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Short Communication

Acne Severity Grading Utilizing an Attention Mechanism Guided Deep Regression

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INTRODUCTION

Acne vulgaris is a prevalent form of acne that mainly affects adolescents, characterized by the emergence of inflammatory and/or non-inflammatory skin lesions. Precise evaluation and grading of acne severity are crucial for providing accurate treatment to patients. Currently, dermatologists manually examine acne by visually inspecting the patient's skin and counting the number of lesions. However, this process is time-consuming and requires significant effort on the part of dermatologists. In this paper, a novel automated method for acne counting and severity grading from facial images is presented. The proposed approach employs a multi-scale dilated fully convolutional regressor to generate density maps, along with an integrated attention mechanism. The fully convolutional regressor module is based on the UNet architecture, enhanced with dilated convolution filters to effectively gather multi-scale contextual information for generating density maps. Additionally, a prior knowledge-based attention mechanism is incorporated using bounding boxes generated by Faster R-CNN.

DESCRIPTION

This attention mechanism guides the regressor model to focus on the most salient features related to acne lesions, enhancing its robustness in dealing with diverse distributions of acne in sparse and dense regions of the face. The density maps obtained from this process enable accurate acne lesion counting, which, in turn, indicates the severity level of the acne [1]. Experimental results demonstrate that the proposed method outperforms state-of-the-art approaches in terms of regression and classification metrics. By reducing the manual assessment workload, this computer-based diagnosis tool significantly benefits and supports automated acne lesion severity grading. In recent years, remarkable progress has been made in automated acne lesion analysis, covering various tasks such as classification, segmentation, detection, localization, and severity grading [2]. Prior methods used image processing techniques to extract hand-crafted features and employed classifier models or CNNs for automated feature learning. In this work, the focus is specifically on acne severity grading from facial images. Previous methods addressed this issue by extracting hand-engineered features from segmented acne areas and using SVM models to classify acne severity into four levels, following the criteria established by Ramli [3]. However, the proposed method stands out by incorporating an attention mechanism integrated with a dilated UNet regressor. This novel combination of Faster R-CNN-generated bounding boxes with density maps enhances the acne counting and severity grading performance compared to existing methods. The attention mechanism plays a pivotal role in simultaneously locating sparse and dense acne lesion regions, making the proposed method more robust to diverse distributions of facial acne. To address the scarcity of annotated medical data and the prevalence of partial annotations, future work should focus on implementing and training the model within a weakly supervised framework [4]. This shift towards weakly supervised learning would allow the model to learn from limited annotated data, making it more applicable in medical domains where comprehensive annotations are often hard to come by.

CONCLUSION

In conclusion, this paper presents an innovative approach to automated acne counting and severity grading from facial images. By integrating multi-scale dilated fully convolutional regressors with an attention mechanism based on Faster R-CNN-generated bounding boxes, the proposed method achieves superior

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performance compared to existing techniques. This computer-based diagnosis tool holds great promise in reducing the manual workload of dermatologists and improving the accuracy of acne lesion analysis, ultimately benefiting patients in need of precise and efficient acne treatment

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CONFLICT OF INTEREST

The author has declared no conflict of interest.

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