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Light-Dermo: A Lightweight Pretrained Convolution Neural Network for the Diagnosis of Multiclass Skin Lesions

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Abstract: Skin cancer develops due to the unusual growth of skin cells. Early detection is critical for the recognition of multiclass pigmented skin lesions (PSLs). At an early stage, the manual work by ophthalmologists takes time to recognize the PSLs. Therefore, several "computer-aided diagnosis (CAD)" systems are developed by using image processing, machine learning (ML), and deep learning (DL) techniques. Deep-CNN models outperformed traditional ML approaches in extracting complex features from PSLs. In this study, a special transfer learning (TL)-based CNN model is suggested for the diagnosis of seven classes of PSLs. A novel approach (Light-Dermo) is developed that is based on a lightweight CNN model and applies the channelwise attention (CA) mechanism with a focus on computational efficiency. The ShuffleNet architecture is chosen as the backbone, and squeeze-and-excitation (SE) blocks are incorporated as the technique to enhance the original ShuffleNet architecture. Initially, an accessible dataset with 14,000 images of PSLs from seven classes is used to validate the Light-Dermo model. To increase the size of the dataset and control its imbalance, we have applied data augmentation techniques to seven classes of PSLs. By applying this technique, we collected 28,000 images from the HAM10000, ISIS-2019, and ISIC-2020 datasets. The outcomes of the experiments show that the suggested approach outperforms compared techniques in many cases. The most accurately trained model has an accuracy of 99.14%, a specificity of 98.20%, a sensitivity of 97.45%, and an F1-score of 98.1%, with fewer parameters compared to state-of-the-art DL models. The experimental results show that Light-Dermo assists the dermatologist in the better diagnosis of PSLs. The Light-Dermo code is available to the public on GitHub so that researchers can use it and improve it.

Keywords: pigmented skin lesions; deep learning; convolutional neural network; transfer learning; pretrained models; ShuffleNet; depthwise separable CNN

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1. Introduction

Skin cancer is affecting the population and posing a significant financial burden on the global healthcare system. This is despite the fact that preliminary treatment may dramatically increase the cure rate for skin cancer. It is challenging due to the lack of access to dermatologists and the lack of training among other healthcare professionals [1]. The World Health Organization (WHO) anticipates that one individual in every three may suffer from skin cancer. The prevalence of skin cancer has been rising over the past few decades in nations including the USA, Canada, and Australia [2]. Early detection of skin cancer decreases the mortality rate. To identify early skin cancer, dermatologists use computer-aided diagnosis (CAD) systems, which were developed through machine learning (ML) and deep learning (DL) techniques. Recently, there is growing evidence that ML and DL can help dermatologists to make better clinical decisions. Studies have shown that DL algorithms can help doctors figure out the type of skin cancer [3].