall of 0.889, mAP@50 of 0.949, and mAP@50–95 of 0.676, indicating significant improvements in detection accuracy and localization quality. Detection data are automatically transmitted to the Intelligent Monitoring Platform (IMRON) for real-time visualization of object counts and related statistics. Accordingly, this system improves the efficiency of access monitoring and supports compliance with information security standards such as ISO/IEC 20000 and ISO/IEC 27001.

Keywords: YOLOv8, Hyperparameter Optimization, Optuna, Real-time Detection, Access Security, Raspberry Pi.