Left Ventricle Segmentation by Circular Shape Constrained Clustering Algorithm

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This study presents a novel clustering algorithm for the automated segmentation of the left ventricle (LV). A circular shape function is incorporated into the dissimilarity measure of the objective function of the well-known fuzzy c-means (FCM) clustering algorithm. In that way, the proposed circular shape constrained FCM (CS-FCM) algorithm integrates both intensity related feature and spatial shape information into the clustering procedure. As a result, pixels having similar intensity information but located in different regions (LV region and non-LV region) can be differentiated. A weighting parameter is introduced to adjust the weight of the spatial distance against the intensity feature, which increases the flexibility of the proposed CS-FCM algorithm. The experimental results on benchmark cardiac magnetic resonance (CMR) images show two obvious advantages of the proposed CS-FCM over the standard clustering algorithms like FCM: it successfully distinguishes the LV from other structures which have similar intensity as LV; and it correctly segment the LV even when papillary muscles are adjacent to or fall inside the LV structure in the image.

Keywords: Left Ventricle Segmentation, Data Clustering, Fuzzy C-Means, Circular Shape Function.