ABSTRAK

Kerusakan jalan di Indonesia masih banyak ditangani secara manual, yang menyebabkan proses pendeteksian dan pengukuran menjadi tidak efisien. Penelitian ini bertujuan untuk menerapkan metode deteksi tepi Sobel dalam memperkirakan luas kerusakan lubang jalan berbasis citra digital serta mengevaluasi tingkat akurasinya. Dataset citra lubang jalan dikumpulkan menggunakan kamera ponsel dalam berbagai kondisi pencahayaan dan permukaan.

Citra yang diperoleh diproses melalui tahapan pra-pemrosesan seperti konversi ke grayscale dan penerapan median filter untuk mereduksi noise. Proses segmentasi dilakukan menggunakan metode deteksi tepi Sobel dengan variasi ukuran kernel (3, 5, dan 7), dilanjutkan dengan operasi morfologi seperti erosi dan dilasi. Deteksi kontur diterapkan untuk memperoleh luas area lubang dalam satuan piksel. Evaluasi sistem dilakukan menggunakan Confusion Matrix, dengan membandingkan hasil segmentasi sistem terhadap data groundtruth yang dibuat manual.

Klasifikasi citra dilakukan berdasarkan nilai Intersection over Union (IoU) dengan ambang batas 0,5. Citra dengan nilai IoU $\geq$ 0,5 diklasifikasikan sebagai “lubang”, sedangkan < 0,5 sebagai “bukan lubang”. Hasil pengujian menunjukkan akurasi tertinggi sebesar 79,45% diperoleh pada penggunaan kernel Sobel berukuran 3.

Kata kunci : Citra Digital, Sobel, Morofologi, Pengolahan Citra.

ABSTRACT

Road damage in Indonesia is still largely handled manually, resulting in inefficient detection and measurement processes. This study aims to apply the Sobel edge detection method to estimate the area of pothole damage based on digital images and to evaluate its accuracy. A dataset of pothole images was collected using a smartphone camera under various lighting and surface conditions. The images were preprocessed through grayscale conversion and the application of a median filter to reduce noise.

Segmentation was performed using the Sobel edge detection method with different kernel sizes (3, 5, and 7), followed by morphological operations such as erosion and dilation. Contour detection was then applied to calculate the area of potholes in pixel units. System evaluation was conducted using a Confusion Matrix by comparing the segmentation results with manually created ground truth data.

Image classification was based on the Intersection over Union (IoU) value, using a threshold of 0.5. Images with an IoU ≥ 0.5 were classified as "pothole", while those with an IoU < 0.5 were classified as "non-pothole". The experimental results showed the highest accuracy of 79.45% was achieved using a Sobel kernel size of 3.

Keywords: Digital Image, Sobel, Morphology, Image Processing.