

H30年度修士論文

題目 : Segmentation of Spine Region in CT Images Using 3D Edge Detection and 3D Region Growing Method

氏名 : 付 光華 (Dong Ran)

Recently, bone metastasis is considered as one of the life-threatening diseases that cause death. Bone metastasis is abnormal tissue masses inside or around the spinal cord and spine. Early diagnosis is an important factor in the treatment of spinal tumors. In clinical diagnosis, an accurate image-guided treatment plan for radiation therapy needs to define the treatment volume and clearly define the normal tissue, and its exposure should be prevented or minimized. Segmentation procedures that accurately divide the target volume and related organs can greatly reduce the time and effort of radiation therapy and surgical planning. To analyze the treatment, it is necessary to segment the spinal region based on an accurate three-dimensional image processing technique. In this thesis, we propose an image segmentation method based on 3D edge detection and 3D region growing techniques.

The limitation of region-based segmentation is that there are chances of under-segmentation and over-segmentation of regions in the image. For the spine, the bone region, a hybridized approach of edge and region is proposed. The 3D approximate Canny edge detection method is first used to determine the initial ROI growth range. Based on the 3D region growing method, estimate gradient to obtain the gradient histogram is used to select the initial seed points set. Such a collection of homogeneous voxel-groupings is identified by choosing an initialization threshold in a low gradient range. The region growing begins at a voxel position with a small gradient magnitude and ends at a location with a large gradient magnitude, producing a map comprising the initial partition (or subvolume) set. Considering that the shape of the spinal canal is similar to a circle, the Hough Transform is used to locate the ROI to find the seed points. Similarly, based on 3D region growing techniques, the spinal canal surrounded by the spine is segmented.

The proposed method has been tested on various synthetic and real CT images which are obtained 3373 CT slices of from 10 datasets. In view of the fact that the slices are selected from different parts of the body in different shapes of the spine region, the accuracy of segmentation was measured by the metric, Intersection over Union (IOU) is used as the performance evaluation of target extraction by the region growing method. About evaluation of vertebral segmentation with the proposed method, IOU is 92.48 [%] and IOU of spinal canal is 77.32[%]. Besides, the proposed method achieves the balance between accuracy and speed.