Automatic pressure ulcer measurement using RGB-D data

Accurate pressure ulcer measurement is critical in assessing the effectiveness of treatment. However, the traditional measuring process is subjective. Each health care provider may measure the same wound differently, especially related to the depth of the wound. Even the same health care provider may obtain inconsistent measurements when measuring the same wound at multiple times. Also, the measuring process requires frequent contact with the wound, which increases the risk of contamination or infection and can be uncomfortable for the patient. This manuscript describes a new automatic pressure ulcer monitoring system (PrUMS), which uses a tablet connected to a 3D scanner, to provide an objective, consistent, non-contact measurement method. We combine color segmentation on 2D images and 3D surface gradients to automatically segment the wound region for advanced wound measurements. To demonstrate the system, two pressure ulcers on a mannequin are measured with PrUMS; ground-truth is provided by a clinically trained wound care nurse. The results of PrUMS 2D measurement (length and width) are within 1 mm average error and 2 mm standard deviation; the average error for the depth measurement is 2 mm and the standard deviation is 2 mm. PrUMS is tested on a small pilot dataset of 8 patients: the average errors are 3 mm, 3 mm, and 4 mm in length, width, and depth, respectively.