Student Project **Performance Optimization on GPU-based Direct Volume Rendering**

University of Zurich
Department of Informatics

Topic

Today, real direct volume rendering (DVR) approaches are an important research area in computer graphics and visualization. Compared to surface rendering approaches, DVR approaches produce real three-dimensional volumes, which allow cuts through the volume and transparent areas. The most popular technique is ray casting, where for each pixel of the screen a ray is shot through the volume. The final color of the pixel is obtained by sampling along the ray. However, due to the ongoing cubic growth of the volume data sets it becomes very difficult to efficiently process larger volumes.

The rendering efficiency can be increased tremendously by taking advantage of the massive parallel computing power of today's graphics processing units (GPUs). This requires the data to be stored on the graphics cards, which limits the size of volume to the available graphics memory. To overcome this limitation, the volume can be split into several bricks (subvolumes), which are transferred sequentially to the graphics card. Bricking methods define schemes to send the parts of the original volume one after the other individually to the GPU as well as they define schemes to reconstruct the data received after computation on the GPU.

Assignment

In this student project, you would implement state of the art bricking algorithms into a readily available GPU-based volume renderer at our lab. This is a hot topic in computer graphics and you have therefore the chance to get insight into the most current volume visualization approaches.

Requirements

Cross-platform application development with QT, C++ and OpenGL

Work Load

- 20% theory
- 60% implementation
- 20% testing

Student Project Type

This project can be done as Master/ Diploma thesis or Bachelor/Semester thesis. Goals are adjusted depending on the project type.

Supervision

Prof. Dr. Renato Pajarola
Philipp Schlegel (Assistant)
Susanne Suter (Assistant)

Contact

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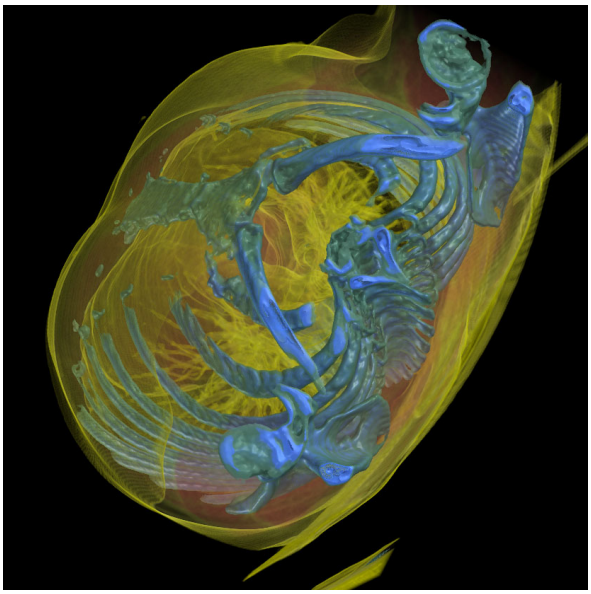
GPU-based direct volume rendering of a human head



GPU-based direct volume rendering of a human chest

VISUALIZATION AND MULTIMEDIA LAB