Automatic Quantification of Oedema from T2 Weighted CMR Image using Hybrid Thresholding Oedema Sizing Algorithm

Kushsairy Kadir*, Alex Payne, John J Soraghan and Colin Berry

Dept of Electronic and Electrical Engineering/Centre for Excellence in Signal and Image Processing(CeSIP), University of Strathcylde, Glasgow, United Kingdom

Oedema is fluid retention within the myocardial tissue due to damage tissue causing swelling in the affected area after myocardial infarction (MI). Thus quantification of oedema area after an MI is an important step in medical diagnosis to differentiate between viable and death myocardial tissue. A novel automatic quantification of oedema is proposed in this work. It is based on hybrid thresholding where image morphological operation is combined with statistical thresholding to classify oedema tissue. First an image morphology opening operation is first performed to remove the spurious small positive bright object on the myocardial wall. Next the mean value of the normal tissue is estimated by the maximum value of the lower part of the intensity profile of the image. Threshold value is then calculated as a 2 standard deviation (SD) above the mean value. The segmented oedema is then further processed to remove any disjointed false positive bright region by labelling all segmented region and removing any region area below a certain threshold which is empirically determined. Once the segmentation of the oedema has been achieved additional post processing step is applied to take into account of dark pixel region that may account for microvascular obstruction (MVO). An iterative dilation operation is performed to joint the remaining oedema area and finally remaining isolated dark pixel is analysed to identify potential MVO. Each dark region is classified as MVO if the border is completely encompassed by oedema pixel. The method is then applied to cardiac magnetic resonance (CMR) images of eight patients, for each patient between nine to twelve slices of T2 weighted MR image were acquired. All short axis images were used except for the extreme basal and apical slices. The result for oedema quantification is very encouraging with correlation score of 81.1% when compare to manual segmentation.