ABSTRAK

Penyakit bercak daun merupakan salah satu jenis penyakit tanaman yang dapat menurunkan kualitas dan produktivitas apabila tidak ditangani dengan tepat. Proses identifikasi penyakit di lapangan umumnya masih dilakukan secara manual melalui pengamatan visual yang bersifat subjektif dan membutuhkan waktu relatif lama. Penelitian sebelumnya banyak menggunakan metode klasifikasi berbasis *Convolutional Neural Network* (CNN) yang hanya menghasilkan label tanpa mampu menunjukkan lokasi area penyakit secara spesifik. Selain itu, sebagian besar penelitian belum mampu membedakan objek daun target dan non-target secara otomatis. Oleh karena itu, penelitian ini mengimplementasikan model *You Only Look Once version* 8 berbasis segmentasi (YOLOv8-seg) untuk mendeteksi, melakukan segmentasi area penyakit bercak daun, serta mengidentifikasi daun kelapa sawit dan daun non-sawit.

Metodologi penelitian meliputi pengumpulan dataset primer berupa citra daun tanaman yang difokuskan pada daun kelapa sawit, proses anotasi berbasis *polygon*, penyeragaman ukuran citra, serta augmentasi data untuk meningkatkan variasi pelatihan. Model dilatih menggunakan pendekatan *transfer learning* dengan penyesuaian *hyperparameter* untuk mengoptimalkan proses pembelajaran. Evaluasi performa model dilakukan menggunakan metrik *Precision*, *Recall*, *Confusion Matrix*, serta *Mean Average Precision* (mAP) untuk mengukur kemampuan model dalam melakukan segmentasi dan klasifikasi objek secara akurat.

Hasil segmentasi berupa mask objek digunakan untuk menghitung luas area bercak dan luas total daun berdasarkan jumlah piksel. Perbandingan kedua nilai tersebut menghasilkan persentase tingkat keparahan penyakit secara otomatis. Sistem juga mampu menolak objek daun non-sawit sehingga proses analisis tingkat keparahan hanya dilakukan pada daun kelapa sawit sebagai objek target penelitian. Dengan demikian, penelitian ini tidak hanya mampu mendeteksi keberadaan penyakit, tetapi juga memberikan analisis kuantitatif terhadap tingkat keparahan penyakit secara lebih objektif. Penelitian ini diharapkan dapat memberikan kontribusi dalam penerapan teknologi deep learning untuk deteksi dini penyakit bercak daun serta mendukung pengambilan keputusan dalam pengelolaan tanaman kelapa sawit.

Kata Kunci: Penyakit bercak daun, YOLOv8-seg, *Instance segmentation*, Deteksi penyakit tanaman, Tingkat Keparahan

ABSTRACT

Leaf spot disease is one of the plant diseases that can reduce crop quality and productivity if not properly managed. In practice, disease identification is still commonly performed manually through visual observation, which is subjective and time-consuming. Previous studies mostly utilized classification-based methods such as Convolutional Neural Networks (CNN), which only provide class labels without indicating the specific location of the disease area. In addition, most previous studies were unable to automatically distinguish target and non-target leaf objects. Therefore, this study implements the You Only Look Once version 8 segmentation model (YOLOv8-seg) to detect, segment leaf spot disease areas, and identify oil palm leaves and non-oil palm leaves.

The methodology includes primary dataset collection in the form of plant leaf images focused on oil palm leaves, polygon-based annotation, image resizing, and data augmentation to increase training variability. The model is trained using a transfer learning approach with hyperparameter tuning to optimize the learning process. Model performance is evaluated using Precision, Recall, Confusion Matrix, and Mean Average Precision (mAP) metrics to assess the model capability in performing object segmentation and classification accurately.

The segmentation results are represented as object masks, which are then used to calculate the area of leaf spots and the total leaf area based on pixel values. The ratio between these areas is used to determine the severity level of the disease automatically. The system is also capable of rejecting non-oil palm leaf objects, ensuring that the severity analysis is only performed on oil palm leaves as the target objects of the study. Thus, this study not only detects the presence of disease but also provides a more objective quantitative analysis of disease severity. This research is expected to contribute to the application of deep learning technology for early detection of leaf spot disease and support decision-making processes in oil palm plant management.

Keywords: *Leaf spot disease, YOLOv8-seg, Instance segmentation, Plant disease detection, Severity*