Evaluation of skin pathologies by RGB autofluorescence imaging

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Abstract

A clinical trial on autofluorescence imaging of malignant and non-malignant skin pathologies comprising 32 basal cell carcinomas (BCC), 4 malignant melanomas (MM), 1 squamous cell carcinoma (SCC), 89 nevi, 14 dysplastic nevi, 20 hemangiomas, 23 seborrheic keratoses, 4 hyperkeratoses, 3 actinic keratoses, 3 psorias, 1 dermatitis, 2 dermatofibromas, 5 papilofibromas, 12 lupus erythematosus, 7 purpura, 6 bruises, 5 freckles, 3 fungal infections, 1 burn, 1 tattoo, 1 age spot, 1 vitiligo, 32 postoperative scars, 8 post cream therapy BCCs, 4 post radiation therapy scars, 2 post laser therapy scars, 1 post freezing scar as well as 114 reference images of healthy skin was performed. The sequence of autofluorescence images of skin pathologies were recorded by smartphone RGB camera under continuous 405 nm LED excitation during 20 seconds with 0.5 fps. Obtained image sequences further were processed with subsequent extraction of autofluorescence intensity and photobleaching parameters.

Keywords: skin cancer, autofluorescence, photobleaching, image processing.

Method

AF images of healthy and diseased human skin excited in vivo using 405 nm LEDs were periodically captured by a smartphone RGB camera to make a series of 20 images. Overall images sequences from 61 subjects of healthy skin, benign and malignant lesions were investigated using MATLAB and Python software. The AF photobleaching was fitted to an exponential model: \( I(t) = a \exp(-t/\tau) + c \), with subsequent extraction of the photobleaching parameters. The photobleaching parameters where compared as well as their ratios with the photobleaching of the healthy skin of the subject.

Results

![Exponential fitting and extraction of photobleaching parameters](image)

AF photobleaching background parameter \( c \) of BCC and benign lesions

Mean AF intensity of BCC and other benign lesions

Ratio of the photobleaching parameter \( \tau \) between a disease and healthy surrounding skin

Summary

- The proposed technique and data processing method showed a good specificity for non-invasive differentiation of Basal Cell Carcinoma from seborrheic keratosis.
- Analysis of photobleaching component \( \tau \) seems to be potential for melanoma differentiation from benign nevi, however further studies are necessary to collect statistically reliable data.

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