

Immersive Analytics in Radiology

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Abstract. We present an immersive analytics application to be used by radiologists. The virtual reality application uses direct volume rendering techniques that achieve real-time performance and high image quality. DICOM data can be imported and transfer functions can be manipulated in the virtual environment.

Keywords: Immersive Analytics; Visual Analytics; Virtual Reality; Direct Volume Rendering.

1 Introduction

Immersive analytics [1] merges visual data analysis [2] and immersive environments [3] to support data understanding and decision making. This demonstration presents the results of the master’s thesis [4]. We implemented tools to use immersive visualization in radiology.

We defined a workflow to pre-process volume data sets, especially using the DICOM file format [5]. Users can move around in a virtual room and interact with the data and the application. On the ‘walls’ we display the 2D slices of the data and meta-data imported from DICOM. Using voice recording the users can store remarks and findings for further examination. Figure 1 shows a screen capture of the application.



Fig. 1. Screen Capture — 3D data, 2D slices and meta-data in a virtual environment

To use volume rendering techniques the scalar data is classified using transfer functions, assigning color and transparency [6]. The transfer function can be edited a-posteriori in real-time in the virtual environment. Figure 2 shows a screen capture of a session and the interactive editing. The classification can be changed at any time and the results are visualized immediately. The defined transfer functions can be stored and retrieved for re-use.



Fig. 2. Interactive editing of transfer functions

2 Conclusions and future work

The implemented virtual environment is a proof of concept for the application of direct volume rendering of radiology data sets with high frame rates on modern virtual reality equipment like HP Reverb or HTC Vive Pro.

We visualized the complete visible human dataset [7] in the application. Using all the data we ran in memory problems, although the application runs on a workstation with 32 GB RAM and a NVIDIA GeForce 2020 GPU. To load such large volume data sets on the GPU compression and clipping algorithms will be implemented and integrated in the shaders.

Due to the pandemic situation we could not do a user study. We plan to do a usability study at our campus to test the UX design. As soon as possible we will do a workflow study in close cooperation with the colleagues at the radiology department at the University Hospital in Homburg/Saar.

The implemented software can be setup as an immersive learning application [8], e. g. for anatomy or biology classes.

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