

3D Image Processing

Lab Assignment 4

X-Ray Volume Rendering

Due: 20 January 2015, 9:30am

In this assignment you will write an X-Ray volume renderer based on some advanced wavelet and frequency domain techniques. This assignment is based on the following paper:

M.A. Westenberg, J. B. Roerdink, *X-Ray volume rendering through two-stage splatting*, Machine Graphics and Vision 9, no. 1/2 (2000): 307-314.

http://www.win.tue.nl/~mwestenb/papers/ts_splat.pdf

- (a) (10 Points) Load the same data set as Lab 3 (`1ab3.vol1`) and encode it with 4-level Haar wavelet using `wt3d` you implemented. Visualize it through slicing (as done in lab 3) to make sure you are loading data properly.
- (b) (35 Points) Implement the X-Ray projection only for the coarsest level data using two-stage splatting.
- (c) (35 Points) Implement an incremental method to add the details of each level to the approximation of the previous level.
- (d) (20 Points) Suppose that data is presented in (X, Y, Z) domain and we would like to calculate X-Ray projection along one of the main axes, say X -direction. Can you think of a fast way to compute this projection? Prove your idea mathematically and with simulations. (HINT: the X-ray in X direction is equal to the zero frequency for the $(:, Y, Z)$ signal, for each fixed (y, z) pixel in the final image.)

Submission

You need to submit a pdf report, and one Matlab/Octave function for each task, all in the same folder. Please write your name and student ID on top of each Matlab file as well as the pdf report. Feel free to define other auxiliary functions. I should be able to test your code with the following sequence of commands:

```
img_wt3d = taskA(filename);  
img2d = taskB(img_wt3d, viewing_direction);  
img2d_details = taskC(img_wt3d, viewing_direction);  
img2d = taskD(img_wt3d, axis);
```

If you are using other programming/scripting languages: please provide similar functions. Your code should also include a Makefile to compile and a README.txt explaining the procedure I can follow to test your code and call the functions listed above.