同空間並存多組容積資料的容積立體顯像法

Volume Visualization Algorithms for Multiple Sets of Volume Data Coexisting in The Same Space

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摘要

由容積資料所得的組織立體影像可幫助臨床醫生觀察各種解剖結構。近來的MRI機器可以在同一定位上而以不同方向來掃描，可使人體組織較小或較薄的地方獲得更好的解析。此法比只掃描一個方向更有效、更經濟。但現今仍沒有此同空間多組容積資料並存的立體顯像法。在本研究中我們使用局部二次式來近似單組容積資料中的同質面。此二次表面乃從2×3×3的相鄰容積素中得到的3×3樣點來求得。對多組容積資料，我們分別計算各組容積資料中的二次表面，而不將各組容積資料組合後再來計算。對於佔有同空間的各組容積之二次表面，我們取較近視點者來作顯像。我們使用3D DDA演算法來改進計算效率並有效取得視線所通過之容積素。利用DDA搜尋的資訊，我們可知各組容積資料中，是否存在著欲觀察組織之二次表面。在多組容積資料都解析到解剖結構時，則計算各組之局部二次表面以顯像。如果只有單組容積資料解析到時，則以單組容積資料來作顯像即可。這可使得多組容積資料之顯像時間不會比單組容積資料時多太多。

Abstract

3D images of various tissues assist the clinician in observing anatomical structures. Recent MRI machines can generate multiple sets of volume data from various directions under the same positioning. As the result, we can get better resolution for small or slender anatomical structures. This is more effective and economical than from only one direction. However, there are still no methods for visualizing multiple volume data that occupy the same space. We used a local quadratic formula to reconstruct the isosurface in a voxel extent. We calculate the quadratic surface from 3×3 sample points that are determined from $2 \times 3 \times 3$ neighboring voxels. For reconstructing the isosurface of multiple volume data, we calculate the quadratic surface for each volume data respectively rather than combine all volume data. Among the quadratic surfaces that occupy the same space, we consider the near-viewpoint one as visible. We use the 3D DDA algorithm to improve computing efficiency and to obtain ray traversal information. By the traversal information, we know the voxels that the ray intersects in all volume data. We need to compute more than one quadratic surface only when more than one volume data resolve the anatomical structure. Therefore, the increased computation time of multiple volume data is small comparing to the case of only one volume data.