Weakly Supervised Deformation Network for 3D Echocardiography Segmentation on Left Ventricle

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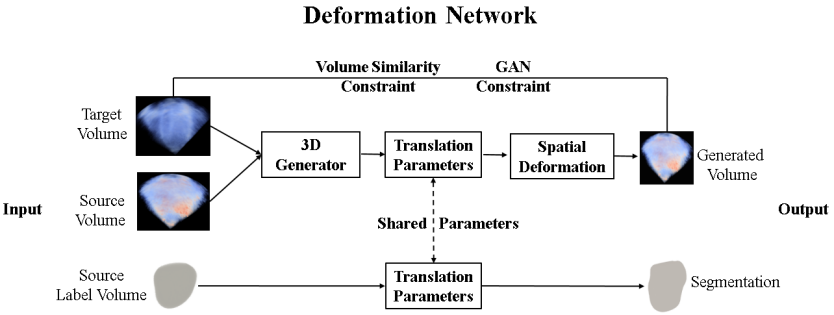
Aims: The automated 3D echocardiography segmentation of the left ventricular (LV) is very important for clinical evaluation of LV function. However, the segmentation is difficult due to the 3D echocardiography's challenges, such as the low signal-to-noise ratio, indistinguishable boundaries between LV and other heart substructures, and limited annotation data. Hence, this paper aims to propose a novel method to achieve accurate 3D echocardiography segmentation on left ventricle, based on a weakly supervised deformable network.

Methods: The proposed method is three-fold: (1) For the first time, we used weakly supervised deformation network to achieve 3D echocardiography segmentation on LV. (2) We designed a generative adversarial network (GAN) to achieve weakly supervised segmentation. (3) Volume similarity constraint and GAN constraint were jointed to optimize the proposed frame. The weakly supervised deformation network was trained and validated on 3D echocardiography datasets which including 70 patients (35 train patients and 35 test patients).



Results: The proposed method was evaluated by the widely used criterions, including mean surface distance (MSD), mean hausdorff surface distance (HSD), and mean dice index (D). The results by comparison with ground truth are as following: MSD=1.87±0.39mm, HSD=7.8±4.9mm, Dice=0.92.

Conclusion: A novel and accurate LV segmentation method is proposed, which can be used for clinical evaluation of LV function.