Studi Komparasi Varian Yolo11 dan Rekayasa Augmentasi Dataset Untuk Deteksi Multi-Fase Generatif
Tanaman Melon (Cucumis Melo L.)
Agatha Kristi Septiani Setyaningwidhi, Dr. Agung Putra P., S.T.P., M.Agr. ; Dr. Muhammad Prasetya Kurniawan, S.T.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

STUDI KOMPARASI VARIAN YOLO11 DAN REKAYASA AUGMENTASI DATASET UNTUK DETEKSI MULTI-FASE GENERATIF TANAMAN MELON (Cucumis melo L.)

INTISARI

Monitoring fase generatif tanaman melon (*Cucumis melo L.*) di *greenhouse* penting dilakukan karena berkaitan dengan penentuan perlakuan budidaya pada setiap tahap pertumbuhan. Pada praktiknya, proses monitoring masih dilakukan secara manual melalui pengamatan visual sehingga berpotensi menimbulkan subjektivitas dan keterlambatan dalam pengambilan keputusan. Alternatif solusi yang dapat diterapkan adalah penggunaan teknologi computer vision dengan metode deep learning untuk mendeteksi fase generatif tanaman secara otomatis. Penelitian ini bertujuan untuk m%, dan FPS sebesar 241,1. Pengujian video menghasilkan *precision* sebesar 93,3%, *recall* sebesar 87,5%, F1-score sebesar 90,3%, rata-rata FPS sebesar 96,7, dan rata-rata inference time sebesar 10,7 ms/frame. Berdasarkan hasil tersebut, model YOLO11s dengan konfigurasi terpilih mampu mendeteksi fase generatif melon pada citra maupun video, serta berpotensi mendukung simulasi monitoring berbasis video di *greenhouse*.enganalisis kinerja berbagai varian arsitektur YOLO11, menentukan konfigurasi hyperparameter terbaik, serta implementasi model terpilih pada data video untuk mensimulasikan proses monitoring fase generatif melon di *greenhouse*. Objek yang dideteksi terdiri atas enam kelas, yaitu flower bud, blooming, fruit set, fruit non-netting, fruit netting, dan harvest. Dataset diperoleh dari *greenhouse* PT Mitra Sejahtera Membangun Bangsa (MSMB), kemudian melalui proses anotasi, pembagian dataset, pelatihan model, optimasi hyperparameter, pengujian pada *test* set, dan pengujian video. Hasil penelitian menunjukkan bahwa YOLO11s pada Dataset 2 menjadi model dasar terpilih. Konfigurasi akhir model diperoleh pada batch size 16, epoch 125, dan learning rate 0,005. Pengujian pada *test* set menghasilkan mAP50 sebesar 81,0%, mAP50-95 sebesar 56,7%, *precision* sebesar 85,7%, *recall* sebesar 75,9%, F1-score sebesar 80,5.

Kata kunci: deep learning, deteksi objek, fase generatif melon, *greenhouse*, YOLO11

Studi Komparasi Varian Yolo11 dan Rekayasa Augmentasi Dataset Untuk Deteksi Multi-Fase Generatif
Tanaman Melon (Cucumis Melo L.)
Agatha Kristi Septiani Setyaningwidhi, Dr. Agung Putra P., S.T.P., M.Agr. ; Dr. Muhammad Prasetya Kurniawan, S.T.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

A COMPARATIVE STUDY OF YOLO11 VARIANTS AND DATASET AUGMENTATION TECHNIQUES FOR MULTI-PHASE GENERATIVE DETECTION OF MELON PLANTS (*Cucumis Melo* L.)

ABSTRACT

Monitoring the generative phases of melon (Cucumis melo L.) in a *greenhouse* is important because it is related to determining appropriate cultivation treatments at each growth stage. In practice, monitoring is still carried out manually through visual observation, which may lead to subjectivity and delays in decision-making. An alternative solution is the application of computer vision technology using deep learning methods to automatically detect plant generative phases. This study aimed to analyze the performance of several YOLO11 architecture variants, determine the best hyperparameter configuration, and implement the selected model on video data as a simulation of melon generative phase monitoring in a *greenhouse*. The detected objects consisted of six classes, namely flower bud, blooming, fruit set, fruit non-netting, fruit netting, and harvest. The dataset was obtained from the *greenhouse* of PT Mitra Sejahtera Membangun Bangsa (MSMB) and processed through annotation, dataset splitting, model *training*, hyperparameter optimization, *test* set evaluation, and video *testing*. The results showed that YOLO11s on Dataset 2 was selected as the base model. The final model configuration was obtained with a batch size of 16, 125 epochs, and a learning rate of 0.005. The *test* set evaluation produced an mAP50 of 81.0%, mAP50-95 of 56.7%, *precision* of 85.7%, *recall* of 75.9%, F1-score of 80.5%, and FPS of 241.1. The video *testing* produced a *precision* of 93.3%, *recall* of 87.5%, F1-score of 90.3%, average FPS of 96.7, and average inference time of 10.7 ms/frame. Based on these results, the YOLO11s model with the selected configuration was able to detect melon generative phases in both images and videos and has the potential to support video-based monitoring simulation in *greenhouse* environments.

Keywords: deep learning, object detection, melon generative phase, *greenhouse*, YOLO11