

ABSTRAK

Penentuan waktu panen jamur tiram (*Pleurotus sp*) secara manual masih bergantung pada pengamatan visual petani yang bersifat subjektif, tidak konsisten, dan kurang efisien untuk skala produksi besar. Penelitian ini bertujuan menganalisis dan membandingkan performa dua algoritma *deep learning*, yaitu Convolutional Neural Network (CNN) dengan arsitektur ResNet50 dan YOLOv11, dalam mendeteksi tingkat kematangan dan kelayakan panen jamur tiram ke dalam dua kelas: “layak panen” dan “belum layak panen”. Dataset terdiri dari 1.200 citra yang dikumpulkan langsung di Kulat Aceh Farm (600 citra per kelas) dengan variasi sudut, jarak, dan kondisi pencahayaan. Seluruh citra melalui tahap *preprocessing* berupa *auto-orientation* dan *resize* ke resolusi 640×640 piksel, kemudian dibagi menjadi data latih (70%), validasi (20%), dan uji (10%), dengan augmentasi diterapkan hanya pada data latih. Evaluasi perbandingan dilakukan menggunakan 30 citra baru yang sepenuhnya terpisah dari proses pelatihan untuk mengukur kemampuan generalisasi pada kondisi nyata, dengan metrik *accuracy*, *precision*, *recall*, *F1-Score*, dan waktu pelatihan. Hasilnya, YOLOv11s mengungguli CNN ResNet50 dengan memperoleh nilai *accuracy*, *precision*, *recall*, dan *F1-Score* yang seimbang sebesar 93%, sementara CNN ResNet50 memperoleh *accuracy* 90%, *precision* 100%, *recall* 83,3%, dan *F1-Score* 90,9%. Dari sisi efisiensi, CNN ResNet50 memiliki waktu pelatihan lebih singkat (71,9 menit) dibandingkan YOLOv11s (89,3 menit), namun nilai *recall* yang rendah mengindikasikan masih adanya objek yang gagal terdeteksi. Secara keseluruhan, YOLOv11s terbukti lebih optimal dan andal untuk sistem pendeteksian kematangan dan kelayakan panen jamur tiram, dengan keseimbangan performa yang lebih baik di seluruh metrik evaluasi serta berpotensi diintegrasikan ke dalam sistem *smart farming* berbasis *IoT* untuk otomasi panen jamur tiram.

Kata Kunci: Analisis Perbandingan, CNN, YOLOv11, Jamur Tiram, Kelayakan Panen.

ABSTRACT

*The manual determination of the optimal harvest time for oyster mushrooms (*Pleurotus sp.*) still relies on farmers' subjective visual observations, which can be inconsistent and inefficient for large-scale production. This study aims to analyze and compare the performance of two deep learning algorithms, namely a Convolutional Neural Network (CNN) with the ResNet50 architecture and YOLOv11, in detecting the maturity level and harvest readiness of oyster mushrooms into two classes: "harvest-ready" and "not harvest-ready." The dataset consisted of 1,200 images collected directly at Kulat Aceh Farm, with 600 images for each class, and included variations in camera angles, object-to-camera distances, and lighting conditions. All images underwent preprocessing, including auto-orientation and resizing to a resolution of 640×640 pixels, and were subsequently divided into training (70%), validation (20%), and testing (10%) sets, with augmentation applied exclusively to the training set. Comparative evaluation was conducted using 30 newly acquired images that were completely separated from the training process to measure the models' generalization capabilities under real-world conditions, using accuracy, precision, recall, F1-score, and training time as evaluation metrics. The results showed that YOLOv11s outperformed CNN ResNet50 by achieving balanced values of 93% for accuracy, precision, recall, and F1-score, while CNN ResNet50 achieved an accuracy of 90%, precision of 100%, recall of 83.3%, and F1-score of 90.9%. In terms of efficiency, CNN ResNet50 required a shorter training time of 71.9 minutes compared to 89.3 minutes for YOLOv11s. However, its lower recall indicates that some objects were still incorrectly missed during detection. Overall, YOLOv11s demonstrated better overall performance and reliability for oyster mushroom maturity and harvest readiness detection, with a more balanced performance across the evaluation metrics. Furthermore, the model has the potential to be integrated into an IoT-based smart farming system to support the automation of oyster mushroom harvesting.*

Keywords: Comparative Analysis, CNN, YOLOv11, Oyster Mushroom, Harvest Readiness