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# 1 Supplementary Material

## 1.1 Parametric Model Analysis

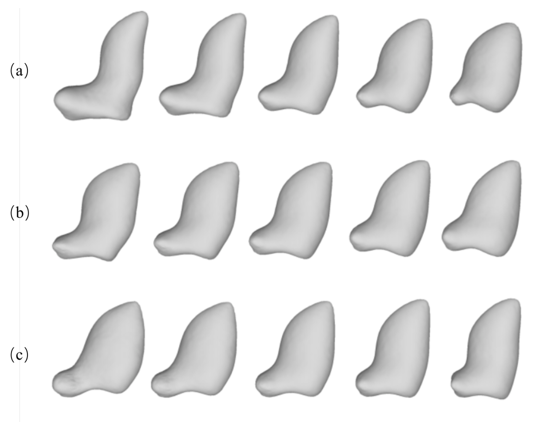


**Fig. 1.** Effects of anterior three-dimensional shape parameters on left ventricular topology. Each row represents the shape parameters of the corresponding dimension from left to right. The number gradually increases, and the shape parameters of other dimensions are set to zero, which affects the changing trend of the left ventricular topology.

We obtain a parametric model of the left ventricle through rigid registration, non-rigid registration, and principal component (PCA) analysis. According to the PCA algorithm, the more advanced shape parameters play a more significant role, so we carry out a visual analysis of the first three-dimensional shape parameters, as shown in Figure 1, each row represents The influence of the first, second, and third shape parameters respectively. The parameters of the corresponding dimension increase from left to right, and the parameters of other dimensions are set to zero.

It can be seen that as the first-dimensional parameters continue to increase, the topological model of the corresponding left ventricle of the heart gradually shows a state of contraction at both ends and expansion in the middle, indicating that the first-dimensional parameters mainly control the overall size and expansion of the model topology. With the continuous increase of the second-dimension parameter, the topology of the top of the left ventricle gradually shrinks, while the overall topology size does not change significantly. The opposite is true for the third-dimensional parameter, where the topology of the left ventricle tail decreases as it increases. Therefore, for the shape parameters of the first three dimensions, the first-dimension parameter mainly controls the overall size of the topology, affecting the shrinkage at both ends and the expansion in the middle. The second-dimensional parameters mainly control the scaling changes of the

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top of the left ventricle. In contrast, the third-dimensional parameters mainly control the scaling of the tail of the left ventricle.

### 1.2 View Plannning

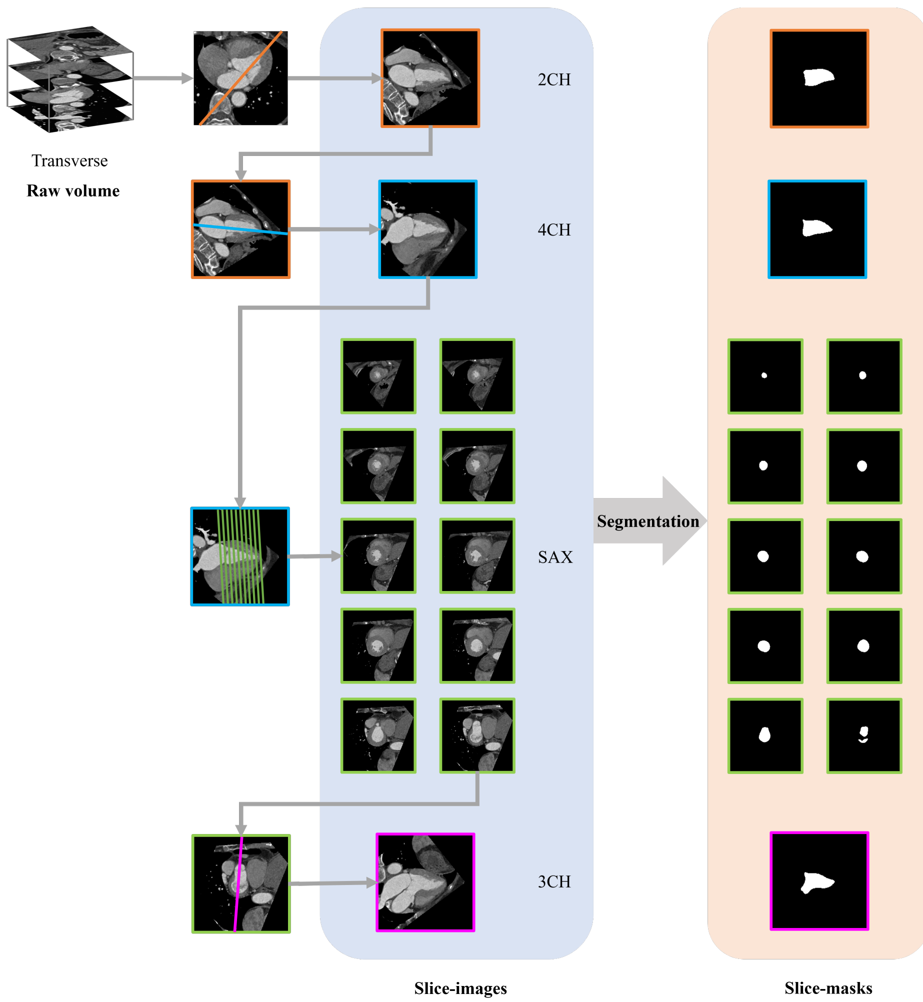


**Fig. 2.** The process of view planning for CT volume.

Whether it is MRI or CT imaging, a scanning plane needs to be determined, such as three standard planes of the human body: transverse, sagittal and coronal. These three planes are determined by the long axis of the human body, which refers to the direction from head to toe. Similarly, the heart has its own axis,

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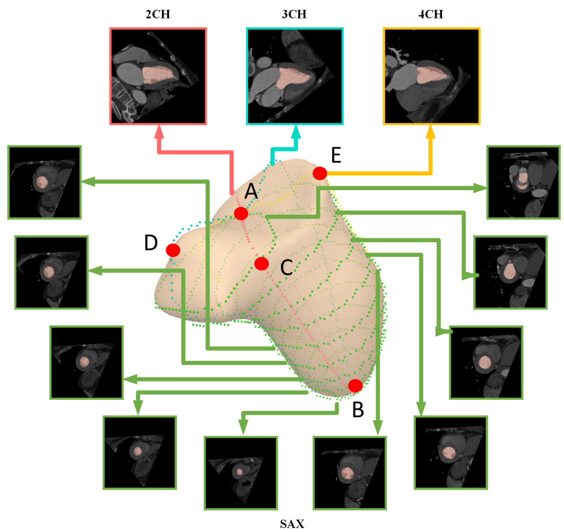


**Fig. 3.** The landmarks that determine the positions of the slice-masks on the 3D synthetic model.

but it generally does not coincide with the axis of the human body. As shown in Figure 2, we plan the view of the raw CT volume to get the slice-images as the input of the segmentation network. First, scan the transverse plane of the human body to locate the midpoint of the left ventricular apex and the mitral valve. Then scan along this line to obtain a two-chamber view (2CH) reflecting the left atrium and left ventricle. In the 2CH view, scan the line connecting the midpoint of the mitral valve and the apex of the left ventricle to obtain a four-chamber view (4CH) reflecting the left and right atrium and left and right ventricle. With the 4CH view as the reference plane, continuous vertical scanning in the long-axis direction of the left ventricle is performed to obtain a series of images, which are the short-axis views (SAX) reflecting the left ventricle. The three-chamber view (3CH) is obtained by planning a view orthogonal to the 2CH or 4CH view and the basal SAX view, dissecting the aortic valve and posterior wall. By segmenting the obtained slice-images, the slice-masks can be obtained as the input of the parametric regression network.

The landmarks that determine the positions of the slice-masks on the template model are shown in Figure 3. They are decided by the clinician so that the position of the plane obtained from the model is consistent with the position planned on the CT volume. First, we connect A and B to get the long axis of the heart. A sequence of SAX views is obtained from a plane perpendicular to the long axis, from A planning to B. C, D, and E combine with the long axis to form a 2CH view, 3CH and 4CH view, respectively. These landmarks can be propagated to any synthetic model from the template model.