



DERMOSCOPY AND SKIN IMAGING

A DEEP LEARNING APPROACH TO AUTOMATICALLY CLASSIFY SKIN INFLAMMATION OF IN VIVO CONFOCAL IMAGES

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Introduction: In vivo confocal microscopy is a non-invasive technique widely used in dermatology. However, it generates many data that have to be classified and quantified. A visual evaluation by experts allows scoring these skin images but this approach requires a substantial analysis time and is operator dependent. Recent researches in the field of artificial intelligence introduced a new deep learning algorithm named Convolutional Neural Network (CNN) which can be used to analyze such images.

Objective: The aim of this study was to develop a new CNN architecture to automatically assess skin inflammation of in vivo confocal skin images.

Methods: For this study, healthy volunteers were selected by an immune-allergist and inflammation was induced by application of occlusive patches of leukotriene B4 on the forearm for 8 hours. Firstly, 3797 image patches of healthy and inflammatory skins were acquired by in vivo confocal microscopy and scored by experts on a 5 stages scale (0: no inflammation to 4: high-inflammatory skin) in order to dispose of a set of classified images. Then, a CNN dedicated to texture analysis was trained to reproduce the expert scoring on 3,000 of the image patches. Finally, the CNN was evaluated on the test batch composed of the 797 remaining patches.

Results: At the end of the training steps, the CNN attributed an inflammation score with an accuracy of 87% and a mean absolute deviation of 0.037 relatively to the expert scores. Furthermore, precise map of emphasized inflammation could be obtained by repeating the CNN evaluation across entire confocal skin images.

Conclusion: Hence, this deep learning approach allowed to efficiently and automatically reproduce an expert's classification of inflammatory skin images. In the future, this approach could be translated to other image acquisitions in order to support dermatologists in both diagnosis of skin condition and medical follow-up.

