

ABSTRAK

MEILANI AUDI KUSTANTI. Analisis Perbandingan *Preprocessing* (*Blur*, *Thresholding*, CLAHE) dalam Meningkatkan Akurasi OCR pada Sistem Inspeksi Berbasis Raspberry Pi. Dibimbing oleh MUHAMAD RADZI RATHOMI dan NOVRIZAL FATTAH FAHMITRA.

Proses inspeksi *product code label* pada industri manufaktur masih banyak dilakukan secara manual sehingga berpotensi menimbulkan kesalahan pembacaan dan menurunkan efisiensi proses produksi. Salah satu solusi yang dapat diterapkan adalah sistem inspeksi visual berbasis *Optical Character Recognition* (OCR). Namun, kualitas citra yang dipengaruhi oleh pencahayaan dan *noise* dapat menurunkan performa OCR sehingga diperlukan tahapan *preprocessing*. Penelitian ini bertujuan menganalisis perbandingan metode *preprocessing* *Blur*, *Thresholding*, dan *Contrast Limited Adaptive Histogram Equalization* (CLAHE) dalam meningkatkan performa OCR pada sistem inspeksi visual berbasis Raspberry Pi 4 Model B. Penelitian menggunakan 100 citra *product code label* yang diproses melalui tahapan *Region of Interest* (ROI), *preprocessing*, dan OCR menggunakan Tesseract OCR engine berbasis *Long Short-Term Memory* (LSTM). Sistem dievaluasi menggunakan parameter *Character Error Rate* (CER), *Character Accuracy*, dan *Processing Time*.

Hasil penelitian menunjukkan bahwa metode *Thresholding* memberikan hasil optimal dengan nilai CER sebesar 30,33%, *Character Accuracy* sebesar 69,67%, dan *Processing Time* sebesar 0,528 detik. Metode *Blur* memperoleh CER sebesar 40,60%, *Character Accuracy* sebesar 60,00%, dan *Processing Time* sebesar 0,646 detik, sedangkan CLAHE menghasilkan performa terendah dengan CER sebesar 96,33%, *Character Accuracy* sebesar 4,00%, dan *Processing Time* sebesar 1,256 detik. Selain itu, sistem mampu mempercepat waktu inspeksi 100 produk dari 15 menit menjadi 9 menit. Berdasarkan hasil tersebut, metode *Thresholding* merupakan *preprocessing* yang paling optimal untuk meningkatkan performa OCR pada sistem inspeksi visual berbasis Raspberry Pi 4 Model B.

Kata kunci: *Optical Character Recognition* (OCR), *Preprocessing*, *Thresholding*, Raspberry Pi 4 Model B, *Product Code Label*.

ABSTRACT

MEILANI AUDI KUSTANTI. Comparative Analysis of Preprocessing Methods (Blur, Thresholding, and CLAHE) for Improving OCR Accuracy in a Raspberry Pi-Based Inspection System. Supervised by MUHAMAD RADZI RATHOMI and NOVRIZAL FATTAH FAHMITRA.

The inspection process of product code labels in the manufacturing industry is still largely performed manually, which may lead to reading errors and reduced production efficiency. One solution to this problem is the implementation of a visual inspection system based on *Optical Character Recognition* (OCR). However, image quality affected by lighting conditions and noise can degrade OCR performance, making image preprocessing an essential step. This study aims to compare the performance of Blur, Thresholding, and *Contrast Limited Adaptive Histogram Equalization* (CLAHE) preprocessing methods in improving OCR performance on a visual inspection system using a Raspberry Pi 4 Model B. The study employed 100 images of product code labels, which were processed through *Region of Interest* (ROI) extraction, image preprocessing, and OCR using the Tesseract OCR engine based on *Long Short-Term Memory* (LSTM). The system was evaluated using three performance metrics: *Character Error Rate* (CER), *Character Accuracy*, and *Processing Time*.

The results indicate that the Thresholding method achieved the best performance, with a CER of 30.33%, a Character Accuracy of 69.67%, and a Processing Time of 0.528 seconds. The Blur method obtained a CER of 40.60%, a Character Accuracy of 60.00%, and a Processing Time of 0.646 seconds, while the CLAHE method produced the lowest performance, with a CER of 96.33%, a Character Accuracy of 4.00%, and a Processing Time of 1.256 seconds. In addition, the developed system reduced the inspection time for 100 products from 15 minutes to 9 minutes. Based on these findings, the Thresholding method is the most effective preprocessing technique for improving OCR performance in a Raspberry Pi 4 Model B-based visual inspection system.

Keywords: Optical Character Recognition (OCR), Preprocessing, Thresholding, Raspberry Pi 4 Model B, Product Code Label.