

ABSTRACT

Communication for Deaf individuals faces challenges due to the limited public understanding of Bahasa Isyarat Indonesia (BISINDO). The development of a BISINDO alphabet detection using deep learning offers a solution. This study aims to analyze the performance and efficiency of the YOLOv8 model in detecting 26 BISINDO alphabet classes through hyperparameter tuning using the grid search method to obtain the optimal model configuration. The dataset used in this study consists of 11,468 BISINDO images obtained from Kaggle. The research was conducted in three experimental stages, selecting the best model from three YOLOv8 variants (YOLOv8n, YOLOv8s, and YOLOv8m) performing hyperparameter tuning using grid search by testing 12 combinations of learning rate, batch size, and optimizer, and conducting three repeated training runs using the best configuration to evaluate model stability. The evaluation was carried out using precision, recall, mAP50, mAP50-95, number of parameters, FLOPs, and inference time. The results show that YOLOv8m achieved the highest mAP50-95 of 94.48%, followed by YOLOv8n with 94.11% and YOLOv8s with 91.71%, with no significant performance difference between the variants. Considering computational efficiency, YOLOv8n was selected as the best model because it has the lowest number of parameters and complexity (3.01 million parameters, 8.1 GFLOPs) and the fastest inference time of 5.31 ms, with only a 0.37% mAP50-95 difference compared to YOLOv8m. The best hyperparameter combination obtained was a learning rate of 0.01, batch size of 32, and SGD optimizer. The YOLOv8n model with hyperparameter tuning achieved an average mAP50-95 of 92.77% with a standard deviation of 0.03%, indicating consistent performance across training runs.

Keywords : BISINDO, grid search, hyperparameter tuning, object detection, YOLOv8