

Cardiac MR database of Digital Imaging Group (DIG-Cardiac)

Data Acquisition:

The DIG-Cardiac database consists of 145 cine-MRI images collected from 3 hospitals affiliated with two health care centers (London Healthcare Center and St. Josephs HealthCare). The subjects age from 16 yrs to 97 yrs, with average of 58.9 yrs. The pixel spacings of the MR images range from 0.6836 mm/pixel to 2.0833 mm/pixel, with mode of 1.5625 mm/pixel. Diverse pathologies are in presence including regional wall motion abnormalities, myocardial hypertrophy, mildly enlarged LV, atrial septal defect, LV dysfunction, etc. Each subject contains $n_F = 20$ frames throughout a cardiac cycle. In each frame, LV is divided into equal thirds (basal, mid-cavity, and apical) perpendicular to the long axis of the heart following the standard AHA prescription and a representative mid-cavity slice is selected for this database.

Preprocessing and Contouring:

All cardiac images undergo several preprocessing steps, including landmark labelling, rotation, ROI cropping, and resizing. The two landmarks are the intersections of the LV and RV. The resulted images are approximately aligned with dimension of 80×80 . Then, these cardiac images are manually contoured to obtain the epicardial and endocardial borders, which are double-checked by two experienced cardiac radiologists.

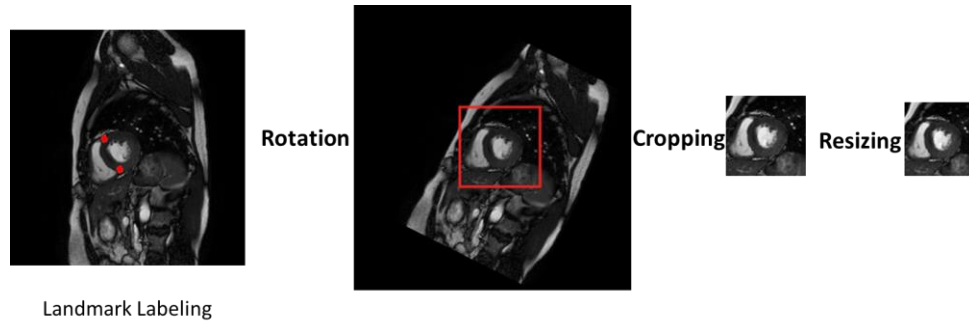


Figure 1. Preprocessing of the database.

Ground truth:

Besides the epicardium and endocardium contour obtained through the above procedure, quantification results of LV are also provided, as shown in Figure 2. These quantifications include: areas of the myocardium and LV cavity, three directional LV cavity dimensions, six regional wall thicknesses, and one cardiac phase.

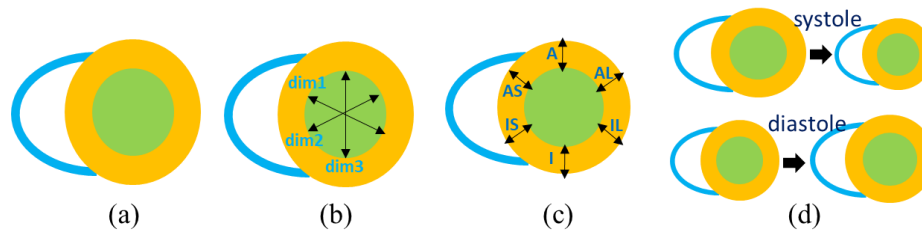


Figure 2. Demonstration of the cardiac indices considered in the database. (a) area of myocardium and LV cavity. (b) Three LV cavity dimension. (c) Regional wall thickness. (d) Cardiac phase.

MATLAB file: cardiac-dig.mat

images_LV: cardiac MR images after preprocessing. Every 20 images (along the third dimension) are for one subject.

endo_LV and epi_LV: the manually obtained binary mask of the endocardium and epicardium.

areas: areas of LV cavity and myocardium, normalized by image area 80×80.

dims: dimensions of LV cavity, normalized by image dimension 80.

rwt: regional wall thickness of myocardium, normalized by image dimension 80.

lv_phase: binary cardiac phase, can be obtained from cavity area. 1 denotes systolic phase, and 0 denotes diastolic phase.

The values of regional wall thicknesses (RWTs), cavity dimensions are normalized by the image dimension (80), while the areas are normalized by the pixel number (6400). During evaluation, the results should be converted to physical measurements (in mm for RWT and dimension, and in mm² for areas) by reversing the resizing procedure and multiplying the pixel spacing for each subject. The pixel spacing for each subject and the ratio to reversing the resizing procedure are also provided.

pix_spacing: the original pixel spacing (in mm) of MR images. The 20 images for each subject are of the same pixel spacing.

ratio_resize_inverse: ratio to reverse the resize procedure in Figure 1.

For RWTs and dimensions,

physical measurements = results obtained from imgs_LV × (ratio_resize_inverse×pix_spacing)

For areas,

physical measurements = results obtained from imgs_LV × (ratio_resize_inverse×pix_spacing)²

References:

- [1]. Wufeng Xue, Gary Brahm, Sachin Pandey, Stephanie Leung, and Shuo Li. "Full left ventricle quantification via deep multitask relationships learning." *Medical Image Analysis* 43 (2018): 54-65.
- [2]. Wufeng Xue, Andrea Lum, Ashley Mercado, Mark Landis, James Warrington, and Shuo Li. "Full Quantification of Left Ventricle via Deep Multitask Learning Network Respecting Intra-and Inter-Task Relatedness." *MICCAI*, 2017.