Illustrative Visualization of Segmented Human Cardiac Anatomy Based on Context-Preserving Model

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Background:Heart is one of the most important organs of human beings. Due to the complexity of the cardiac anatomical structure, good visualization would be beneficial to no-invasive clinical approach, pathology research, presurgical planning, and medical training. Method: The layered structure of human heart is a challenging task for visualization. In this work we adopt the context-preserving volume rendering model which has been widely applied to layered medical data sets. We design a novel lighting model and an interactive tuning transfer function to enhance the tissue silhouettes. In this work, we focus our research on the following parts: 1. A Graphic Processing Units (GPU) based ray casting algorithm is implemented; 2. A transfer function is designed to map the gray scale in 3D cardiac data to the corresponding optical attribute according to the anatomical structure; 3. A context-preserving volume rendering model is adopted to visualize the interior and exterior structures of cardiac volumetric data with preserving the whole heart silhouette; 4. A gradient magnitude based opacity computing method is proposed to enhance the boundary among different components of cardiac anatomical model; 5. An interactive method for tuning transfer function parameters is designed. Results: Our method can very clearly reveal the interior structure of heart while preserving the silhouette of the whole heart. By means of proposed interactive method for tuning transfer function parameters, one can focus his attention to an interested part and observe the detailed structures without losing global information. In addition, our approach has been implemented in a system equipped with an NVidia GeForce 9600 GPU. The rendering performance is 25 frames per second and meets the requirement of a real time system. The results show that the proposed method is well-suited for the layered 3D cardiac anatomical data.