Analytics for 3D/4D MR Images: Modeling, Segmentation, Quantification and Diagnosis

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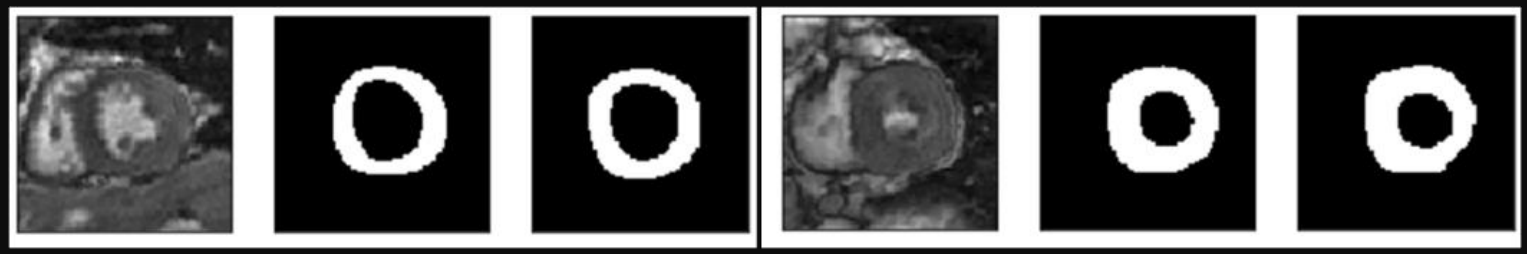
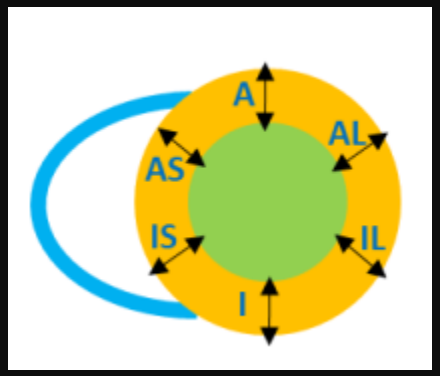
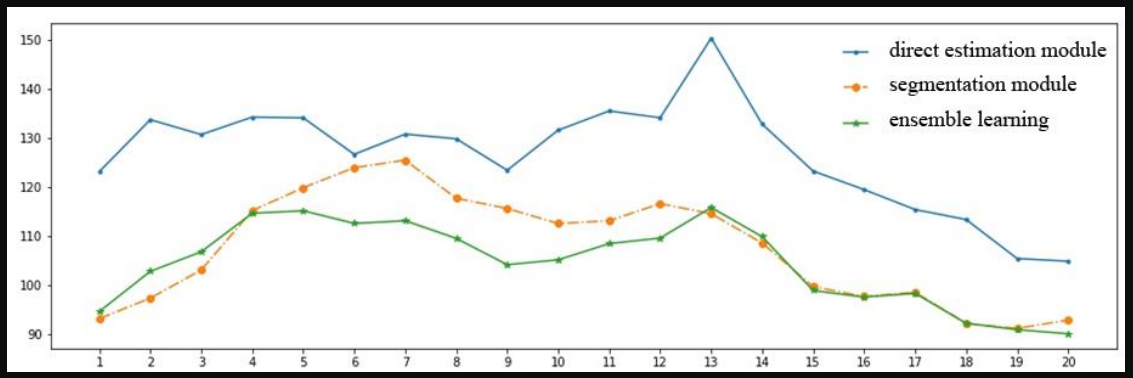
❖ Cardiac MR: Left Ventricle Segmentation



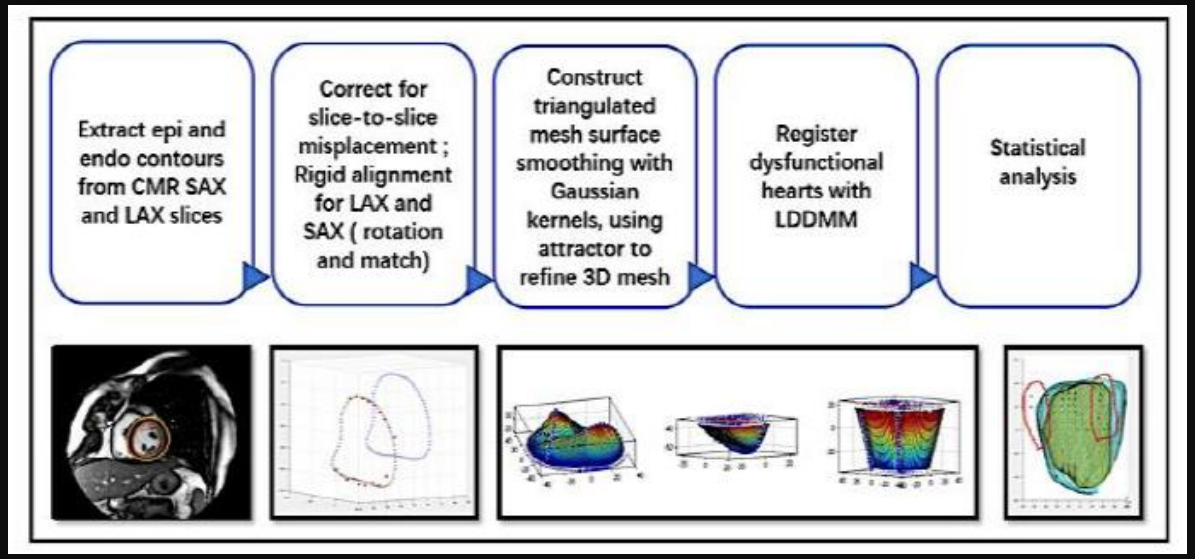
❖ Cardiac MR: Parameter Quantification:



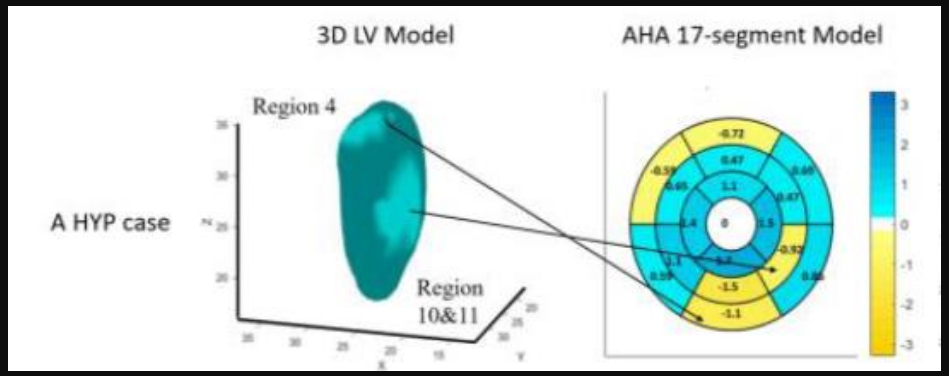


Average frame-wise estimation errors of the area quantification estimated by the two 1st-level module (direct estimation in blue and segmentation in orange), as well as the ensemble learning framework (green). X-axis shows the indices of temporal frames, from 1st frame to the 20th frame. Y-axis shows the MSE of predictions, measured in mm^2.

❖ Cardiac MR: 3D Morphology Modeling and Shape Statistics



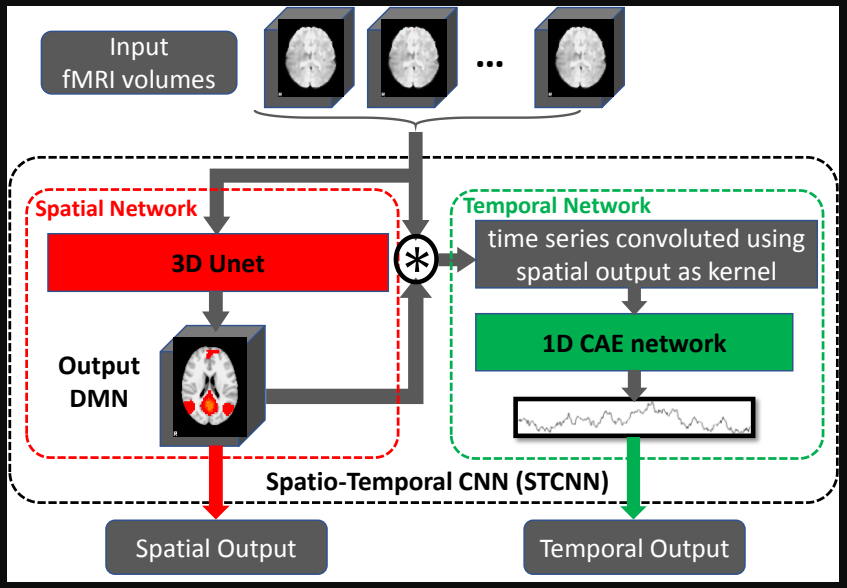
❖ Cardiac MR: Morphology-based Diagnosis

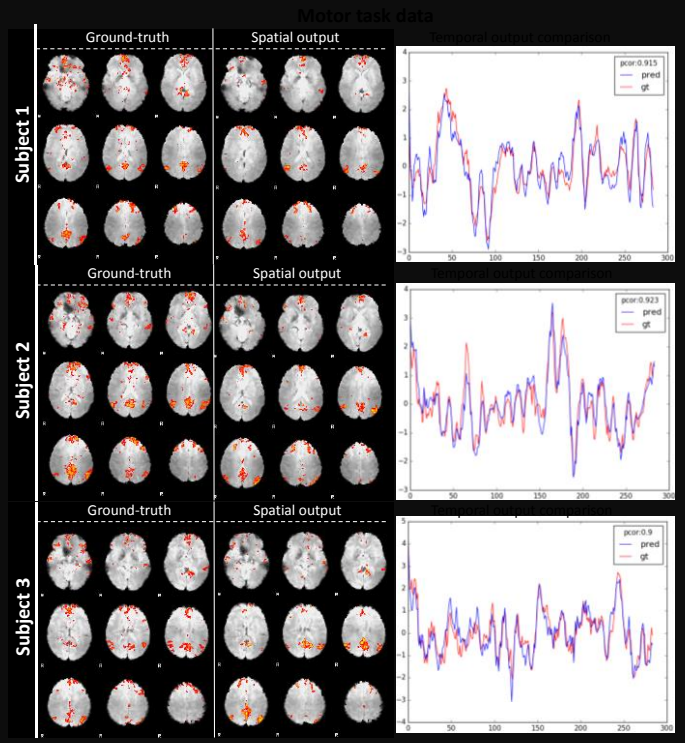


Visualization of abnormal regions of HYP (Hypertrophy) on endocardium of left ventricle. Left: Highlight of abnormal region on reconstructed 3D surface of LV; Right: Quantification of dysfunction based on displacement field from nonlinear registration from normal shape (template) to individual shape.

"3D Regional Shape Analysis of Left Ventricle Using MR Images: Abnormal Myocadium Detection and Classification",
IEEE 16th International Symposium on Biomedical Imaging, 2019

❖ Brain Functional MR: Spatio-Temporal Modeling through Learnable Convolution Kernel





Left: ST-CNN framework, consisting of two subnetworks: spatial network (red part) and temporal network (green part). Combination of the two subnets is defined using "⊛"; Right: DMN identification with spatio-temporal co-learning by ST-CNN. Randomly-selected 3 subjects are visualized with their ground-truth DMN spatial map (decomposed by dictionary learning and sparse representation and identified by spatial overlap with DMN template), spatial output map from ST-CNN, and temporal dynamics of both SR and ST-CNN.

"4D Modeling of fMRI Data via Spatio-Temporal Convolutional Neural Networks (ST-CNN)",
IEEE Transactions on Cognitive and Developmental Systems, 2019