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Non Invasive Imaging (Echocardiography, Nuclear, PET, MR and CT)

DEEP LEARNING BASED AUTOMATIC SEGMENTATION OF CARDIAC COMPUTED TOMOGRAPHY

Poster Contributions
Poster Hall, Hall F
Monday, March 18, 2019, 9:45 a.m.-10:30 a.m.

Session Title: Non Invasive Imaging: CT/Multimodality, Angiography, and Non-CT Angiography 5
Abstract Category: 27. Non Invasive Imaging: CT/Multimodality, Angiography, and Non-CT Angiography
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Authors: *Gurpreet Singh, Subhi Alaref, Gabriel Maliakal, Mohit Pandey, Alexander van Rosendael, Benjamin Lee, Jing Wang, Zhouran Xu, James Min, Weill Cornell Medicine, New York, NY, USA*

Background: Cardiac Computed Tomography Angiography (CCTA) is routinely performed in clinical practice to visualize cardiac structures and for quantification of functional parameters such as Left Ventricular (LV) and Right Ventricular (RV) volume. These cardiac measurements are mostly obtained using manual, intensity-based or atlas-based methods that are time-consuming and prone to errors.

Methods: A deep learning model named U-Net was trained on 1378 axial images obtained from twenty CCTA volumes for automated segmentation of RV and LV volumes. This model captures context, performs precise localization and makes robust use of data augmentation to alleviate the need for annotating a large number of images. The dataset was randomly split into the training (70%), testing (20%), and validation (10%) sets. The model performance was evaluated using Dice score. The ground truth for annotation was established by two cardiologists.

Results: A comparison between the annotated images and masks predicted by U-Net are shown in the figure. An overall Dice score of 0.73 was achieved, with 0.76 for RV and 0.68 for LV volume. Automated segmentation using U-Net took approximately 0.48 seconds per image.

Conclusion: Fast and accurate segmentation of cardiac structures is critical for quantification of cardiac measurements that assist in clinical diagnosis. A deep learning model was developed for automated segmentation of RV and LV volumes. Future work will be aimed at extending this model to other heart structures.

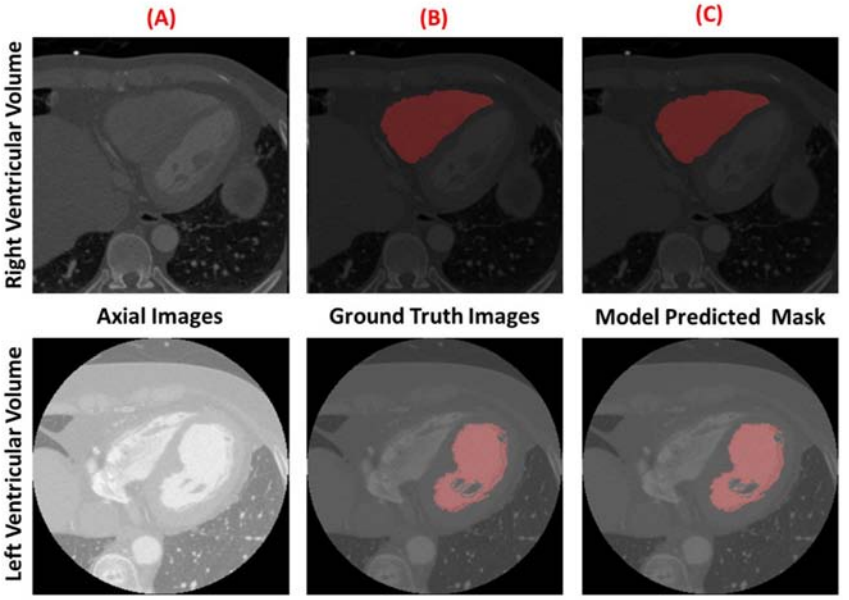

Figure 1: A comparison between the **(A)** Axial images, **(B)** Ground truth images and **(C)** Masks predicted using U-Net model for Left Ventricular and Right Ventricular Volume.