

Breast boundary segmentation in thermography images based on random walkers

ABSTRACT

Breast and areola boundary detection and segmentation present the biggest challenge in breast segmentation from thermography images, as breast boundaries, especially in the upper quadrants of the breast, are nonexistent. Many segmentation approaches have been proposed for breast segmentation, such as active contours and snakes, circular Hough transforms, and live wires, but these methods often fail to achieve satisfactory results. With recent advances in image processing techniques, new segmentation concepts are being developed, such as random walkers, which have received high interest from the medical imaging community. In this study, 91 images acquired utilizing a FLIR A320 thermal camera are used for developing an automatic breast segmentation from thermography images based on the random walker algorithm. A series of enhancement filters are applied to the image to make areola detection more accurate. Afterwards, the areola is detected using a series of circular Hough transforms. The detected areola region is then utilized for automatic seed placement for the random walker algorithm. Based on expert radiologist evaluation, the proposed segmentation algorithm was able to achieve 81.3% success rate in breast segmentation, while there was a 37.5% increase in the detection of breast cancer-related abnormalities by radiologists utilizing the segmented images, compared to utilizing original images.

Keyword: Image segmentation; Random walkers; Breast thermography; Breast segmentation