Abstract: Wound Imaging in 3D Using Low-Cost Mobile Devices

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The state-of-the-art method of wound assessment is manually performed by clinicians. Such procedure has limited reproducibility and accuracy, large time consumption and high costs. Novel technologies such as laser scanning microscopy, multi-photon microscopy, optical coherence tomography and hyperspectral imaging [1], as well as devices relying on the structured light sensors [2, 3] have limitations due to high costs and may lack portability and availability. The high prevalence of chronic wounds, however, requires inexpensive and portable devices for 3D imaging of skin lesions.

We present a low-cost wound assessment system and architecture for fast and accurate cutaneous wound assessment using inexpensive consumer smartphone devices [4]. We reconstruct wounds in 3D as dense models, which are generated from images taken with a built-in camera of a smartphone device. For that, we adapt the method of Ondruska et al. [5], where dense tracking is performed in each recorded frame: camera positions are estimated using a dense feature-free monocular camera tracking method. The system architecture includes imaging, processing and storage devices. It supports tracking over time by alignment of 3D models, color correction using a reference color card placed into the scene and automatic segmentation of wound regions. Using our system, we are able to detect and document quantitative characteristics of chronic wounds, including size, depth, volume, rate of healing, as well as qualitative characteristics as color, presence of necrosis and type of involved tissue.

References

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