ABSTRAK

Penelitian ini berada pada bidang *Computer Vision*, khususnya *Small Object Detection* (SOD). Pada industri farmasi, inspeksi kerusakan morfologi obat masih banyak dilakukan secara manual sehingga rentan terhadap *human error*, terutama pada kondisi *small object detection* dengan karakteristik *fine-grained*. Penelitian ini bertujuan menganalisis kinerja model *You Only Look Once* versi 12 (YOLOv12) dalam mendeteksi, menghitung jumlah objek (*counting*), dan mengklasifikasikan kerusakan morfologi obat. Penelitian mengadaptasi kerangka kerja CRISP-DM dengan memanfaatkan dataset hasil integrasi tiga dataset publik Roboflow dan dataset primer. Evaluasi dilakukan menggunakan dua skenario pembagian dataset, yaitu 80:10:10 dan 70:15:15, dengan metrik *Precision*, *Recall*, mAP@50, dan *F1-Score*. Hasil penelitian menunjukkan bahwa skenario 80:10:10 memberikan performa terbaik dengan *Precision* 75,31%, *Recall* 83,45%, mAP@50 sebesar 84,13%, dan *F1-Score* sebesar 79,17%. Secara keseluruhan, YOLOv12 mampu mendeteksi, menghitung jumlah objek, dan mengklasifikasikan objek obat berukuran kecil dengan karakteristik *fine-grained* pada kondisi *real-world*.

Kata Kunci: *Computer Vision*; *Small Object Detection*; *Fine-Grained Object Detection*; YOLOv12; *Object Detection*; Kerusakan Morfologi Obat; *Real-World Scenario*.

ABSTRACT

This research is conducted in the field of Computer Vision, particularly Small Object Detection (SOD). In the pharmaceutical industry, the inspection of drug morphological defects is still predominantly performed manually, making it prone to human error, especially when dealing with small objects with fine-grained characteristics in real-world conditions. This study aims to analyze the performance of the You Only Look Once version 12 (YOLOv12) model in detecting, counting, and classifying drug morphological defects. The research adopts the CRISP-DM framework and utilizes a dataset integrated from three public Roboflow datasets and a primary dataset collected by the researcher. The model was evaluated using two dataset splitting scenarios (80:10:10 and 70:15:15) based on Precision, Recall, mAP@50, and F1-Score metrics. The results show that the 80:10:10 splitting scenario achieved the best performance, with a Precision of 75.31%, Recall of 83.45%, mAP@50 of 84.13%, and an F1-Score of 79.17%, while the 70:15:15 scenario yielded relatively similar performance. Overall, YOLOv12 demonstrated good performance in detecting, counting, and classifying small pharmaceutical objects with fine-grained characteristics under real-world conditions.

Keywords: *Computer Vision; Small Object Detection; Fine-Grained Object Detection; YOLOv12; Object Detection; Drug Morphological Defects; Real-World Scenario.*