

A NOVEL PERCEPTUALLY-ORIENTED APPROACH FOR SKIN TUMOR SEGMENTATION

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ABSTRACT. *In this paper, a novel and automatic approach for skin tumor segmentation is presented. Tumors images with a dermoscope are usually affected by hairs, low contrast, specular reflections, shadows due to uneven illumination, etc, making the segmentation step extremely difficult. The proposed technique, mainly based on region-based active contour algorithm extended to multiple region detection, is performed in the CIECAM02 based uniform color space to achieve an adaptation to human perception. It also avoids the limitations introduced by the conventional active contour algorithms: level set initialization step, fixed regularization parameters, and overlapping of the contours in the presence of multiple objects. The improved region-based active contour technique automatically initializes the level set curves by a blob technique, determines the required parameters for convergence and utilizes a conditional function to avoid overlapping contours. In this new algorithm, dermoscopic images are preprocessed in order to correct specular reflection, improve contrast and remove hairs with techniques based on homomorphic filtering, optimal contrast adjustment and exemplar-based inpainting, respectively. To validate the segmentation results obtained, comparisons with three state-of-the-art segmentation algorithms have been performed. Experimental results on 170 images gave an average segmentation error of 4.10 ± 2.42 . In terms of visual perception, the integration of a uniform color space makes the algorithm closer to experts than the other state-of-the-art methods. The preprocessing steps included and the improved segmentation algorithm make the technique useful in practical applications.*

Keywords: Skin tumor segmentation, Image enhancement, CIECAM02 color appearance model, Visual perception, Region-based active contour model

1. **Introduction.** Malignant melanoma (*MM*) [1] is one of the rare skin cancers with an increasing incidence rate. In the United States alone, the number of new cases and deaths associated with *MM* in 2010 is estimated to be 68,130 and 8,700, respectively [2]. In recent years, digital dermoscopy has revealed a new dimension of clinical morphology in pigmented skin tumors, becoming one of the most cost-effective non-invasive technique for early detection of skin cancer [3]. In dermoscopy, the diagnosis of skin tumors is frequently performed according to the *ABCD* rule (*A*: asymmetry, *B*: border irregularity,