Visualization Techniques for 3D Microscopic Imaging Data

ABSTRACT

Three-dimensional (3D) microscopic imaging techniques such as confocal microscopy have become a common tool in measuring cellular structures. While computer volume visualization has advanced into a sophisticated level in medical applications, much fewer studies have been made on data acquired by the 3D microscopic imaging techniques. To optimize the visualization of such data, it is important to consider the data characteristics such as thin data volume. It is also interesting to apply the new GPU (graphics processing unit) technology to interactive volume rendering of the data. In this paper, we discuss several texture-based techniques to visualize confocal microscopy data by considering the data characteristics and with support of GPU. One simple technique generates one set of 2D textures along the axial direction of image acquisition. An improved technique uses three sets of 2D textures in the three principal directions, and creates the rendered image via a weighted sum of the images generated by blending the individual texture sets. In addition, we propose a new approach based on stencil such that textures are blended based on a stencil control. Given the viewing condition, a texel needs to be drawn only when its corresponding projection on the image plane is inside a stencil area. Finally, we have explored the use of multiple-channel datasets for flexible classification of objects. These studies are useful to optimize the visualization of 3D microscopic imaging data.