Assignment: CT Scans

Software, Systems and Applications IV - Visualisation

This assignment is to be completed and handed in via DUO. Deadline is 02/05/2018 (please consult the Level 4 handbook). One report and one single source code file have to be handed in, i.e. two files in total. The report has to be a PDF file. If the source code is a C++ file, the first line of the file shall be a comment how to compile it.

Description

We study CT scans. They are voxel fields (regular Cartesian grids) which are given as a set of horizontal 2d image slices. Each voxel is assigned one scalar value. We want to process these data via an application invoked through

./myCode xPixelsPerImage yPixelsPerImage noOfImages File0 File1 File2 ...

If the application is written in Python, the Python interpreter call is to be added as prefix. Each image file is a raw sequence of unsigned 8 bit values, i.e. each image file is xPixelsPerImage x yPixelsPerImage bytes large.

Write an application that loads the sequence of noOfImages data files as specified on the command line and extracts an isosurface model from the CT scan. The isosurface value (threshold) should be around 10% of the maximum voxel value found in the data set.

Implementation

There are two variants to realise this assignment. Only one of them has to be done. Please clarify in your report which variant you have chosen:

a) Write all algorithmic core components yourself (either in C/C++ or Python). In this case, the solution shall be a stand-alone command line tool which yields a VTK model (output file) that we can load into Paraview.

b) Write your own renderer using the Visualization Toolkit (VTK). This is the recommended solution: If you use VTK, you are allowed to use all algorithmic components from this package within your program, notably its isosurface extraction algorithms.

You can find example input data at https://graphics.stanford.edu/data/voldata. VTK file format descriptions (for the first variant a) can be obtained from Paraview's/KitWare's webpage. All source code must include source code documentation (directly within the code).

Report

Write a brief report of at most one page where you summarise your main design rationale, sketch your software architecture, and highlight unique selling points of your solution. Add up to six pages of screenshots documenting how you have tested your application, i.e. what images you have been able to obtain from particular input data sets.

Feedback sheet

Criterion	Mark	Comments
Three different data sets (randomly chosen) are processed correctly, i.e. yield meaningful visualisations. The data will be exactly the format of the example data from https://graphics.stanford.edu/data/voldata.	(/ 60)	
Report is clear and well-written.	(/ 10)	
Quality of code: Description of used VTK components or implemented algorithms from lecture are straightforward to follow, all variables have meaningful names, all steps are clearly highlighted, all functions are documented, and so forth.	(/ 30)	

Total: (/ 100)