VR for Medical Imaging Data in Unity using VTK

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1. Abstract

The use of Virtual Reality (VR) with volumetric medical imaging data such as computed tomography (CT), magnetic resonance (MR) and 3D Ultrasound (US) is of significant interest as a way to address the limitations of viewing and interacting with fundamentally 3D data on a 2D screen. To become widely adopted VR medical imaging systems need to be intuitive and comfortable to use, have fast, high quality rendering, and provide the functionality users have come to expect from existing applications.

We propose a system that combines advanced medical imaging features with VR capabilities, enabling a more natural and intuitive way of analysing and understanding 3D medical images.

2. Methods

Our system uses the HTC Vive and allows the user to load CT, MR or US data from the scanner without the need for time consuming segmentation or model building. The user may then easily examine and manipulate the 3D nature of images, and interact by cropping, placing landmarks, altering its appearance and slicing it in an intuitive way directly using the volumetric rendered image, instead of 2D cut slices.

We aimed to incorporate the volume rendering technology of the Visualisation Toolkit (VTK) into the video games development platform Unity. VTK is a de facto standard within the medical visualisation community, already widely used for volume rendering in applications. Unity is an industry standard development platform, which allows fast and flexible development and compatibility with a wide variety of display and interaction hardware.

3. Results and Discussion

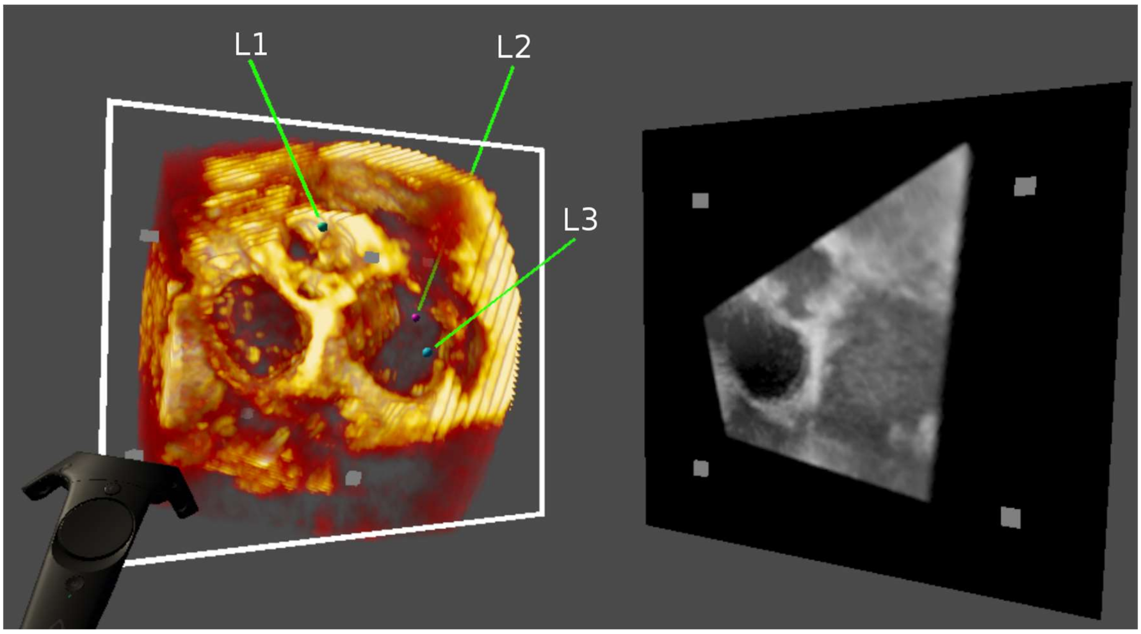

Figure 1: VR (using HTC Vive) visualization of medical imaging data: 3D rendered volume and a 2D slice

We have integrated Unity and VTK through the Unity native plugin system and low level modifications to the VTK library. Our integration maintains high rendering performance for VR, with a friendly user interface for developers. An example of a rendered ultrasound volume with a clip plane and the resulting 2D slice, controlled by a HTC vive, is shown in Fig. 1.

In order to make the system as clinically useful as possible, any manual or time consuming special steps to prepare data should be avoided. Our system allows volumetric rendering in VR, as opposed to most medical VR systems which rely on surface rendering techniques. Surface rendering requiring the skilled and time consuming segmentation of the source volume data to extract a surface model. Our proposed system can render volumes directly from the acquired data.

4. Conclusions

Our system allows to combine state of the art VR development capabilities with the most widespread visualization library for medical imaging. Future plans include the sharing of our platform with the research community, allowing a wide variety of VR medical imaging researchers to take advantage of our work.

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References

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