

ABSTRACT

Inflammatory acne remains one of the most common skin problems, particularly among adolescents and young adults. Manual detection by medical professionals often encounters challenges, especially in individuals with darker skin tones, where lesion identification becomes more difficult due to varying melanin levels and uneven lighting conditions. To address this issue, this study proposes an automated deep learning-based acne detection system designed to be accurate, inclusive, and applicable across diverse skin types. The proposed system consists of two main stages: (1) skin tone classification using a Convolutional Neural Network (CNN) based on the ResNet50 architecture, and (2) inflammatory acne detection using the YOLOv11 object detection algorithm. The ResNet50 model successfully classifies skin tones into three categories white, brown, and black with an accuracy of 93% and a highest F1-score of 0.94. Meanwhile, the YOLOv11 model demonstrates excellent detection performance, achieving a mean Average Precision (mAP@0.5) of 90% and an overall F1-score of 0.84 in detecting three types of inflammatory acne: papule, pustule, and nodule. Both models have been integrated into a Flutter-based mobile application, enabling users to capture or upload facial images and receive automated, real-time analysis. Each prediction is displayed with a bounding box, lesion label, skin tone classification, and a confidence score. The results indicate that the system provides accurate and consistent inflammatory acne detection across various skin tones, making it suitable for self-monitoring, clinical assistance, and supporting the advancement of mobile health technology in dermatology.

Keywords—Inflammatory acne detection, Deep learning, Skin Tone Classification, ResNet50, YOLOv11.