ABSTRAK

Citra dermoskopi untuk diagnosis lesi kulit sering kali mengandung artefak rambut yang dapat mengaburkan batas lesi dan mengganggu proses segmentasi otomatis berbasis *deep learning*. Penelitian ini menganalisis pengaruh teknik *hair removal* sebagai tahap *preprocessing* terhadap kinerja model U-Net dalam melakukan segmentasi lesi kulit. Dua metode *hair removal* yang diuji adalah Black-Hat Transform (Bot Hat) dan Laplacian *filtering*, yang dibandingkan dengan skenario tanpa *preprocessing* (*Original*). Eksperimen dilakukan menggunakan dataset ISIC 2018 dengan pembagian 2.594 data latih, 101 data validasi, dan 1.001 data pengujian. Total 18 konfigurasi eksperimen dijalankan dengan mengombinasikan tiga skenario *preprocessing*, dua optimizer (AdamW dan Lion), dan tiga variasi *learning rate* (0,01; 0,001; dan 0,0001). Hasil eksperimen menunjukkan bahwa keberadaan rambut memberikan pengaruh negatif yang konsisten terhadap kinerja segmentasi, dengan skenario *Original* menghasilkan performa terendah di seluruh konfigurasi. Kedua teknik *hair removal* terbukti meningkatkan kinerja model pada seluruh metrik evaluasi yang digunakan, yaitu *Intersection over Union* (IoU), *Dice Coefficient*, *Pixel Error*, *Rand Error*, dan *Warping Error*, tanpa menurunkan kualitas segmentasi akibat hilangnya detail tekstur. Konfigurasi terbaik dicapai oleh skenario Laplacian dengan optimizer AdamW dan *learning rate* 0,0001, menghasilkan IoU sebesar 0,7584, *Dice Coefficient* sebesar 0,8579, *Pixel Error* sebesar 0,0766, *Rand Error* sebesar 0,1118, dan *Warping Error* sebesar 0,0140 pada data pengujian.

Kata kunci: segmentasi lesi kulit, dermoskopi, *hair removal*, U-Net, Black-Hat Transform, Laplacian *filtering*, *deep learning*, ISIC 2018

ABSTRACT

Dermoscopic images used in skin lesion diagnosis frequently contain hair artifacts that can obscure lesion boundaries and interfere with automated deep learning-based segmentation. This study analyzes the effect of hair removal preprocessing techniques on the performance of a U-Net model for skin lesion segmentation. Two hair removal methods were evaluated: Black-Hat Transform (Bot Hat) and Laplacian filtering, compared against a baseline scenario without preprocessing (*Original*). Experiments were conducted using the ISIC 2018 dataset, comprising 2,594 training images, 101 validation images, and 1,001 test images. A total of 18 experimental configurations were executed by combining three preprocessing scenarios, two optimizers (AdamW and Lion), and three learning rate values (0.01, 0.001, and 0.0001). Results consistently show that hair artifacts negatively affect segmentation performance, with the *Original* scenario yielding the lowest metrics across all configurations. Both hair removal techniques improved model performance across all evaluation metrics used — namely Intersection over Union (IoU), Dice Coefficient, Pixel Error, Rand Error, and Warping Error — without degrading segmentation quality through texture detail loss. The best configuration was achieved by the Laplacian scenario using the AdamW optimizer with a learning rate of 0.0001, producing an IoU of 0.7584, Dice Coefficient of 0.8579, Pixel Error of 0.0766, Rand Error of 0.1118, and Warping Error of 0.0140 on the test set.

Keywords: skin lesion segmentation, dermoscopy, hair removal, U-Net, Black-Hat Transform, Laplacian filtering, deep learning, ISIC 2018