ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.3

Liver Segmentation using Non Linear Diffusion Process and Region Growing Algorithm

K. Sophia[1], P.Suresh[2]
Department of Computer Science and Engineering
Sethu Institute of Technology, Tamil Nadu, India

Abstract:
The segmentation in medicinal images was more helpful for the identification the separate organs from the images if there are any organs in the scan like abdominal scan. The image was clean using Gaussian filter which annul the blast in the input images. Thresholding process is employed inorder to identify and eliminate portions other than liver in the abdominal scan image. Nonlinear dispersal is enforced to the threshold applied image inorder to eliminate the other portions further. Improved district growing algorithm is enforced for which the larger portion segmented in the nonlinear diffusion acts as the seed. The conduct of the action is consistent based on conduct metrics.

Keywords: Liver Segmentation, Non-Linear Mapping, Quasi- Monte Carlo, Region Growing.

I.INTRODUCTION

Today, the medical image distribution captivate more and thought and interest. It lent, naturally, to delimit the internal formation of the calm; this arrangement can be anatomical (organs) but also pathological (lesions). Mechanical distribution of abrasion in a broad image database has an obvious activity: it allows the radiologist to assist in analysis, by disclose possibly forgotten abrasion, and accelerate the deal of investigation. Therefore the automatic distribution of liver plays an central act in study of liver function and can assist in inquiry of liver stroke such as steatosis, fibrosis, etc.... In extension, liver is most of them central agency of the animal body. When it is afflicted by a tumoral pathology, it is desirable to serve it by cutting the sick part. But this cut has to respect decree of volumetric and very specific vascularization. [1]-[5]The beneficial imaging is then used to catch and anticipate the domestic arrangement. These arrangements do not appear in a single image, but requires several acquisitions which will therefore be compared. The hepatic volumetric is possible only after a moment of segmentation of these images. The detached of the modern inquiry works is to achieve the distribution automatically, to obtain the volume of liver and its internal structures, in particular the tumors. Computer back planning of various liver treatments which can be an important aid for operability decisions and visualization of personal patient anatomy in 3D. The disclosure of the barrier between the segments is then the initial step of the operative planning. Radiologists currently use CT images with drip contrast infusion, in line to catch abrasion and barge in the liver. The key point of the above-cited medicine is the liver volume distribution. This step is quite time engrossing when it is done manually. The aim is to develop a method that is precise, brief and robust sufficient to use it in the everyday impersonal practice. There are a few circulated approach about distribution of CT images. Most of this approach is some modification of the region-growing, active contour, thresholding, classification algorithms. In addition, the methods are commonly based on some statistical, anatomical, or geometric model. An automatic access for distribution of liver in CT images based on a numerical aspects model is presented in the paper of Lamecker. This iterative technique first frame a analytical model from a education set of shapes. Each aspect is defined by some anatomically specific points sampled on the surface. The next step is the arrange the mean shape into the image. Then single shape regulation is applied. Sadly, there is no impersonal evaluation and the choice of the landmarks is very severe due to the very volatile aspect of the liver. The level set rule family has been profitably used for medicinal image segmentation. The advantages of the level set access are that it stem topological changes and defines the problem in one higher aspect. The main disadvantages are that these designs are time-consuming and they usually crop over-segmentation. The alive curve design is used to division abdominal organs in the clinical proceeding. It works well on endemic images, because the organs are homogeneous. In case of contrast-augment images, the contrast agent is cumulated individually in noticeable chunk of the liver. For example the barge and some tumors will have higher intensity than the liver parenchyma. Another example would be in measuring the dimension of airways, which can be easily computed provided that accurate distribution of the airway lumen, airway walls, and the whole airway tree is applicable. Besides skill, image distribution is also used in other therapeutic imaging related fields. In computer boost surgery, image distribution is needed for extraction of objects from medical images to allow for visualization and manipulation purpose, e.g. virtual colonoscopy. Image distribution is also used for extraction of landmarks needed for computer aided boating related tasks, such as computer guided bronchoscopy. Another application of image distribution is in easing or developing the act of other processes, such as image registration.

II.RELATED WORK

Threshold based segmentation segments the Region of concern based on the particular intensity or color. The threshold for each and every image differs. For each image the threshold for segmentation has to give manually. Edge disclosure methods identifies the edge regions in the images and with the help of the identification of edge regions the Region Of concern can be distill from the image. Region based method identifies the interested portion with the help of object locations or identification of seed point for the identification of the initial position of the interested portion. Hybrid segmentation methods segments the images based on the merger of disparate

segmentation approaches for the identification of the interested portions in the images. Thresholding approaches were not advisable for all type of images and also the value for threshold differs for different images based on the object to be segmented and the input image. The edge based approaches may sometimes results in over segmentation since some complex organs like liver were more closer to the other organs. The region based approaches requires the exact seed point from the user and hence the cooperation between user and system is increased.

III. PROPOSED SOLUTION

Input abdominal scan images were obtained from the dataset. The images were filtered using Gaussian filter inorder to remove unwanted pixels in the images. Thresholding process is applied to the preprocessed image. The threshold for the image is access from the histogram values obtained. Threshold for the process is identified based on the calculation of histogram of input image. The maximum value of histogram of input image is obtained and the value is reduced inorder to set the threshold. The value is compared with every pixel of image. If the pixel value is langer than the threshold then the region is given value 0 and the for the other regions the original image pixels were obtained. Nonlinear diffusion is applied to the threshold applied image inorder to remove some other additional portions segmented from the image. In Nonlinear diffusion process the sigmoid filter is used for the transformation of input gray level pixels based on minimum and maximum pixel value for the image. From the Nonlinear diffused image the image region with maximum area is obtained as seed region for the improved region growing distribution process. eliminate unwanted portions segmented along with the liver portion. The liver portions that have maximum area were alone extracted from the image. The extracted portions acts the seed point for the improved region growing segmentation. In enhanced region growing distribution process the authentic seed region is grown around the basic seed region based on identification similarity between the nearby pixels. The seed region obtained in the previous step is grown in size along its boundaries. The boundary expansion process is employed depend on the analogyof the pixels in the nearby regions of the initial boundary regions. The action of boundary increase is repeated in emphasis till the changes between the nearby pixels were very high. Nearby pixels were identified depend on the calculation of average gray scale values of the nearby points around the current position. The average angle value is estimated in each iteration inorder to obtain the boundary pixels of the segmented portion. The resulting segmented regions gives the liver portion of the input image. The act of the process is consistent in-charge of the performance metrics. The coduct of the process for liver segmentation process is improved which is due to the merger of the region based methods and thresholding based segmentation process. The act of the process indicates that the proposed approach is more efficient compared to the other existing works. The seed region for revised region growing process is exclusive based on the thresholded region and hence the interaction between the user and the system is reduced.

IV. IMAGE PRE-PROCESSING

In computer artwork, image escalate is course of resizing analog image. Escalate is a non-incidental convert that affect a deal off between ability, precision and bite. With bitmap graphics, as the size of an image is diminished or inflated, the pixels that form the image become more clear, making the image arrive"soft" if pixels are averaged, or jagged if not. With vector artwork the trade-off may be in alter power for re-rendering the image, which may be obvious as slow re-depiction with still artwork, frame quota and fabric skipping in computer animation. The input skin images were pre-processing we are applying Gaussian filtering to our input image. Gaussian filtering used to remove the noise from the image. Gaussian filter process is employed to filter the image inorder to remove unwanted image pixels in image. Gaussian filter uses distant kernels that serve the shape of Gaussian (`bell-shaped') hump. Distinct approximation to Gaussian function is cause before complexity is achieve. The degree of filtering is resolute by the accepted breach of the Gaussian. The Gaussian outputs a `complete average' of each pixel's district, with the average adequate more against the value of the critical pixels. [7]-[9]The Gaussian filtering is an important space for the weighted mean filter. It is based on the aspect of the Gaussian function to select the right value of continuous smoothing filter. It consistently uses the Gaussian activity of distinct two-dimensional by zero-mean to be smoothing filter. The Gaussian filter for the elimination of Gaussian normal distribution noise is very effective.

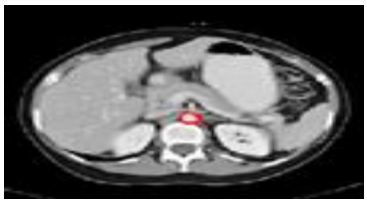

Figure.1. The abdominal CT image

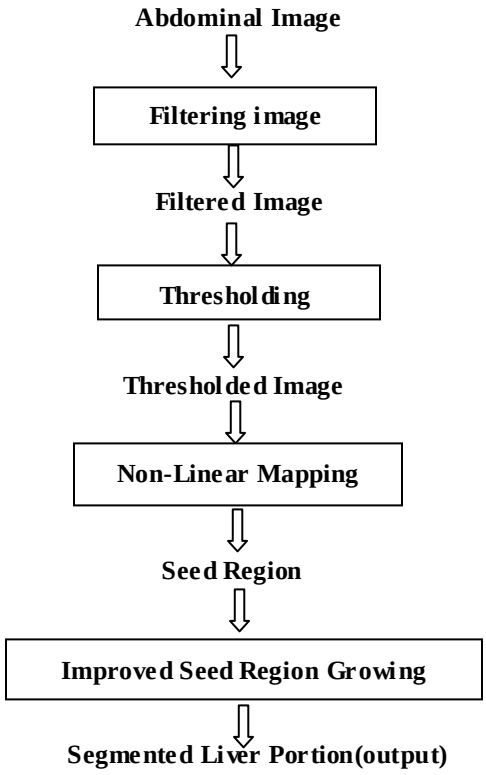

Figure.2. Algorithm structure diagram.

V.THRESHOLDING

Threshold for the process is identified based on the calculation of the histogram of the input image. The maximum value of histogram of the input image is obtained and the value is

reduced inorder to set the threshold. The value is compared with every pixel of image. If the pixel value is larger than threshold then the region is given value 0 and for the other regions the original image pixels were obtained. The threshold value for the liver regions will be around 150 value. Thresholding approach is very useful on break outdoor colour images. The picture is threshold at its most certainly distant peak. The process iterates for each disjointed part of the image until no separate peaks are begin in any of histograms. The criterion to isolated mountain was based on the ratio of peak maximum to peak minimum to be greater than or equal to two. Face areas were separated from inflexible regions by using a Sobel driver marking field that contain enormous edge action. These were called "busy" areas. The authentic area was not to distribute inside these busy areas based on thresholding but sometimes it is crucial to do so as in the case of segmenting skylines.

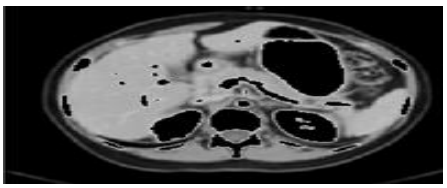

Figure.3. Thresholded image

VI. NON-LINEAR MAPPING

Non-linear diffusion process is employed inorder to select the seed point for the improved region growing segmentation process. In non-linear diffusion process the image pixels were transformed based on the following equation The image pixels were filtered based on sigmoid filters inorder to eliminate unwanted portions segmented along with the liver portion. The liver portions that have maximum area were alone extracted from the image. The extracted portions acts the berry point for the revised region growing segmentation. The nonlinear aligning does not change the attention about the quantity of the factors. With the Gaussian model for the factors, the nonlinear aligning yields an expansion of the natural factor inquiry, that is, there is the same indeterminacy relative path of aspect. Nonlinear mapping with non-Gaussian model for the factors yields an expansion of nonpartisan factor analysis which is able to regain the hidden aspect if they exist.

$$p' = (Max - Min)\frac{1}{1 + e^{-(P-\beta)/\alpha}} + Min$$

Figure.4. Using non linear mapping

VII. REGION GROWING ALGORITHM

The seed region obtained in earlier step is grown in size along its boundaries. The boundary increase process is employed based on comparison of pixels in the nearby regions of the initial boundary regions. The process of boundary expansion is imitated in emphasis till the contrasts between the nearby pixels were very high. Nearby pixels were identified based on calculations of average gray extent values of the nearby points around the current position. The average gradient value is estimated in each emphasis inorder to attain the barrier pixels of the segmented portion. The resulting segmented regions gives the liver portion of input image. The aspect of region-growing approach is highly reliant on the initial locale chosen to initialize the growing procedure. propose an alternative action for region growth that does not based alone on the initial assignment of clusters for the final segmentation. The action searches for field in the image where no edges have been detected. The selected regions form the initial set of clusters to distribut the image. [11]-[14]Sky, skin, and in general, objects of no strong color variance are selected in this step. Subsequent clusters are incorporated with various levels of edge density during the growth procedure, to account for all other objects that are found in natural images. The procedure continues by increasing the threshold found in the initial seed generation and detecting new regions or child seeds that fall below the new threshold. These child berry need to be confidential into bordering-to-existent or non-adjacent seeds. In plan to make the region growth action efficient, it is crucial to also know the parent seed to which the child is adjacent. The equitable is to be able to process all neighboring child berry in a vectorized approach. To accomplish this burden proceed to first detect the outside edges of PS map using a nonlinear spatial filter. The drain act on the pixels of a district, and the return of its operation is assigned at the inside pixel of the neighborhood. The fulfilled of slum being operated will be afflicted to be unless specified otherwise.

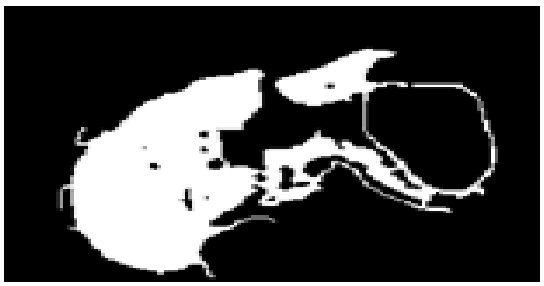

Figure.5. Region growing method

VIII. PERFORMANCE MEASURES

The act of the process is measured based on the performance metrics like volumetric overlap error (VOE), relative volume difference (RVD), average symmetric surface distance (ASD) and root mean square symmetric surface distance (RMD).

$$\text{VOE}=\left\{1-\frac{vol_{seg} \cap vol_{ref}}{vol_{seg} \cup vol_{ref}}\right\}\times 100\%$$

$$\text{RVD}=\left|\frac{vol_{seg}-vol_{ref}}{vol_{ref}}\right|\times 100\%$$

$$\text{ASD}=\frac{\sum_{a\in A}(min_{b\in B}\{d(a,b)\})+\sum_{b\in B}(min_{a\in A}\{d(a,b)\})}{N_A+N_B}$$

$$\text{RMS}=\sqrt{\frac{\sum_{a\in A} min_{b\in B}\{d(a,b)\})^2+\sum_{b\in B} min_{a\in A}\{d(a,b)\})^2}{N_A+N_B}}$$

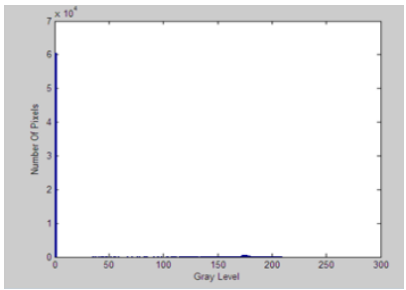

Figure.5. Gray level histogram of segmented image

VIII. EXPERIMENTAL RESULTS AND ANALYS

In order to prove the improved region growing algorithm cansegment liver region well, three discontinuous images are selected for liver segmentation. The traditional region growing method is used to compare with the improved algorithm. The distribution of the gray level of visceral CT image is ide-ally orderly without non-linear mapping, and gray level is even. But, liver gray level is more accessible than other cotton using non-linear mapping . So, the image, which is processed by non-linear mapping is easy to distinguish liver region and select seed points. The images are low drab contrast intestinal CT images, the traditional region growing method cannot distribute liver region of intestinal CT images if they are not processed by non-linear mapping. The traditional region growing method can segment liver region of abdominal CT images using non-linear mapping, but the liver region is over-segmentation and has many holes which are difficult to process . And the revised region growing algorithm pro-posed in this paper can segment liver region well. In order to prove the accuracy of liver segmentation, the liver segmentation result that is segmented by the improved region growing algorithm is compared with the segmentation results of manual segmentation MICCAI evaluation criterionis used for evaluating the segmentation objectively.

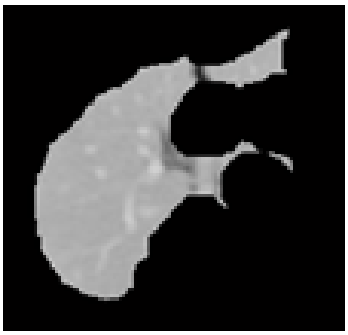

Figure.6. Post preprocessing

IX. CONCLUSION & FUTUREENHANCEMENT

The abdominal scan images were filtered using Gaussian filter. Threshold is identified based on the histogram of images. Non Linear mapping applied to the threshold applied image. The nonlinear mapping image identifies the seed region from the images. The seed region is then developed based on improved seed region process inorder to obtain the lung region. The act of the process is measured based on the performance metrics. The proposed access is appraise using Liver images with eight new access, and it attain the apical VOE, RVD, ASD and RMS. empirical results show that the proposed method is admirable to eight other state of the art methods. The proposed design alleviates segmentation problems of conventional affected regions including inaccurate point correspondences, generalization ability of the model and awareness to initialization. The proposed method is also robust against leakage to nearby organs with similar intensities.

X. REFERENCES

[1]. J.A. Bogovic, J.L. Prince, P.L. Bazin, A multiple object geometric deformablemodel for image segmentation, Comput. Vis. Image Und. 117 (2) (2013)145–157.

[2]. C.J. Yang, X. Yang, Abdominal CT image segmentation based on graph cuts andfast level set, CT Theory Appl. 20 (3) (2011) 291–300.

[3]. T. Landesberger, S. Bremm, M. Kirschner, et al., Visual analytics for model-basedmedical image segmentation: opportunities and challenges, Expert Syst. Appl.(2013).

[4]. Y.D. Chen, S.S. Bao, Novel segmentation algorithm of region growing based onCT image sequences of liver, Comput. Eng. Appl. 46 (13) (2010) 188–190.

[5]. Yan Gao, Boliang Wang, The improved region growing algorithm and its appli-cation in kidney segmentation, J. Xiamen Univ. (Nat. Sci.) 51 (4) (2012) 701–703.

[6]. H.R. Xu, L.F. Tian, P. Chen, et al., An improved region growing algorithm usedin medical image segmentation, J. Biomed. Eng. Res. 3 (20) (2005) 187–190.

[7]. H. Niederreiter, Quasi-Monte Carlo methods and pseudo-random numbers,Bull. Am. Math. Soc. 84 (6) (1978) 957–1041.

[8]. H.Niederreiter,Low-discrepancy and low-dispersion sequences, J. NumberTheory 30 (1) (1988) 51–70.

[9] .T.J.G. Davies, R.R. Martin, Low-discrepancy sequences for volume properties insolid modeling, Proc. CSG 98 (1998) 139–154.

[10]. H. Badakhshannoory, P. Saeedi, K. Qayumi, Liver segmentation basedon deformable registration and multi-layer segmentation, in: 17thIEEE International Conference on IEEE Image Processing (ICIP), 2010,pp. 2549–2552.

[11]. L. Ruskó, G. Bekes, M. Fidrich, Automatic segmentation of the liver from multi-and single-phase contrast-enhanced CT images, Med. Image Anal. 13 (6) (2009)871–882.

[12]. Adnan Mujahidin Khan,Bogovic A multiple object geometric deformable model for image segmentation, Comput. Vis. Image Und. 117 (2) (2013) 145–157.

[13] Chen .Y.D,Bao.S.S, Novel segmentation algorithm of region growing based on CT image sequences of liver, Comput. Eng. Appl. 46 (13) (2010) 188–190.

[14]. Frank Heckle, Colby.T.V and Lombard.C. “Histiocytosis X in the liver,” Human Pathol. , vol. 14, no. 10, pp. 847–856, 1983.

[15].GuodongLi,Huang.S.F,Chang.R.F,Chen.D.R,andMoon..K “Characterization of spiculation on ultrasound lesions,” Jan. 2004.