IMPROVING THE ACCURACY OF DEEP LEARNING-BASED OBJECT DETECTORS ON RASPBERRY PI

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SUMMARY

HASIBULLAH ATIQI. Improving the Accuracy of Deep Learning-Based Object Detectors on Raspberry Pi. Supervised by SRI WAHJUNI and MUSHTHOFA

This study focuses on the implementation and performance evaluation of the YOLOv8 object detection algorithm on a resource-limited device, Raspberry Pi 5, to detect abnormalities in melon leaves. A secondary dataset containing images of melon leaves captured using a Raspberry Pi camera was utilized in two forms: original and augmented. The model was trained and evaluated using key performance metrics such as mean Average Precision (mAP), precision, recall, and F1 score. Two backbone architectures, Original and GhostNet, were compared to assess both detection accuracy and computational efficiency. The results revealed that data augmentation significantly improved detection performance, with mAP@0.5 for the Original Backbone increasing from 0.52 to 0.80, and for GhostNet from 0.49 to 0.78. After hyperparameter tuning, the best results achieved were mAP\@0.5 of 0.81 for the Original Backbone and 0.80 for GhostNet. Although the Original Backbone attained slightly higher accuracy, the GhostNet model demonstrated superior computational efficiency with faster inference speed (3.97 FPS vs. 2.75 FPS), lower latency, and smaller model size (9.23 MB vs. 20 MB). Based on these findings, the GhostNet backbone with augmented data and optimized hyperparameters provides the best trade-off between accuracy and efficiency, making it the most suitable option for real-time deployment on low-powered devices such as Raspberry Pi 5, and offering a promising solution for field-based monitoring of melon leaf abnormalities in resource-constrained agricultural environments.

Keywords: Deep learning, YOLOv8, GhostNet. Melon leaf, Raspberry Pi.

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FORWORD

Praise and gratitude are expressed to Almighty Allah SWT for His blessings and mercy, allowing the author to complete this thesis entitled *"Improving the Accuracy of Deep Learning-Based Object Detectors on Raspberry Pi."* This thesis is prepared as a requirement for obtaining a Master's degree in the Information Technology program. This research focuses on the development and optimization of deep learning-based detection models implemented on Raspberry Pi to identify abnormalities in melon leaves. Through this approach, it is expected to provide an efficient and real-time solution for farmers to monitor plant health directly in the field.

The author realizes that the completion of this thesis would not have been possible without the support and assistance of many parties. Therefore, the author would like to express the deepest gratitude to the supervisors, family, and colleagues who have provided support, suggestions, and motivation throughout the research and writing process. The author hopes that the results of this research can contribute positively to technology-based agriculture and serve as a reference for future studies.

Hopefully this scientific paper will be useful for those in need and for the advancement of science.

Bogor, August 2025

Hasibullah Atiqi

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