

Transformer based Semi-Supervised Learning for Skin Lesion Classification

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Skin cancer is one of the most prevalent cancers worldwide, and early detection is crucial for successful treatment. Deep learning has shown promise in automating skin lesion classification; however, most methods require large volumes of labeled data, which are scarce and costly to obtain in the medical domain. To address this limitation, we propose a Transformer-based Semi-Supervised Learning (SSL) framework for skin lesion classification. Our approach employs the Vision Transformer (ViT) as the backbone model, leveraging its strength in capturing long-range dependencies and global contextual information from dermoscopic images. By integrating SSL, the framework effectively utilizes both labeled and unlabeled data, thereby reducing reliance on extensive manual annotations. We evaluate the proposed method on the publicly available ISIC-2018 dataset. Experimental results show that our SSL framework achieves substantial performance improvements over a fully supervised baseline. Specifically, it achieves an accuracy of 74.3%, balanced accuracy of 62.9%, and F1 score of 62.7, representing relative improvements of 9.3%, 11.7%, and 19.9%, respectively, compared to the baseline (65.0% accuracy, 56.3% balanced accuracy, and 52.3% F1 score). These findings demonstrate that SSL can significantly enhance skin lesion classification when labeled data are limited. The proposed Transformer-based SSL framework offers a promising direction for developing cost-effective, reliable, and scalable tools to support early skin cancer detection and improve clinical decision-making.

Keywords: Semi-supervised learning, Vision Transformers, Skin Lesion Classification