

AUTOMATIC EXTRACTION OF TISSUE FORM IN BRAIN IMAGE

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Abstract: *For the simulation of surgical operations, the extraction of the selected region using MR images is useful. However, this segmentation requires a high level of skill and experience from the technicians. We have developed an unique automatic extraction algorithm for extracting three dimensional brain parenchyma using MR head images. It is named the "three dimensional gray scale clumsy painter (CP), moves along the contour of the selected region and extracts the region surrounded by the contour. This method has advantages compared with the morphological filtering and the region growing method. Previously, this method was applied to binary images, but there were some problems in that the results of the extractions were varied by the value of the threshold level. We introduced gray level information of images to decide the threshold, and depend upon the change of image density between the brain parenchyma and CSF. We decided the threshold level by a map of the vector of templates, and changed the map according to the change of image density. As a results, the over extracted ratio was improved by 36%, and the under extracted ratio was improved by 20%.*

Introduction

For the simulation of surgical operations, the extraction of the selected region using MR images is useful. However, this segmentation requires a high level of skill and experience from the physicians. We have developed an unique automatic extraction algorithm for extracting three dimensional brain parenchyma using MR head images. It is named the " three dimensional gray scale clumsy painter method". In this method , a template having the shape of a pseudo-circle, a so called clumsy painter, moves along the contour of the selected region and extracts the region surrounded by the contour.(Fig. 1) .

Method

The algorithm of the method is divided into two processes. The first one's called the edge-searching process and the second one's the edge -following process. The purpose of the first process is to set an appropriate initial condition. In the edge-searching process, the initial point of the template is placed manually so that the template is included in the interested region. The basis of this method is that the template of the approximate circle type(Fig. 2) is made to move along the contour of region of interest, after the image of the cerebral parenchyma was transferred to binary image, and that the shape of region of interest is extracted using the locus.

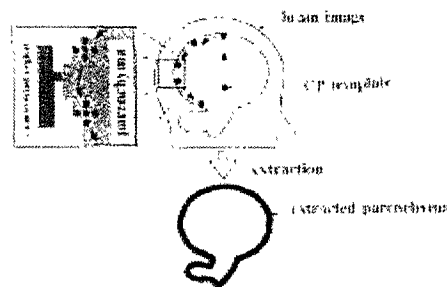


Fig.1 Schematic diagram of brain parenchyma extraction process

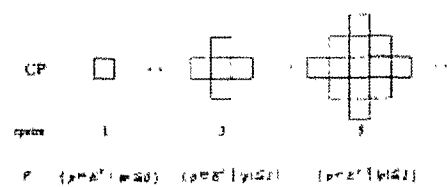


Fig.2 Digital shapes of CP templates in two dimensional CP method

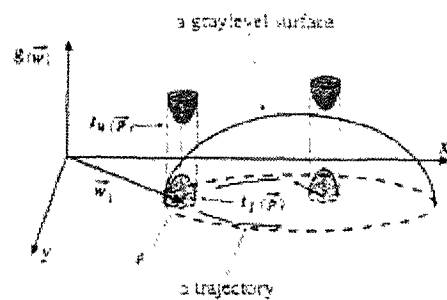


Fig.3 Schematic representation of a trace of CP Template in the edge of parenchyma

It is possible to obtain the optimum value of K from the histogram of difference image between the T2 weighted image and Proton density image. In the Fig. 4, the distribution having a peak value at density 127 correspond to the background except brain organ. It is here, and the distribution of cerebral parenchyma is made to be fbp. Mean value of fbp is μ , standard deviation σ is calculated. Finally, K is decided from this T. The above algorithm is shown in the flow chart. (Fig. 5)

Results & Discussion

As a results, the boundary between distribution of the cerebral parenchyma and distribution of the CSF was clarified. It is possible to rightly require the threshold to separating the cerebral parenchyma from the CSF. The proposed technique has introduced the excellent improvement. The extraction accuracy as follows;
Excessive extraction ratio was reduced from 1.79% to 1.16%.
Lack of extraction ratio was reduced from 2.44% to 1.95%.
We shall also display three-dimensional image in order to visually show the result improving the extraction accuracy.

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