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The preprocessing effect using K-means clustering and merging algorithms in cardiac left ventricle segmentation

Ik-Hwan Cho[1] • Ki-Bum Do[2] • Jung-Su Oh[3] • In-Chan Song[4] • Kee Hyun Chang[5] • Dong-Seok Jeong[6]

[1]Department of Electronic Engineering, College of Engineering, Inha University

[2]Department of Electronic Engineering, College of Engineering, Inha University

[3]Interdiciplinary Program of Medial and Biological Major, Seoul National University

[4]Department of Diagnostic Radiology, Seoul National University Hospital

[5]Department of Diagnostic Radiology, Seoul National University Hospital

[6]Department of Electronic Engineering, College of Engineering, Inha University

목적 : For quantitative analysis of the cardiac diseases, it is necessary to segment the left-ventricle(LV) in MR cardiac images. Snake or active contour model has been used to segment LV boundary. In using these models, however, the contour of the LV may not converge to the desirable one because the contour may fall into local minimum value due to image artifact in inner region of the LV. Therefore, in this paper, we propose the new preprocessing method using K-means clustering and merging algorithms that can improve the performance of the active contour model.

대상 및 방법 : The MR cardiac images were acquired from five patients. In the five patients, we acquired only 16 phases - 8 slices breath-hold images from three patients, and acquired 16 phases - 8 slices breath-hold as well as non breath-hold images from two patients using 1.5T MR machine. Because of artifacts in original MR cardiac images, it was not easy to segment the desired boundary images. To remove the artifacts that disturb the segmentation of the correct contour, we used K-means clustering and merging algorithms. K-means clustering algorithm made original image into simple image that had K intensity levels(K value was set to be 4). An eight connectivity component labeling and merging algorithms were applied for clustered images by using K-means clustering algorithm(The number of labels was set to be 3). Final images were segmented by the active contour algorithm of the gradient vector flow(GVF) model. We evaluated the performance of active contour model as using K-means clustering and merging algorithms in comparison with using only active contour model.

결과 : Because every acquired image had artifacts, the segmented contours converged to undesirable ones when using only active contour model. By using K-means clustering and merging algorithms, artifacts in inner region of LV disappeared because they were merged into near larger regions. Thus, segmented contours in LV were shown to converge to the correct wall boundary position.

결론 : Our results suggest a preprocessing algorithm using K-means clustering and merging algorithms may improve the performance of the active contour model in the cardiac LV segmentation.