ABSTRAK

TIARA DEVINA PUTRI. Analisis Perbandingan Faster R-CNN dan YOLOv8 dengan Optimasi *Efficient Multi-Scale Attention* (EMA) untuk Deteksi Cacat pada Komponen *Radial Leaded Inductor*. Dibimbing oleh NOLA RITHA dan NOVRIZAL FATTAH FAHMITRA.

Industri manufaktur komponen elektronika dituntut menerapkan standar *Zero Defect* untuk menjamin kualitas produk, termasuk pada komponen *Radial Leaded Inductor* yang rentan mengalami *defect* seperti *chip core* dan *crack core*. Proses inspeksi manual yang masih digunakan memiliki keterbatasan dalam hal kecepatan, konsistensi, dan risiko *human error*, sehingga diperlukan sistem inspeksi visual berbasis *computer vision*. Penelitian ini bertujuan untuk menganalisis dan membandingkan performa deteksi cacat menggunakan metode Faster R-CNN, YOLOv8 *baseline*, dan YOLOv8 yang diintegrasikan dengan modul *Efficient Multi-Scale Attention* (EMA). Metode penelitian meliputi pelatihan *model deep learning* dan evaluasi pada data uji menggunakan metrik *precision*, *recall*, mAP50, mAP50-95, F1-score, serta waktu inferensi. Hasil penelitian menunjukkan bahwa Faster R-CNN menghasilkan performa deteksi terbaik dengan nilai mAP50-95 sebesar 0,827, namun memiliki waktu inferensi sebesar 63,3ms. YOLOv8s memiliki waktu inferensi tercepat sebesar 8ms, tetapi menghasilkan performa deteksi yang lebih rendah. Sementara itu, YOLOv8l-EMA memberikan keseimbangan terbaik antara akurasi dan kecepatan dengan nilai mAP50-95 sebesar 0,778 dan waktu inferensi sebesar 16,5ms. Berdasarkan hasil tersebut, YOLOv8l-EMA dipilih sebagai model yang paling optimal karena mampu memberikan performa deteksi yang tinggi dengan waktu inferensi yang tetap memenuhi kebutuhan inspeksi visual semi otomatis secara *real-time.*

Kata kunci: *Computer Vision*, *Deep Learning*, *Efficient Multi-Scale Attention*, Faster R-CNN, *Radial Leaded Inductor*, YOLOv8

ABSTRACT

TIARA DEVINA PUTRI. Comparative Analysis of Faster R-CNN and YOLOv8 with Efficient Multi-Scale Attention (EMA) Optimization for Defect Detection in Radial Leaded Inductor Components. Supervised by NOLA RITHA and NOVRIZAL FATTAH FAHMITRA

The electronics component manufacturing industry is required to implement Zero Defect standards to ensure product quality, including Radial Leaded Inductor components, which are susceptible to defects such as chip core and crack core. Manual inspection processes still commonly used in industry have limitations in terms of speed, consistency, and susceptibility to human error. Therefore, a computer vision-based visual inspection system is needed. This study aims to analyze and compare the defect detection performance of Faster R-CNN, baseline YOLOv8, and YOLOv8 integrated with the Efficient Multi-Scale Attention (EMA) module. The research methodology includes deep learning model training and evaluation on a test dataset using precision, recall, mAP50, mAP50-95, F1-score, and inference time metrics. The results show that Faster R-CNN achieves the best detection performance with an mAP50-95 of 0.827 but requires an inference time of 63.3ms. YOLOv8s provides the fastest inference time of 8ms however, its detection performance is lower. Meanwhile, YOLOv8l-EMA offers the best balance between accuracy and speed, achieving an mAP50-95 of 0.778 with an inference time of 16.5ms. Based on these results, YOLOv8l-EMA was selected as the most optimal model because it delivers high detection performance while maintaining an inference time that meets the requirements of a real-time semi-automatic visual inspection system.

Keywords: Computer Vision, Deep Learning, Efficient Multi-Scale Attention, Faster R-CNN, Radial Leaded Inductor, YOLOv8