

Volumetric Image Visualization

Prof. Alexandre Xavier Falcão

Task 2

1 Maximum Intensity Projection

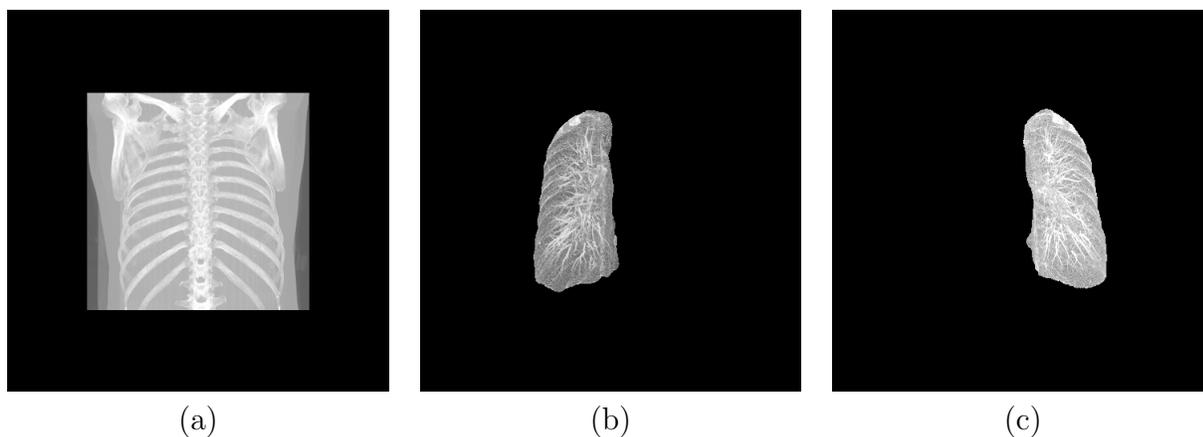


Figure 1: Maximum intensity projections of the (a) thorax, (b) right lung, and (c) left lung of the individual in `thorax.scn` — the image you have in your `libmo815-3dvis` library.

In times of covid-19, patient treatment may be monitored by CT images of the thorax. This imaging modality could be used to assess the severity of the pneumonia in a patient. We have learned that ALTIS [Sousa-MedPhy19] can be used for fast and automatic lung and trachea segmentation in abnormal CT images of the thorax. Once segmented, the maximum intensity projection of each lung may reveal important information about the vascular system and abnormal masses inside the lungs for different tilt and spin angles (Figure 1). Therefore, deep neural networks, largely used for 2D images, could be used on those maximum intensity projections to diagnose pneumonia and assess the treatment.

2 Task

You must develop a C code, `MIP.c`, with the following usage:

MIP P1 P2 P3 P4 P5, where

P1 is the name of the input .scn image.

P2 is the tilt angle alpha.

P3 is the spin angle beta.

P4 is an optional parameter — an .scn object mask.

P5 is the output .png image of the maximum intensity projection.

Note that the output image of the maximum intensity projection must be **colorized** based on a blue-to-red (rainbow) color table, with 16 bits per color channel, in order to visually improve the details of the vascular system. You may also apply window & level to adjust brightness and contrast. I did it interactively and, as you can see, the left and right lungs appear with different settings, which might be confusing. If you want to save the grayscale image as well, recall to normalize it between 0-65535 before the conversion to png.

The object mask of a lung is optional. You will find the masks for the left and right lungs inside this package. They are for the image thorax.scn that you have in your libmo815-3dvis library. If you do not present an object mask, your code must create the maximum intensity projection for the entire scene (Figure 1a). If you present an object mask, it must compute the maximum intensity values only inside the mask (Figures 1b-c).

Referências

- [Sousa-MedPhy19] A.M. Sousa, S.B. Martins, F. Reis, E. Bagatin, K. Irion, and A.X. Falcão. ALTIS: A Fast and Automatic Lung and Trachea CT-Image Segmentation Method. *Medical Physics*, doi 10.1002/mp.13773, 46(11), pp. 4970–4982, Nov 2019.