New Ways of Exploring the Visible Human Data Set

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Introduction

The computer system virtusMED (*Virtu*al *S*cenes for *M*edical *E*ducation and *D*iagnosis) utilizes techniques of Virtual and Augmented Reality (VR/AR) for the exploration of the Visible Human data set. The project's goal was to create an affordable solution that provides high-end visualization and sophisticated human-computer interaction to improve the understanding of human anatomy and medical imaging. The main result is a new kind of human-machine-interface beyond the traditional keyboard and mouse approach.

Methods and Materials

The standard PC based system virtusMED visualizes the different types of the Visible Human image data (photographic images, CT and MRI) within a three-dimensional virtual scene. The view of this scene is determined either by a conventional computer mouse, a head-mounted display or a freely movable flat panel. By relocating and rotating a virtual examination probe, which is designed similar to a medical ultrasound probe, oblique slice images are generated which are reconstructed from the given data. Additionally, several virtual 3D models (e.g. skin, bones, inner organs) can be integrated into the scene. In particular, the system uses the segmentation data from the Voxel Man project (Thanks to Prof. Hoehne, Department of Computer Science in Medicine of the University of Hamburg, Germany). Multiple slices can be visualized simultaneously [Fig. 2, right] and objects can be clipped by the current slice. Furthermore, the system can display the current slice as a planar image, thus simulating a conventional 2D ultrasound examination [Fig. 3, left].

Fig. 1 Learning human anatomy. Left side: Using a sketch of the human body (coronal reconstruction of the Visible Human photographic images), the medical student can examine a virtual patient. On the screen arbitrary slice images are presented within a virtual 3d scene. Right side: Main user interface to produce these slices is the virtual examination probe which can be used like a medical ultrasound probe.

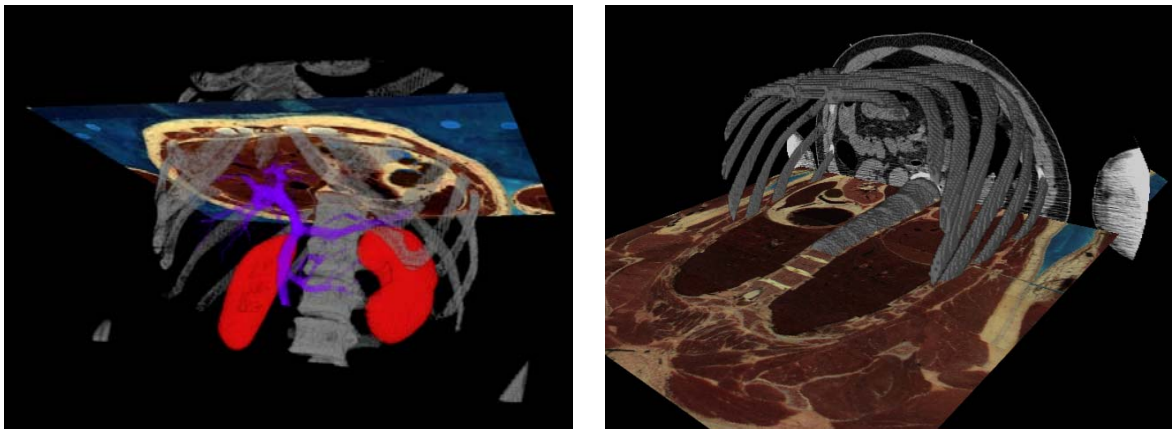

Fig. 2 Data from the Visible Human Project is utilized to create 3D virtual scenes for educational purposes. Left side: An oblique reconstructed photographic slice image and virtual anatomical models (bone structures, kidneys, vessels) are shown. Right side: The virtual scene shows one photographic slice image (foreground, longitudinal) together with a CT slice (background, transverse), both created with the virtual examination probe. In addition a 3d model of bone structures is visualized.

Fig.3 Two examples of virtusMED's visualization features: Left side: Displaying the current slice image as planar image, thus simulating an ultrasound examination based on the Visible Human data set. Right side: Using the freely movable flat panel to produce conventional radiographs in any view (Virtual X-ray scenario).

For assessment of CT data, an additional feature is provided. By moving a flat panel around, the user is able to produce arbitrary virtual x-ray images, thus simulating a real examination based on conventional radiographs [Fig. 3, right].

Results and Discussion

Using a standard PC platform, virtusMED provides an interactive real-time (!) visualization of the Visible Human data set and other medical image data, including volume rendering of virtual models and creation of multiple oblique slice images. virtusMED has been shown to be a very valuable tool for medical education. The system can be applied for learning human anatomy in addition to conventional teaching material (such as books or multimedia CD-ROMs) as well as for sonography training. It helps especially to improve the understanding of spatial relationships due to its intutive user interface(s). Compared to VR systems of the past, the system virtusMED represents a low-cost solution, which is easy to install, handle and maintain. The virtual examination probe has shown to be a simple, but very effective user interface to gather information about any volumetric data.

Further information can be obtained at http://www.virtusmed.com