DERMOSCOPY AND SKIN IMAGING

A SUPER-RESOLUTION METHOD FOR SKIN IMAGING

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Background: Most dermatologists believe high-resolution skin images are diagnostically valuable. Specifically, high-resolution imaging helps in evaluating the sharpness of lesion boundaries, recognizing color borders (e.g., white-to-brown, red/blue-to-brown, differentiating vascular from pigmented structures), identifying pigment streaming and globules, and confirming the dermatofibromas' stellate nature. Super-resolution (SR) is the generation of high-resolution images from one or more low-resolution images. Single-image SR methods create more pixels based on an assumed/learned relationship between low- and high-resolution images, making them unusable when the recovered details must be accurate and the high-resolution images are unavailable. Existing multi-image SR methods cannot handle skin's non-rigid deformation during image acquisition.

Objective: Combining several skin images to obtain one higher resolution image.

Materials and Methods: We take N images from a hairless lesion, moving the dermatoscope after each capture. We align 2nd to Nth images with the first image using global rigid transforms (i.e., translation + rotation). We enlarge the results by 3x (i.e., 9x more pixels in enlarged image) using bilinear interpolation. The results are registered to the first image (also 3x enlarged) using many local similarity transforms, to handle skin non-rigidity. Finally, the resulted images are averaged pixelwise. For the results reported below, the lesion is a healing burn on author's foot, imaged cross-polarized under red illumination (N=11).

Results: The output image reveals more tissue details (e.g., vessel morphology and pigment network important for differentiating melanoma vs benign melanocytic lesions) as compared to the original images enlarged using bilinear interpolation. There are blocking artifacts due to the second round of alignments (local similarity transform). Such artifacts may be reduced using smaller blocks at some computational cost.

Conclusions: The proposed method is promising in increasing skin imaging resolution beyond that of the sensor by fusing multiple lower resolution images of a hairless lesion.