ENHANCEMENT OF BREATHING SIMULATION USING INDIVIDUAL LOBE SEGMENTATION

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To tackle the organ movement simulation, the team has developed a platform to simulate a customized breathing movement, where the pulmonary movement has been considered only at the rough border of the whole lung. The goal of this work is to provide an additional information of the lung lobe movement. Thus, the future simulation will be able to take the tumor into consideration. The platform uses artificial neural networks (ANN) to perform the customized computation. We present a new segmentation algorithm that enables the extraction of each lung lobe individually. The lobe data can then be used to train the neural network.

By using the ANN, the key is to first accumulate and construct the learning set from numerous data. Considering the quantity of data, image processing plays an important role and has been utilized for the CT scans. In order to define the lobe of the lung contour, the prior lung fissures are necessarily determined. The procedure begins from the complete lung with several grayscale levels. The bronchus and blood vessels are then eliminated using 3D region growing and morphology, respectively. Eventually, the fissure is localized by expansion of two interactive points on both sides of the lung, and sliding mask with direction estimation.

The work provides the illustration of lung fissure display. The computation yield significant improvement providing effective lobe of the lung contour. Currently, four lobes are automatically detected using the extracted fissures. The simulation has been verified on several CT image sequences from various patients. The example of the result is shown below:

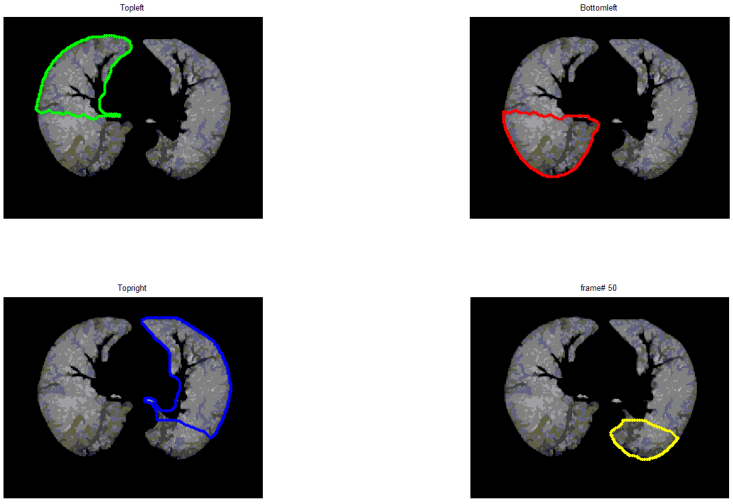

Fig1: Automatic extraction of lobe contours.

The main contribution of this work is dedicated to both radiation therapy and radiation protection. Since the customized simulation of lung movement can be performed independently on each lung lobe, it will allow us to monitor the tumor during the simulation, and compare the lung movements regarding the breathing phases. The clue combination of fissures and primary lung contour provides adequate numbers of points, as the input data to build the learning sets for ANN training.