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Validation Study of Automated Dermal/Epidermal Junction Localization Algorithm in Reflectance Confocal Microscopy Images of Skin.

Kurugol S, Rajadhyaksha M, Dy JG, Brooks DH.; Proc SPIE. 2012 Feb 9;8207. doi: 10.1117/12.909227.

ABSTRACT

Reflectance confocal microscopy (RCM) has seen increasing clinical application for noninvasive diagnosis of skin cancer. Identifying the location of the dermal-epidermal junction (DEJ) in the image stacks is key for effective clinical imaging. For example, one clinical imaging procedure acquires a dense stack of 0.5×0.5 mm FOV images and then, after manual determination of DEJ depth, collects a 5×5 mm mosaic at that depth for diagnosis. However, especially in lightly pigmented skin, RCM images have low contrast at the DEJ which makes repeatable, objective visual identification challenging. We have previously published proof of concept for an automated algorithm for DEJ detection in both highly- and lightly-pigmented skin types based on sequential feature segmentation and classification. In lightly-pigmented skin the change of skin texture with depth was detected by the algorithm and used to locate the DEJ. Here we report on further validation of our algorithm on a more extensive collection of 24 image stacks (15 fair skin, 9 dark skin). We compare algorithm performance against classification by three clinical experts. We also evaluate inter-expert consistency among the experts. The average correlation across experts was 0.81 for lightly pigmented skin, indicating the difficulty of the problem. The algorithm achieved epidermis/dermis misclassification rates smaller than 10% (based on 25×25 mm tiles) and average distance from the expert labeled boundaries of $\sim 6.4 \mu\text{m}$ for fair skin and $\sim 5.3 \mu\text{m}$ for dark skin, well within average cell size and less than 2x the instrument resolution in the optical axis.