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Segmentation of skin lesions using active contours initialized by region growing

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Image processing methods allied to medical imaging systems have been extensively developed, and several solutions have been accomplished to assist medical professionals in the diagnosis and follow up of diseases from images, in a fast and accurate way. For example, the processing and analysis of images of skin lesions have been gained an increasing attention due to the extremely high importance of an adequate precocious diagnosis of such lesions. Some characteristics commonly considered by dermatologists in the analysis of skin lesions are: contour' irregularity, shape' asymmetry, color variation along inner areas and lesion' dimensions [1]. In this sense, techniques of image processing and analyses can be used to help dermatologists on their diagnosis by extracting lesion contours from images and characterizing the lesions involved.

However, for a successful computational diagnosis of skin lesions from images, the extracted contours should maintain the original irregularity, that is, the local details, of the lesions' borders. Thus, in the attempt to extract lesions' contours from images maintaining their original irregularity, we propose the application of the region growing method, followed by the application of the active contours method proposed by Kass, Witkin and Terzopoulos [2, 3]. Thus, the region growing method is applied to segment the original image and extract an approximated contour of the skin lesion presented. Then, this rough contour is used as the initial curve for the active contours method.

In this work, the region growing is implemented using the quadtree algorithm [3] and adopting as the growing control parameter the averaged I component of the HIS (Hue - Intensity - Saturation) color coding system. This algorithm divides recursively each area of the original image, beginning considering the entire image, until that the averaged pixels' color intensity of each area is smaller than a threshold value defined by the Otsu method [3, 4]. After the execution of this algorithm, a merging algorithm is applied, based on the color intensity of the lesion's area, to join the lesion's areas, making possible the extraction of the lesion' approximated contour. This rough contour possesses the same topology of the lesion' border, but needs to be further refined so can represent conveniently the desired border. For this refinement, the traditional method of active contours is used, considering as the initial curve the contour resultant from the merging algorithm.

The proposed computational approach is able to detect skin lesions' areas and to extract their contours from images, maintaining their original irregularity. In Figure 1, we have an original image of a skin lesion and the segmentation obtained by the proposed approach. In the resultant image, we can verify that the extracted contour represents adequately the skin lesion' border, being well adjusted to the border and maintaining its original irregularity.

Figure 1. Segmentation done (contour in red) by the adopted algorithm (right) in an image of a skin lesion (left).

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