

Real-time Three-Dimensional Reconstruction for Volume-Based Surgery Simulations

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摘要

Abstract

This paper describes a three-dimensional reconstruction method to provide real-time visual responses for volume (constituted by tomographic slices) based surgery simulations. The proposed system uses dynamical data structures to record tissue triangles obtained from 3D reconstruction computation. Each tissue triangle in the structures can be modified or every structure can be deleted or allocated independently. Moreover, triangle reconstruction is optimized by only deleting or adding vertices from manipulated voxels that are classified as erosion (in which the voxels are changed from tissue to null) or generation (the voxels are changed from null to tissue). Therefore, by manipulating these structures, 3D reconstruction can be locally implemented for only manipulated voxels to achieve the highest efficiency without reconstructing tissue surfaces in the whole volume as general methods do. Three surgery simulation examples demonstrate that the proposed method can provide time-critical visual responses even under other time-consuming computations such as volume manipulations and haptic interactions.