Multiple Sclerosis Diagnosis with Fuzzy C Means

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INTRODUCTION

Image segmentation is, was and will be a major. research topic for many image-processing researchers. Most computer vision and image analysis problems require a segmentation stage in order to detect objects or divide the image into regions, which can be considered homogeneous according to a given criterion, such as color, motion, texture, etc.

Sometime is necessary to adjust computer vision to human vision. Especially is it necessary, when we are segmenting images, which were segmented by people and we try to replace people with computers or when we want to help people in segmentation of images. Typical application is medicine, e.g. segmentation of MRI images or dermatological images.

MS is an inflammatory demyelinating and degenerative disease of the central nervous system (CNS), distinctive pathologically by a different part of brain inflammation, demyelination, axonal loss, often causing motor, sensorial, vision, correlation and cognitive impairment. Finding an accurate method for diagnosis MS disease, will help the patients. A variety of methods for automatic analysis and segmentation have been developed that the image can be segmented into its basic elements. In my work, I used Canny segmentation method and FCM .

HIGHLIGHTS

- A novel method for diagnosis the Multiple sclerosis disease
- An adaptive learning rate based Fuzzy clustering algorithm

PROBLEM FORMULATION

Edge detection is an image processing technique for finding the boundaries of objects by detecting discontinuities in brightness, it is also used for image segmentation and data extraction by using some famous methods. In this paper, Laplacian edge detection method and Fuzzy Clustering.

Laplacian method searches for zero crossings in the second derivative of the image to find edges. An edge has the one-dimensional shape of a ramp and calculating the derivative of the image can highlight its location. the zero-crossing of differentiated signal as edge points. The two dimensional Gaussian operator G(x , y) is given by

$$G(x,y) = \frac{1}{2\pi\sigma_x\sigma_y} e^{-\left(\frac{x^2}{2\sigma_x^2}+\frac{y^2}{2\sigma_y^2}\right)}$$

For detecting edges, searching for zero-crossing in 2nd order derivative of the image needed which f(x,y) is the image:

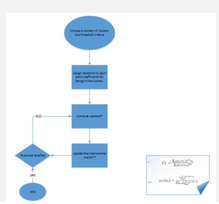
$$g(x,y) = \nabla^2 G(r) * f(x,y)$$

$$\nabla^2 G(r) = \frac{-1}{4\pi\sigma^4}\left[1-\frac{r^2}{2\sigma}\right]e^{\frac{r^2}{2\sigma^2}}$$

Fuzzy Clustering

Fuzzy c-means (FCM) is a data clustering algorithm in which a dataset is grouped into n clusters with any data point in the dataset belonging to every cluster to a main degree. The FCM algorithm assumes that each point belongs to more than one cluster with Given a dataset. Clustering goals to discrete the dataset into different subsets each with a cluster midpoint.

The FCM algorithm is as follow:

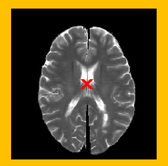


RESULTS

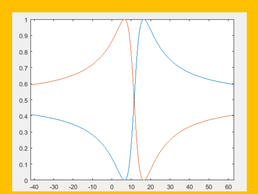
In this paper, first of all, we have to do some pre-processing to our MR Image and extract the brain form the image, which has some data that is not used.

One of our MR image is below:

We want to extract MS lesion from this image and find the center, the result is like below:



After extracting the brain tissue, the process for finding the MS lesion is started. First of all, in this paper, we have a very common way of edge detection , which is CANNY. After adding canny edge detection, FCM is added. You can see the membership plot below:



It should be mentioned that, some other edge detection methods were tested, but canny has the better result in comparison with other methods such as Laplacian of Gaussian or Sobel.

SIMULATION RESULTS

As mentioned in the previous sections, for diagnosis the Multiple sclerosis (MS) disease, extracting the lesion from the MR image is an important thing.

By applying the steps which is mentioned on MR images, we can more effectively observe and tracking Disease progression which is very important in this disease.

The result of this paper is like below, that shows the lesion properly.

REFRENCES:

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