Multigrid methods and automatic segmentation: an application to CT images of the liver

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Resumen

Quantitative analysis of CT and MRI medical images provides an extremely useful tool for medical diagnosis [1]. This analysis is based on image denoising, voxel-based tissue classification, segmentation of organs and tissue boundaries, estimation of physiological parameters and other imaging techniques. In this talk we address the practical problem of liver volumetry as a required step for the clinical planning of liver surgery and resection. For this application, we consider a segmentation technique based on the Chan-Vese model [2] which lead us to a nonlinear diffusion process driven by some low order local statistics of the image.

Once the model is built up, the computational cost of the image processing represents, usually, the trade off between good segmentation and numerical efficiency. In fact, typical 3D images cannot be efficiently processed with a descent method (which amounts to consider the naturally associated parabolic problem and waiting for stabilization) and this motivates our work whereas a quasilinear elliptic equation is numerically solved by a fully 3D multigrid method [3, 4]. We show the results on different data sets and the obtained segmentation is compared to manual delineation by an expert. The computational issues shall be discussed compared to a classic descent method.

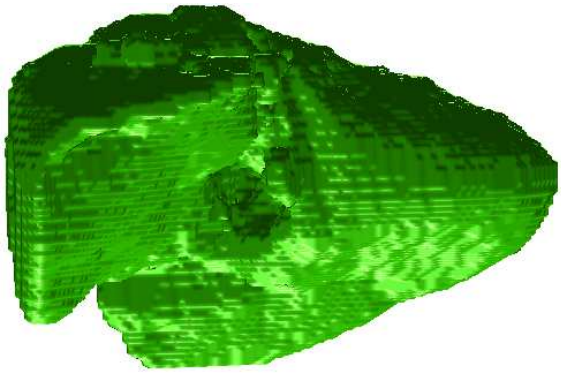

Figura 1: This figure shows the result of the segmentation of the liver using the Chan-Vese algorithm applied to a CT 3D image. The image used in our study were acquired at the Alcorcon Hospital in Madrid. The dimensions are (512x512x40); spatial resolution is (0.74x0.74) mm and slice thickness is 5 mm.

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Referencias

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