

Chapter II

Grid-Based Visualization and its Medical Applications

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ABSTRACT

Traditional visualization approaches cannot handle new challenges in the visualization field such as visualizing huge data sets, communicating between existing visualization systems and providing interactive visualization services, widely. In this chapter, the authors introduce an emerging research direction in the visualization field, grid-based visualization, which aims to resolve the above problems by utilizing grid computing technology. However, current grid computing technology is almost batch job-oriented and does not support interactive visualization applications natively. In this chapter, the authors implement a grid-based visualization system (GVis) which utilizes large-scale computing resources to achieve large dataset visualization in real time and provides end users with reliable interactive visualization services, widely. In GVis system, current grid computing technology is extended to support interactive visualization applications.

INTRODUCTION

Brief Introduction of Visualization

Visualization is the process of transforming scientific data or sampled data into graphical image by utilizing computer graphics and image processing technologies (Drebin, 1988; Kaufman, 1991; Kaufman, 1997). By transforming raw data into understandable graphical image, visualization allows scientists and researchers to gain understanding and insight into the data and the subjects that are studied. Due to this capability, visualization has been widely used in a variety of science and commercial areas since its arising, such as medicine, biology, biological chemistry, atmospheric physics, earth physics, computational fluid dynamics, finite element analysis, meteorology, oil and gas exploration and production, and so

forth (Funchs, 1989; Shi, 1995; Lum, 2002; Bethel, 2003). Figures 1, 2 and 3 present some examples of medical and scientific visualization.

User interactivity is an important feature of user-centered visualization applications, which allows doctors, researchers and scientists to explore the data more directly and effectively. For example, when viewing medical imagery with moderate to high levels of transparency, doctors can perform operations such as moving, rotation, selection and zooming of the visual representation to gain enhancement and efficiency in the visual perception of the image (Russell, 1987). Interactive visualization can also make computational steering enabled as scientists or doctors can change the parameters of simulation dynamically and see the effect of this change immediately.

According to the conceptual model proposed by Harber and McNabb (1990), the overall visu-

Figure 1. Visualization of a tooth with different three dimensional transfer functions (From Chuck Hansen, University of Utah)

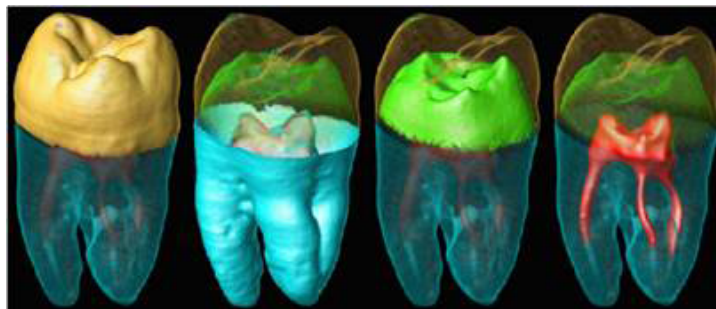
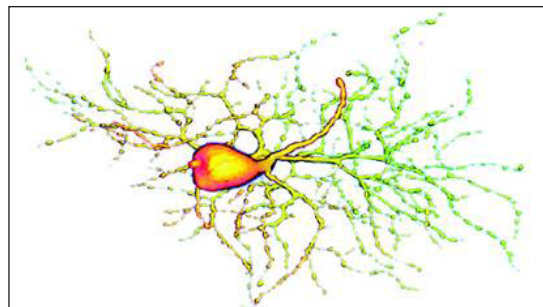


Figure 2. Illustrating ganglion cells (Lum, 2002)



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