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P038: Future of care for patients at high risk for melanoma: from multimode, hyperspectral dermoscopy to self-imaging with smartphone

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Melanoma is the fastest growing cancer worldwide. According to the WHO, 132 000 melanoma skin cancers occur globally each year. Yet, if detected at an early stage, it can generally be cured with wide local excision, a tenfold improvement in survival rate and a hundredfold reduction in treatment cost. Actively engaging patients in their own care has been shown to improve outcomes, and government and private payers are embracing this as a way of reducing health care costs. Timely engagement with a dermatologist can significantly improve the likelihood of effective treatment especially for patients with moderate to high risk of melanoma.

Digital health and mHealth solutions are becoming an increasing part of the continuum of healthcare. Recent advancements of smartphone image quality as well as cloud-based image analysis and electronic health records provide the secure infrastructure for transfer of patient-provided skin images, and automated image analysis reporting biological features scored according to common melanoma checklists.

We have used a multimode hyperspectral imaging dermoscope we developed (SkinSpect^{TM}) to capture skin images up to 50 spectral bands in both parallel and perpendicular polarization states. The goal of this work is to measure the 3-D structural distribution of melanin and hemoglobin in melanocytic nevi and surrounding areas, at the molecular level. As part of this work, we have developed image segmentation and analysis functions to automatically quantify and report biological features of nevi used in standard melanoma checklists (ABCDE, and seven-point checklist). From prior research, it has been shown that hemoglobin and melanin spectra have significant overlap and systems that do not take this into account over/under estimate hemoglobin values (by factor of up to 3) especially when analyzing nevi with high melanin concentration. Our SkinSpect analysis algorithm can disentangle the hemoglobin and melanin absorptions leading to much more accurate hemoglobin measurement independent of melanin absorption. We are presenting the resulting molecular distribution maps as well as corresponding melanoma checklist biological features derived from image analysis of twenty subjects with nevi. All patients were recruited as part of an ongoing IRB-approved study at the University of California Irvine.

We translated the knowledge and algorithms from our SkinSpect multimode hyperspectral image processing to improve detection and image analysis using smartphone-based images by developing an optical attachment that provides wavelength and polarization conditioning. The resulting enhanced images will be employed to extract automatic quantification of melanoma checklist features that dermatologists can view online. In future work, these images and checklists will be assessed by dermatologists for usefulness in triaging patients for urgency of clinical examination.