International Journal of Scientific & Engineering Research Volume 3, Issue 8, August-2012
ISSN 2229-5518

CT Angiography Image Segmentation by Mean Shift Algorithm and Contour with Connected Components Image

Dr. Ali Hassan Al-Fayadh
Assistant Professor
Mathematical Department
Mathematical and Computer Sciences College,
Kufa University, Iraq
aalfayadh@yahoo.com

Hind Rostom Mohamed
Assistant Professor
Computer Department
Mathematical and Computer Sciences College,
Kufa University, Iraq
hindrustum.shaaban@uokufa.edu.iq

Raghad Saaheb Al-Shimsah
Master student
Mathematical Department
Mathematical and Computer Sciences College
Kufa University, Iraq
Akram_00002002@yahoo.com

Abstract— In the present paper, Mean Shift Algorithm and active contour to detect objects for CT Angiography Image Segmentation is proposed.Based on the results we believe that this method of boundary detection together with the mean-shift can achieve fast and robust tracking of the CT Angiography Image Segmentation in noisy environment. The proposed scheme has been tested successfully on a large set of images. The performance of the proposed detector compares favorably both computationally and qualitatively, in comparison with Mean Shift and contour detector which are also based on surround influence .The last stage is stage contain Extraction of connected components CT Angiography image edge detection . The proposed scheme can serve as a low cost preprocessing step for high level tasks such shape based recognition and image retrieval. The experimental results confirm the effectiveness of the proposed algorithm.

Key ward— Image Segmentation,image detection, Image ,CT Angiography Image , mean-shift , contour Image.

1 INTRODUCTION

A segmentation could be used for object recognition, occlusion boundary estimation within motion or stereo systems, image compression, image editing, or image database look-up[3].

The goal of image segmentation is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects.

In general these methods have not performed satisfactorily for image data due to their reliance on an a priori parametric structure of the data segment, and/or estimates of the number of segments expected. Mean shift's appeal is derived from both its performance and its relative freedom from specifying an expected number of segments. As we will see, this freedom has come at the cost of having to specify the size (bandwidth) and shape of the influence kernel for each pixel in advance[1]. The application of the mean shift algorithm to color image segmentation has been proposed in 1997 by Comaniciu and Meer [2]. Since then it has become a widely used method for color image segmentation, as it provides significantly better segmentation results as other [3].

The mean-shift algorithm is an efficient

approach to tracking objects whose appearance is defined by color. (not limited to only color, however. Could also use edge orientations, texture, motion)[4].

The basic idea in active contour models or snakes is to evolve a curve, subject to constraints from a given image , in order to detect objects in that image. For instance, starting with a curve around the object to be detected, the curve moves toward its interior normal and has to stop on the boundary of the object[5].

Edge detection of an image reduces significantly the amount of data and filters out information that may be regarded as less relevant, preserving the important structural properties of an image. Therefore, edges detected from its original image contain major information, which only needs a small amount of memory to store. The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world [4].

Contour detection in real images is a fundamental problem in many computer vision tasks. Contours are distinguished from edges as follows. Edges are variations in intensity level in a gray level image whereas contours are salient coarse edges that belong to objects and region boundaries in the image[8].

the scheme is computationally expensive and produces a contour map which is quite sparser than an edge map though

not as sparse as the ground truth (contour map).

The paper is organized as follows; Section 2,deals with the Mean Shift Algorithm segmentation. Section 3 deals with the active contour to perform the connected component edge image analysis, section 4 deals with the gives the overview of algorithm with results and last section 5 ends the paper with conclusion.

ISSN 2229-5518

2 Mean Shift Algorithm

Segmentation is subdividing an image into its constituent regions or object. The level up to which the subdivision is carried out depends on the problem being solved. [5].
The mean shift algorithm is a nonparametric clustering technique which does not require prior knowledge of the number of clusters, and does not constrain the shape of the clusters.
Given n data points xi, i = 1, ..., n on a d-dimensional space Rd, the multivariate kernel density estimate obtained with kernel K(x) and window radius h is:

$$f(\mathbf{x}) = \frac{1}{nh^d}\sum_{i=1}^{n} K\left(\frac{\mathbf{x}-\mathbf{x}_i}{h}\right) \tag{1}$$

For radially symmetric kernels, it suffices to define the profile of the kernel k(x) satisfying:

$$K(\mathbf{x}) = c_{k,d}\,k(\|\mathbf{x}\|^2) \tag{2}$$

where ck,d is a normalization constant which assures K(x) integrates to 1. The modes of the density function are located at the zeros of the gradient function ∇f(x) = 0. The gradient of the density estimator (1) is:

$$\begin{aligned}\nabla f(\mathbf{x}) &= \frac{2c_{k,d}}{nh^{d+2}}\sum_{i=1}^{n}(\mathbf{x}_i-\mathbf{x})\,g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)\\ &= \frac{2c_{k,d}}{nh^{d+2}}\left[\sum_{i=1}^{n} g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)\right]\left[\frac{\sum_{i=1}^{n}\mathbf{x}_i g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)}{\sum_{i=1}^{n} g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)}-\mathbf{x}\right]\end{aligned} \tag{3}$$

where g(s) = −k ′ (s). The first term is proportional to the density estimate at x computed with
kernel G(x) = cg,dg(‖ x ‖2) and the second term:

$$\mathbf{m}_h(\mathbf{x}) = \frac{\sum_{i=1}^{n}\mathbf{x}_i g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)}{\sum_{i=1}^{n} g\left(\left\|\frac{\mathbf{x}-\mathbf{x}_i}{h}\right\|^2\right)} - \mathbf{x} \tag{4}$$

is the mean shift. The mean shift vector always points toward the direction of the maximum increase in the density. The mean shift procedure, obtained by successive.

- computation of the mean shift vector mh(xt),
- translation of the window xt+1 = xt +mh(xt)

is guaranteed to converge to a point where the gradient of density function is zero. Using Mean-Shift on Color Models
Two approaches:
1) Create a color "likelihood" image, with pixels.
2)weighted by similarity to the desired color (best for uncolored objects)
Represent color distribution with a histogram. Use mean-shift to find region that has most similar distribution of colors.

3 Active contour Image

Image editing tasks normally involve one or more extended contours, not single edge elements in isolation. For this reason, contour-based image editing depends upon an efficient method for specifying a group of edges to which an action is to be applied. An efficient method for grouping edges into closed contours has recently been reported . The algorithm consists of three
main stages:
1. Line segment approximation.
2. Computation of posterior line grouping probabilities.
3. Shortest path computation of maximum-likelihood line segment cycles[7].

4 Experimental Results

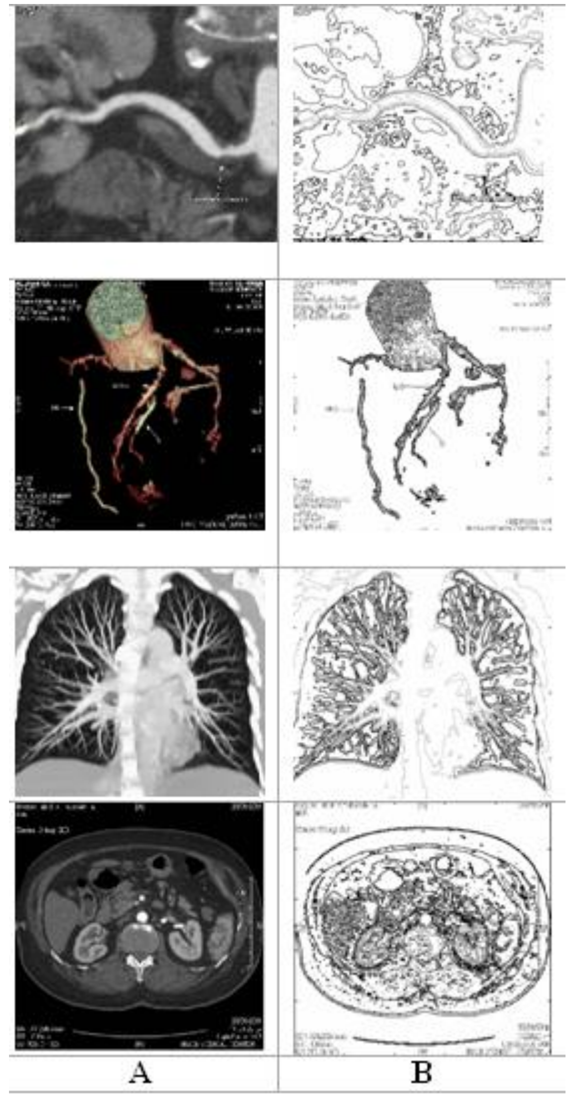
In this section a detailed experimental comparison of the above stated algorithms has been presented. We have used two color image databases:
(1) CT Angiography Images database prepared in our conditions ,images obtained from in thee Hospital.
(2) CT Angiography Images database obtained from internet.
Figure(1) shown sample data base for CT Angiography Images we used in this paper.

Figure(1):
sample data base for CT angio graphy Images.

As we have seen, segmentation involves finding salient regions and their boundaries. A boundary in an image is a contour that represents the change from one object or surface to another. This is distinct from image edges, which mark rapid changes in image brightness, but may or may not correspond to salient boundaries.

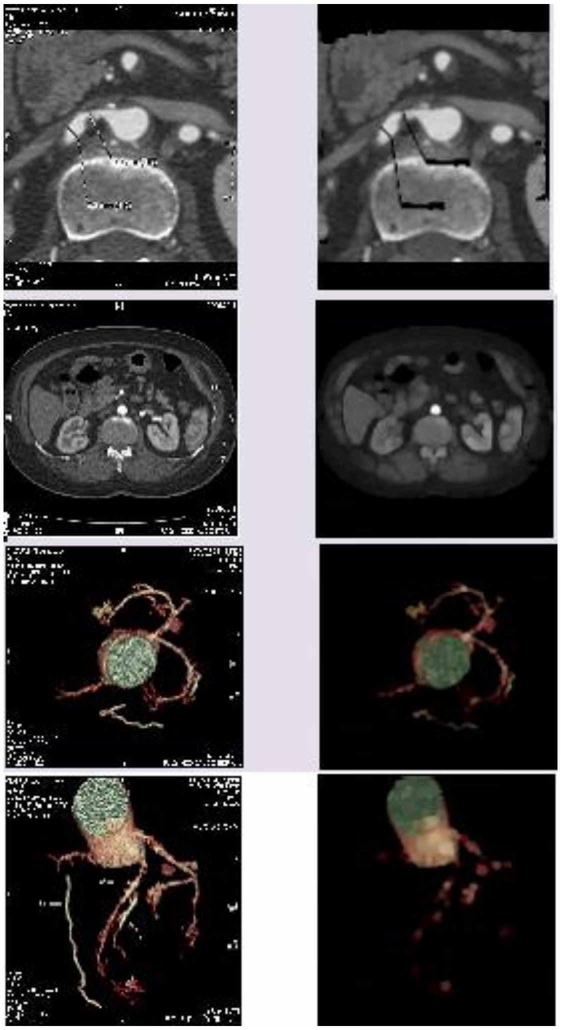
The scale of the mean-shift kernel roughly controls the size and shape of the extracted regions. There is a trade-off between maintaining the salient boundaries but suffering over-segmentation, versus missing some of the important boundaries and under-segmenting the image. Figure(2) shown contour for sample for CT Angiography Images. The segmentations above illustrate a typical compromise.

The resulting image that we obtained after Mean Shift Algorithm segmentation would still contain some noise, which is made up of scattered image pixels and maybe some arbitrary pixels of other objects that share similar tones to that of the image. It is also possible that some pixels are missing within regions of image because the segmentation was too strict, thus removing some pixels which are actually real skin. We end up with a much cleaner image after performing these operations. The subsequent step will perform various feature checks and gradient matching to finally confirm whether or not a particular region is image .



Figure(2): (A) Original CT Angiography Image , (B) Contour for Image

The mean shift algorithm seeks modes or local maxima of density in the feature space.
Figure(3) shown Appling mean shift algorithm for sample for CT Angiography Images.



Figure(3) : Appling mean shift algorithm for sample for CT Angiography Images

5 Conclusion

We proposed a new goodness criterion for segmenting closed figures. We demonstrated our approach for Mean Shift Algorithm and contour Image based segmentation, but it should be straightforward to extend it to incorporate other features.

The demonstration task is that of finding a figure region edge by contour distribution on the surrounding background. Our approach is region based and applies most naturally to closed contours. We can extend it to open contours as long as the contour can be considered as organizing the image into distinct regions. We Connected Components for mean shift results by remove small objects and connected the connected components for skin image that have fewer than P pixels, producing another binary image .The default connectivity is 8 for two dimensions. We used the statement BW2 = bwareaopen(BW, P, conn) to specifies the desired connectivity Figure 9 shown desired connectivity.

Where variable conn can have Value for Two-dimensional connectivity:

A) 4 if 4-connected neighborhood

B) 8 if 8-connected neighborhood

The 1-valued elements define neighborhood locations relative to the central element of conn. Note that conn must be symmetric about its central element.

The basic steps for the desired connectivity are:

1- Determine the connected components:

```
CC = bwconncomp(BW, conn);
```

2- Compute the area of each component:

```
S = regionprops(CC, 'Area');
```

3- Remove small objects:

```
L = labelmatrix(CC);
BW2 = ismember(L, find([S.Area] >= P));
```

The next step we find connected components in binary image .The basic steps in finding the connected components are:

1- Search for the next unlabeled pixel, p.

2- Use a flood-fill algorithm to label all the pixels in the connected component containing p.

3- Repeat steps 1 and 2 until all the pixels are labeled.

For instance, we could associate the pixels on either side of a contour with regions, identifying the “figure” as the more convex side Figure (4) shown first and Second Connected Component then shown CT Angiography Image Detected Output.

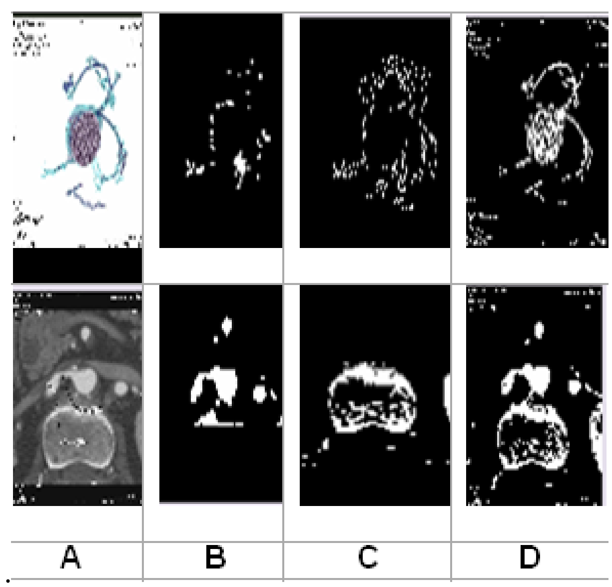


Figure 4 : (A) Original CT Angiography Image,(B) First Connected Component ,(C)Second Connected Component ,(D) CT Angiography Image Detected Output.

Finally, the object tracking process performs as memory for collecting skin-color objects obtained from previous frame to guide the next frame in order to remove image-color pixels that immediately appear from frame to frame. The experimental results show the satisfying subjective test results.

6 References

6.1. Journal Article

[1] Prakash PANDEY, Uday Pratap SINGH and Sanjeev JAIN, Categorization and Searching of Color Images Using Mean Shift Algorithm, Leonardo Journal of Sciences, Issue 14, January-June (2009).

[2] C.NagaRaju, S.NagaMani, G.rakeshPrasad,S.Sunitha ,Morphological Edge Detection Algorithm Based on Multi-Structure Elements of Different Directions, Volume 1 No. 1, International Journal of Information and Communication Technology Research ,2010-11 IJICT Journal. All rights reserved , (2011).

6.2. Book

[3] Jue Wang, Bo Thiesson, Yingqing Xu, Michael Cohen, Image and Video Segmentation by Anisotropic Kernel Mean Shift, Proc. IEEE Int. Conf. on Computer Vision,,(2002).

[4] Farhad Dadgostar1, Abdolhossein Sarrafzadeh1, Scott P. Overmyer2,Face Tracking Using Mean-Shift Algorithm: A Fuzzy Approach for Boundary Detection in IEEE Conference on Computer Vision and Pattern Recognition, (2005).

[5] Tony F. Chan, Member, IEEE, and Luminita A. Vese, Active Contours Without Edges, IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 10, NO. 2, FEBRUARY (2001)

[6] James H. Elder, Member, IEEE, and Richard M. Goldberg, Image Editing in the Contour Domain, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 23, NO. 3, MARCH (2001).

[7] Gopal Datt Joshi and Jayanthi Sivaswamy ,A SIMPLE SCHEME FOR CONTOUR DETECTION, In Computer Vision and Image Understanding.,(2002).

6.3. Conference Proceedings

[8] Quan Huynh-Thu Mitsuhiko Meguro Masahide Kaneko, Skin-Color-Based Image Segmentation and Its Application in Face Detection, IAPR Workshop on Machine Vision Applications, (2002),Dec. 11 – 13. Nara- ken New Public Hall, Nara, Japan.