醫學工程第十卷第二期・民國７９年１２月
JBMESROC Vol. 10 No. 2 Dec. 1990

INTERACTIVE 3-D DISPLAY SYSTEM OF TOMOGRAPHIC IMAGES

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ABSTRACT

The purpose of this study was to develop a fast and interactive environment for the 3-D display of tomographic slices on a PC-based image processing system. A modified front-to-back(FTB) algorithm and dynamic color look-up-table were proposed for improving the efficiency of voxel processing, displaying transparent object and maintaining the interaction of operation.

The algorithm traversed visible voxels from the nearest voxel to the farthest one in slice-by-slice sequence and modified the projected pixels on screen according to the opacity of pixel. We eliminated those invisible voxels and non-surface semi-transparent voxel before projection and build a "visible surface voxel start-end encoded table" to minimize the amount of processed voxels.

In our experiment, voxels were mapped to different material intensity, opacity and color according to the threshold segmentation or the user-defined threshold value. Then the gradient of material intensity was used to estimate the normal vector of a surface likelihood. This method could create a more detailed image than depth-only shading and depth gradient shading methods.

In display system, besides the presentation of semi-transparent and opaque object, cut-away viewing technique could present the 3-D image together with the corresponding cut slice that showed the inner structure and information. After creating 3-D images from different viewpoints or different threshold value, the system could do real-time cine with the feasibility of changing or rotating the object in two degrees of freedom. For the application of SPECT, the system took only about 0.7 second to create a 3-D image. For the application of X-CT, the system could also provide physician better interpretation about the spatial relation of two structure like bone and soft tissue.

In summary, we have developed an effective system to display 3D images of tomographic data without special hardware in a popular PC.