Interactive 3D Virtual Colonoscopy System

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Abstract

We describe a low-cost three-dimensional (3-D) virtual colonoscopy system that is a noninvasive technique for examining the entire colon and can assist physicians in detecting polyps inside the colon. Using the helical CT data and proposed techniques, we can three-dimensionally reconstruct and visualize the inner surface of the colon. We generate high resolution of video views of the colon interior structures as if the viewer's eyes were inside the colon. The physicians can virtually navigate inside the colon in two different modes: interactive and automatic navigation, respectively. For automatic navigation, the flythrough path is determined a priori using the 3-D thinning and two-pass tracking schemes. The whole colon is spatially subdivided into several cells, and only potentially visible cells are taken into account during rendering. To further improve rendering efficiency, potentially visible cells are rendered at different levels of detail. Additionally, a chain of bounding volume in each cell is used to avoid penetrating through the colon during navigation. In comparison with previous work, the proposed system can efficiently accomplish required preprocessing tasks and afford adequate rendering speeds on a low-cost PC system.