Medical Image Analysis - Task 1

Lung segmentation with TV-L1 - Denoising

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Documentation

Task description

The task in this exercise was to extract the lung from a CT volume set of a human torso. Therefore, we used a denoising algorithm named TV-L1 to remove the small details of the input volume, without blurring the edges and hence keeping good contrast. After the denoising step, we applied a threshold filter to get the dark regions and did a shape labeling step to find connected components. This step yields a set of connected components in the denoised and thresholed picture. In our case, the lung is the second biggest region (the background corresponds to the biggest region). The result of the whole task is a lung mask, which we can use as a starting ground for the second task, in which we want to enhance the lung vessels.

Implementation

We followed the guidelines of the pdf in which the task was described and used the ITK framework for our implementation. We think our code should be self-explanatory, that's why we are not losing too many words about the implementation.

TV-L1 denoising

We implemented the algorithm according to the pdf and the slides we saw in class. This implemenation was pretty straightforward, the only obstacle was to adapt to using the ITK framework. The comments in the code should make clear what is going on.

Thresholding

For thresholding we used the *OtsuThresholdImageFilter* of the ITK framework. As outside value we used 255(white) and as inside value 0(black). The number of histogram bins was given in the task decription and was set to 128.

This operation yields a binary image.

Shape Labeling

After thresholding the denoised volume, we had to find connected components. Therefore we used the *BinaryImageToShapeLabelMapFilter* to find these connected components in the binary image and label them.

As described before, we are looking for the second largest shape label. This is the label we used as a mask to find the lung.

Results

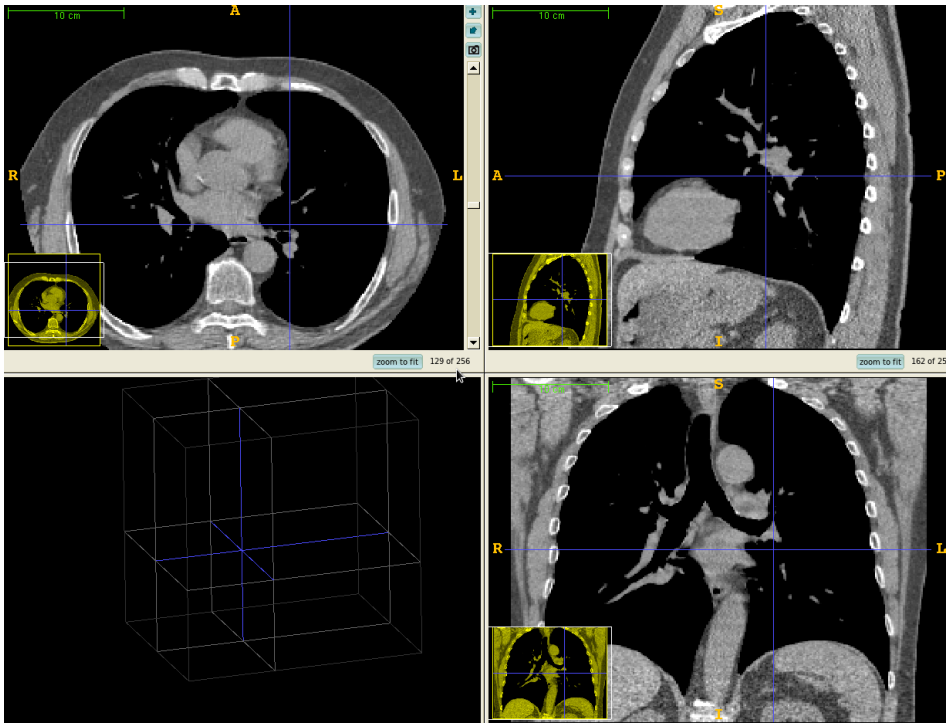

Figure 0.1.: The input volume of the CT

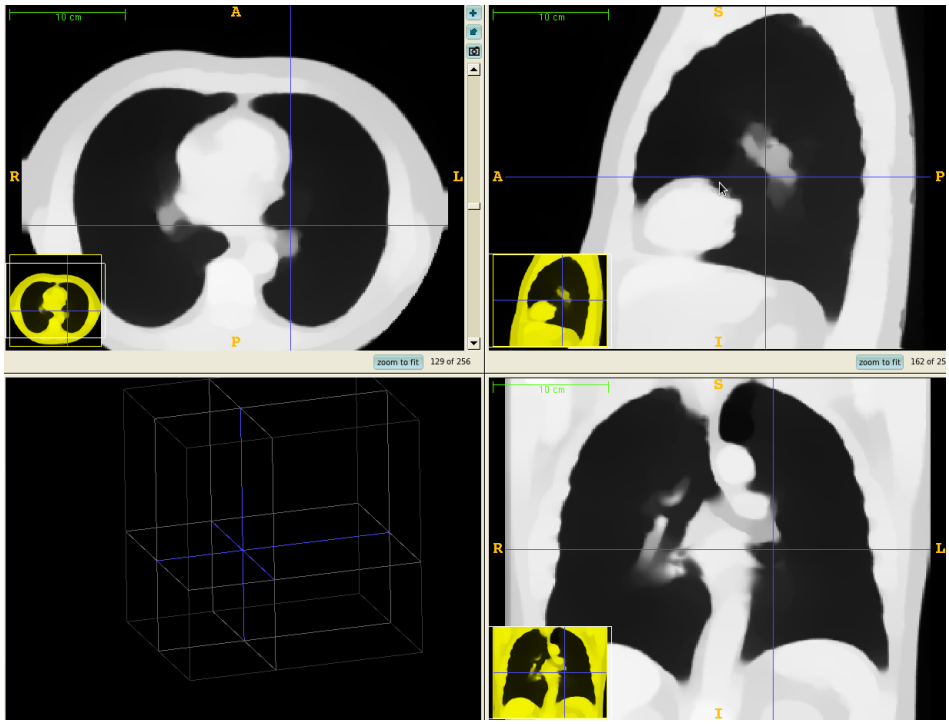

Figure 0.2.: The volume after the TV-L1 denoising step

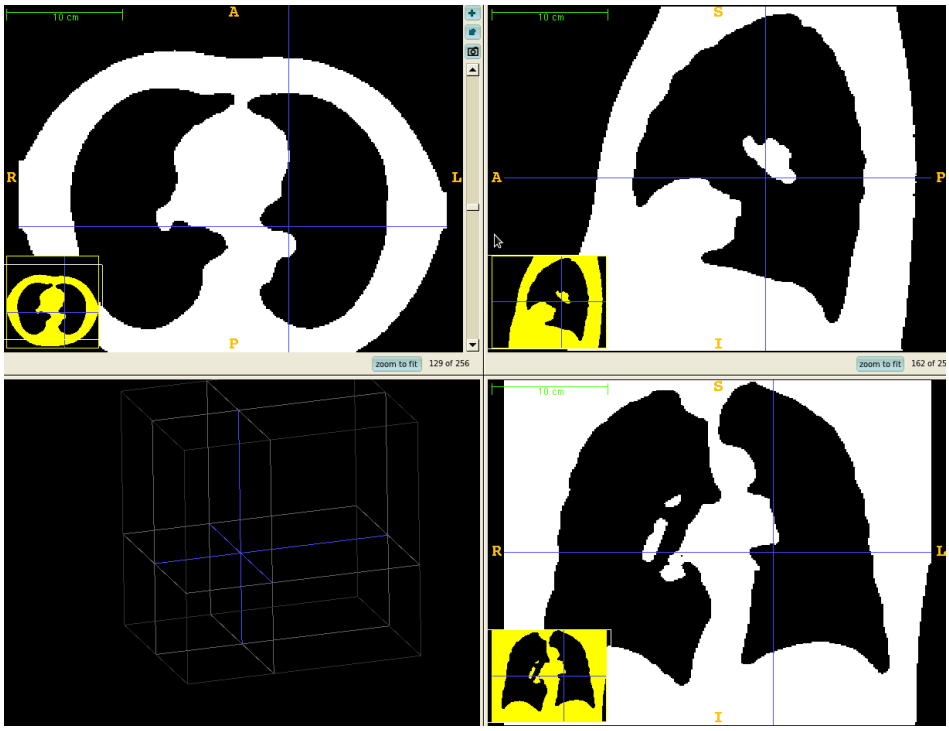

Figure 0.3.: The volume after denoising and thresholding

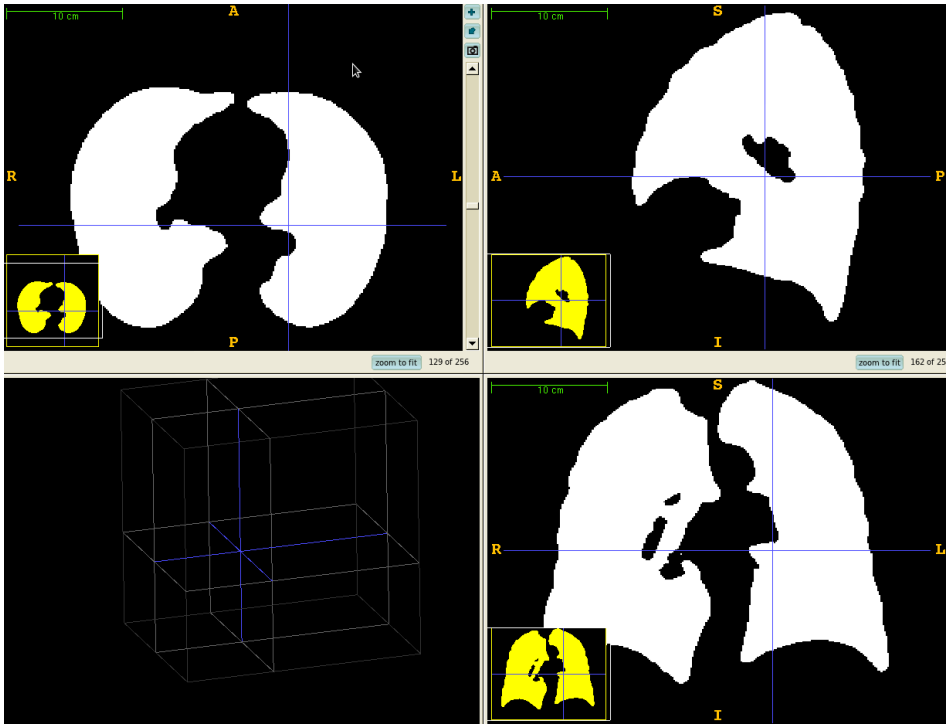

Figure 0.4.: The final result of our lung segmentation