CHEST Online Supplement

Thoracic Quantitative Dynamic MRI to Understand Developmental Changes in Normal Ventilatory Dynamics

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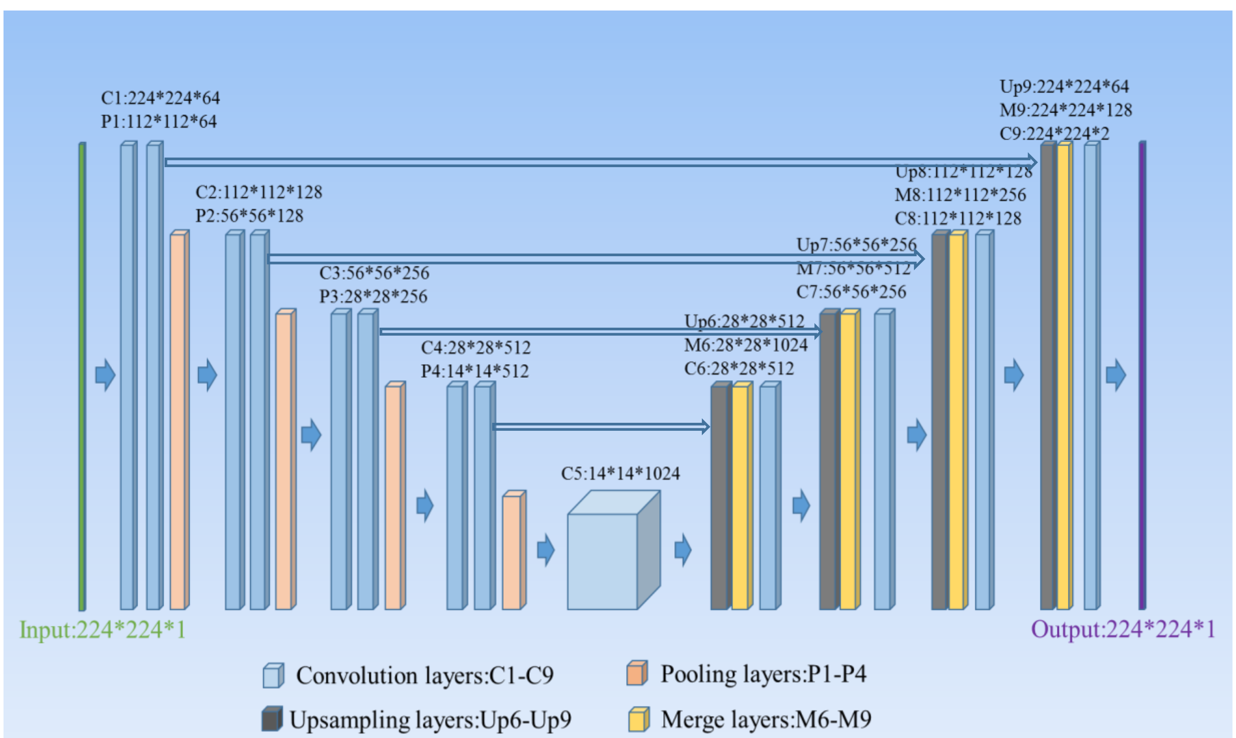
e-Appendix 1.

Text: 2D U-Net for image segmentation

The U-Net has been widely used in medical image processing and it has achieved good results in the object segmentation task. Its multi-layer convolution structure can extract the position and texture information pertaining to the target object. The U-Net used in this paper contains 9 convolutional layers, 4 pooling layers corresponding to 4 up-sampling layers, and after each up-sampling layer, a feature fusion layer. In the structure of U-Net, the shallow layers can effectively extract the object's position information, the deeper layers can obtain more detailed information about the object, and the fusion layer can effectively fuse the feature information output by the pooling layers and the up-sampling layers.

e-Figure 1. 2D U-Net with encoder-decoder type of architecture along with its parameters. The encoder extracts features from the image and builds a latent representation of the features suitable for the lung region by performing various convolution as well as down sampling and max-pooling operations on the image. The decoder produces the segmentation mask by taking this representation and up-sampling the image from the previous layer.



e-Figure 2. Two animations of lung motion in one breathing cycle of two normal children (13.4 yrs, male; 8.2 yrs, female).

http://www.mipg.upenn.edu/Vnews/Animation_normal_lungs.pptx

e-Figure 3a. Linear regression of quantitative dynamic magnetic resonance imaging (QdMRI) volumetric parameters (in ml) vs. age (in years) for male subjects (n = 24). RLVei = right lung volume at end-inspiration, LLVei = left lung volume at end-inspiration, BLVei = bilateral lung volume at end-inspiration, RLVee = right lung volume at end-expiration, LLVee = left lung volume at end-expiration, BLVee = bilateral lung volume at end-expiration, RDtv = right hemi-diaphragm excursion tidal volume, LDtv = left hemi-diaphragm excursion tidal volume, BDtv = bilateral hemi-diaphragm excursion tidal volume, RCWtv = right chest wall excursion tidal volume, LCWtv = left chest wall excursion tidal volume, and BCWtv = bilateral chest wall excursion tidal volume.

e-Figure 3b. Linear regression of quantitative dynamic magnetic resonance imaging (QdMRI) volumetric parameters (in ml) vs. age (in years) for female subjects (n = 27). RLVei = right lung volume at end-inspiration, LLVei = left lung volume at end-inspiration, BLVei = bilateral lung volume at end-inspiration, RLVee = right lung volume at end-expiration, LLVee = left lung volume at end-expiration, BLVee = bilateral lung volume at end-expiration, RDtv = right hemi-diaphragm excursion tidal volume, LDtv = left hemi-diaphragm excursion tidal volume, BDtv = bilateral hemi-diaphragm excursion tidal volume, RCWtv = right chest wall excursion tidal volume, LCWtv = left chest wall excursion tidal volume, and BCWtv = bilateral chest wall excursion tidal volume.

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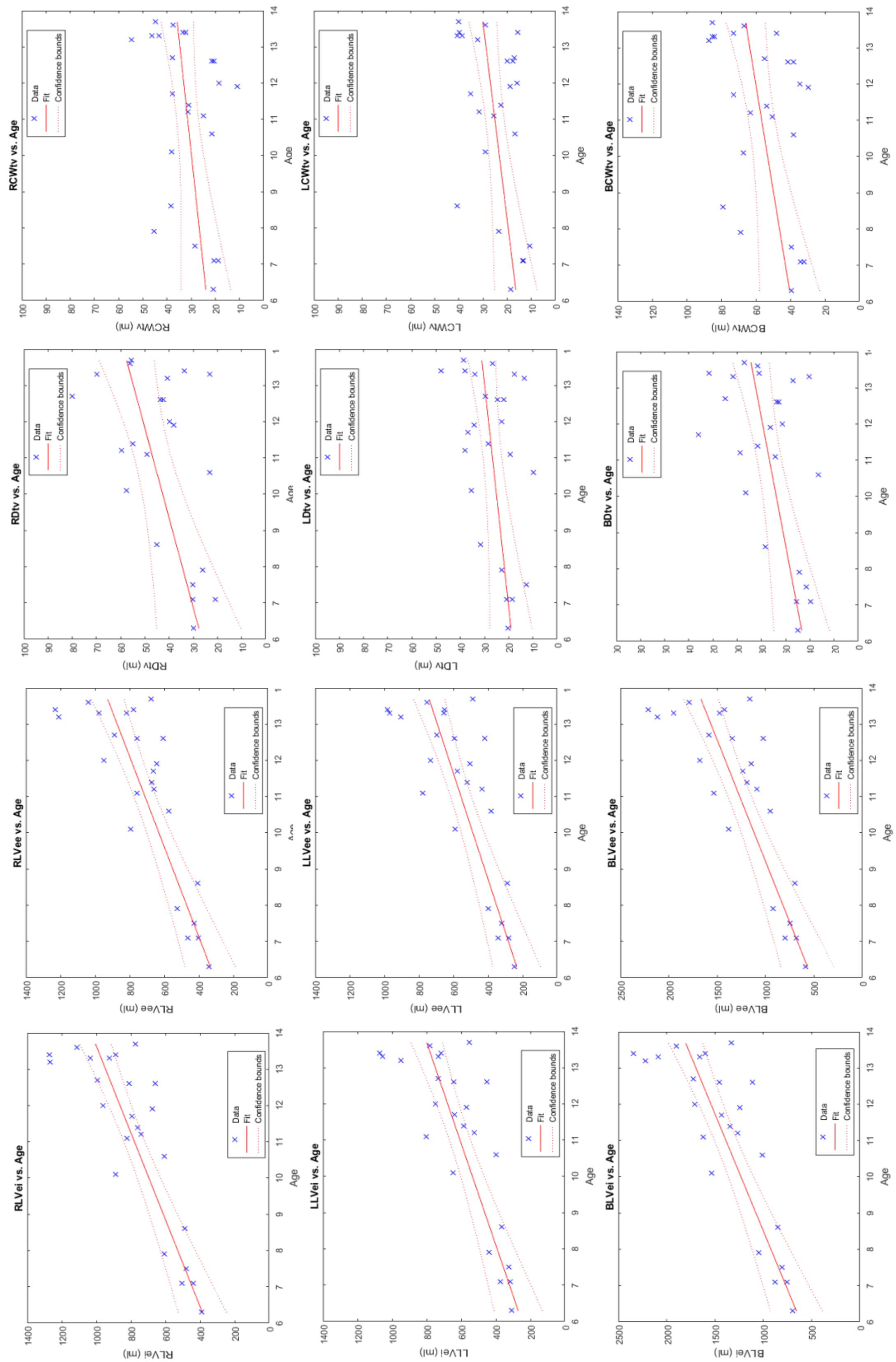
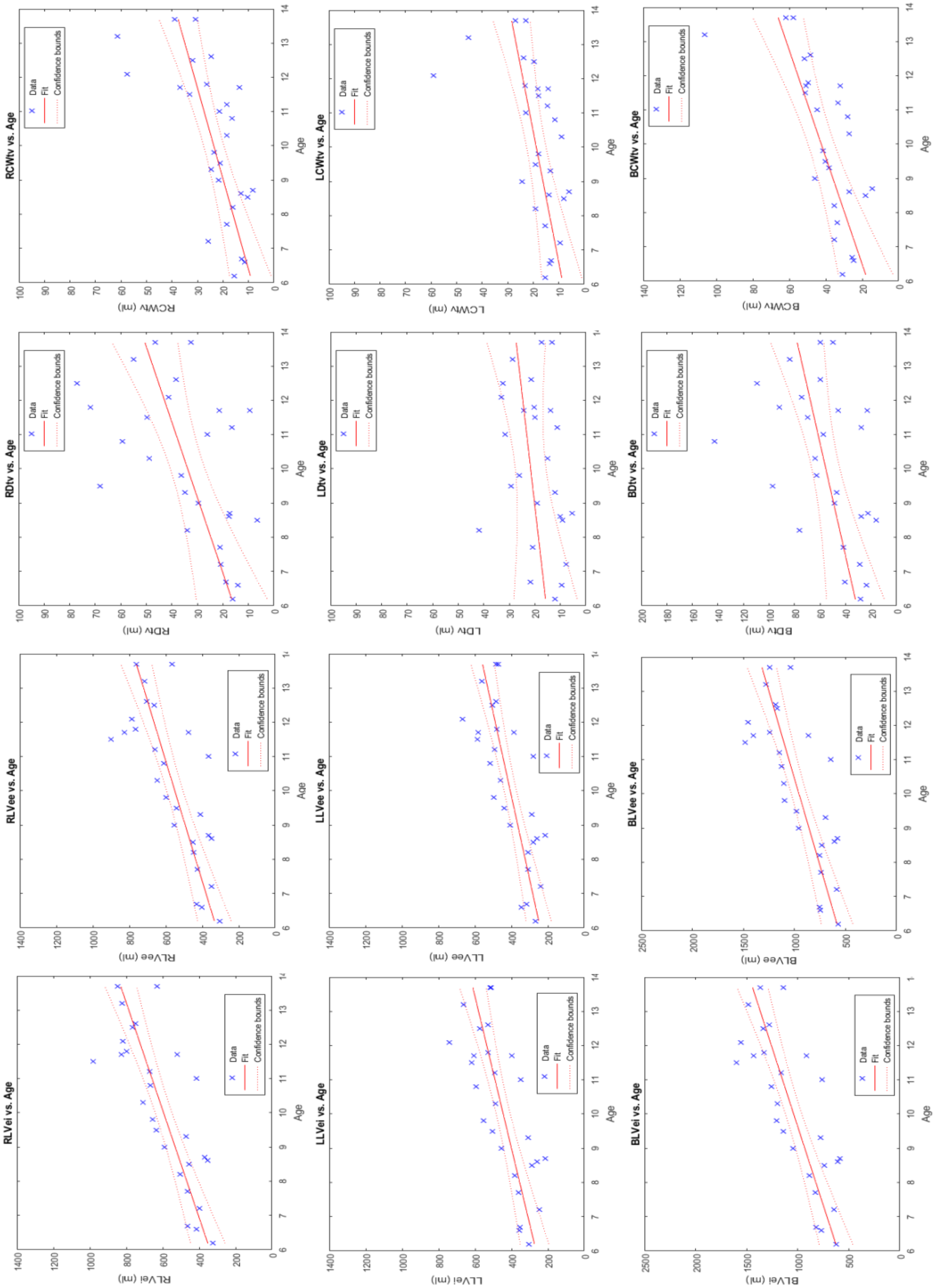


e-Figure 3a.



e-Figure3b.

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