ISSN 2320-9984

Volume 1, Issue 3, October 2013 ISSN: 2320-9984 (Online)

International Journal of Modern Engineering & Management Research

Website: www.ijmemr.org

A Object Retrieval Based on Fuzzy Flood Fill Method

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Abstract—*An Efficient and effective image segmentation is an important task in image processing and object recognition. Since fully automatic image segmentation is usually very hard for natural images, interactive schemes with a human interaction provide us good solutions. If we want to retrieve the particular selected area of any object for any special purpose like quality of the image or any security purpose, we need to select the pixels of the image and retrieve the particular object. This paper presents a new region merging based on fuzzy flood fill method. The users only need to roughly indicate the location and region of the object and background by using strokes, after that use fuzzy flood fill to extraction of object. A region merging mechanism is proposed to guide the merging process with the help of initial segmented image. A region is merged with its adjacent region if they have good similarity among them, here good is fuzzy variable. The proposed method is merging the initially segmented regions and then effectively extracts the object contour. The region merging process is the image content and it does not need to set the similarity threshold in advance, but it based on some fuzzy variables e.g. low, medium, high similarity etc.*

Keywords:—*Image Segmentation, region merging, fuzzy flood fill.*

1. INTRODUCTION

Image segmentation is to separate the desired objects from the background. In general, the color and texture features in a natural image are very complex so that the fully automatic segmentation of the object from the background is very hard. Therefore, semi-automatic segmentation methods incorporating user interactions have been proposed [2, 4, 10] and are becoming more and more popular. For instance, in the active contour model (ACM), i.e. the snake algorithm [11], a proper selection of the initial curve by the user could lead to a good convergence to the true object contour. Similarly, in the graph cut algorithm [9], the prior information obtained by the users is critical to the segmentation performance.

For the classification and interpretation of image data the segmentation of the image is needed [3]. Segmentation means the partitioning of the image in non-overlapping regions. Many segmentation methods have been proposed since beginning of image processing on computers [3, 13]. New techniques for the segmentation have also been developed which was used e.g. similarity functions, watersheds or neural nets. Fuzzy methods are also applied for image segmentation [8, 7].

Fuzzy Flood fill starts with single point or several points so called seed pixels. Each seed pixel represents an expected region. In a recursive process the surrounding pixels of the seed pixels are considered if they fulfill some given predicate. If they do so they are added to the region and the process restarts until all pixels in the image are assigned to one of the regions. The difficulty is the fixing of the homogeneity criteria and the selection of the number and position of the seed points. If too less seed points are chosen a following splitting of the regions is needed (under-segmentation), if too many seed points are chosen, a merging is needed (over-segmentation). Fuzzy flood fill have many application, especially in medical image processing e.g. growth of tumor, cancer detection etc. They contain much variability between each individual. And they are often blurred or noisy depending on the used imaging techniques. So the separation of single structures like the object from the surrounding region is difficult, since the gray value cannot be used as a sufficient criterion. Therefore the use of expert knowledge for the improvement of the results is indispensable [4].

2. IMAGE PRE-PROCESSING

Image pre-processing has the task to improve the image quality for the visualization or for the following processing of the data. Image pre-processing methods are used for noise reduction, contrast enhancement or edge enhancement. Since image data can have a large variety of gray values, a normalization of these gray values in needed. For this task a statistical investigation of the gray values of background pixels has been done. The deviation of the mean gray value of the examined data set is too large, so an adaptation to the mean gray value determined in the statistical investigation is done.

3. REGION GROWING

The aim is to segment object from complex scene of the background. The whole object is fully connected in the 2-dimensional case. This information was used for the decision for a region growing method. First a pixel is needed, which surely belongs to the object. This pixel, which should be the seed point mentioned before, is found by some location and gray value information. Then the four surrounding pixels (left, right, top, bottom) i.e. 4-neighborhood are considered, if they fulfill some criteria. First criterion is the absolute gray value only pixels with gray values inside a defined interval are added to the region. A second criterion is the relative gray value. Only pixels inside an interval around the gray value of the seed point are allowed to belong to the object region. The problem is the definition of these two intervals. This has been done by standard statistical evaluation about the gray value distribution of the object. Although this method delivers good results, a further processing is needed. Sometimes too much pixels are added, since the surrounding pixels has equal or similar gray values like the object. Depending on the partial volume effect, resulting from the digitization of image data, some bridges between these surrounding structures and the object can exist.

4. ALGORITHM FOR OBJECT DETECTION

The proposed algorithm of fuzzy based flood fill is based on initial segmentation [9, 2]. It used a standard image processing algorithm introduced in [3] and contains the first part of it up to the segmentation step. The further description and classification are discussed e.g. in [12, 11] in case of fuzzy methods. Again a general introduction of these fuzzy methods can be found in [3]. The most important part of the here shown algorithm is the step of “fuzzy improvement”, which will be presented in more detail in section 6.

The flood fill, also called the seed fill, is an algorithm that determines the area connected to a given node in a multidimensional array. This algorithm takes three initial values; a start node, a target color, and a replacement color. In the first place, this algorithm looks for those nodes in the array which are connected to the start node via the path of the target color, and changes them to the replacement color. There are several ways by which the flood fill algorithm can be structured, but they all make use of queue or stack data structure, explicitly or implicitly.

The queue-linear flood fill algorithm is adopted in our application. This algorithm is relatively fast, and at the same time, it does not suffer to the stack overflows, no matter how big an input image is processed [8]. For each pixel that matches the starting color closely enough, in calls the second part, which builds a flood fill range starting from the pixel and adds it to the queue, as detailed previously. This process is repeated until the queue is empty. The queue-linear flood fill algorithm and fuzzy flood fill algorithm is as follows:

Input: (1) the image (2) the initial mean shift segmentation of input image

Output: desired object

While there is a merging up to object contour

1. First stage of merging of initial segmented image (by mean shift method) using similar merging rule.
2. After step one number of regions are minimized and again apply similar region merging rule, this is and iterative procedure.
3. After retrieving object contour go to step 4.
4. Apply Region Labeling and after that Flood Fill method on the image obtained in after step 3.

Region Labeling (I)

% I: binary Image; I (u, v) =0: background, I (u, v) =1: foreground %

Let m←2

for all image coordinates (u, v) do

if I (u, v) =1 then

Flood Fill (I, u, v, m)

m← m+1

return the labeled image I.

% After region labeling we apply Flood Fill method using Breadth-First Search %

FloodFill (I, u, v, label)

Create an empty **queue** Q

ENQUEUE (Q, (u, v))

While Q is not empty **do**

(x, y)← DEQUEUE (Q)

If (x, y) is inside image and I (x, y) =1 then

Set I (x, y)= label

ENQUEUE (Q, (x+1, y))

ENQUEUE (Q, (x, y+1))

ENQUEUE (Q, (x-1, y))

ENQUEUE (Q, (x, y-1))

Return

5. RESTRICTION OF SEARCH-AREA

After the region growing process with very limited interval borders too many pixels have been removed (means not added to the object segment). The whole idea of this algorithm is to add these pixels by fuzzy rules. The flood fill has delivered a good approximation of the object appearance (gross contour of the object). Now a polygonal approximation of the contour is determined by some limitation of the number of vertices and gray values of the image.

6. FUZZY MODULE

The selection of pixels which should be added cannot be described exactly. So the use of fuzzy rules which consider different aspects of image data and expert knowledge was tested. All pixels inside the limited search area which do not belong to the object are checked to be adding to the object segment. As input fuzzy variables the gray value of the pixel was used, the number of existing neighbors, and the location "inside the object".

For the gray values five terms "very small", "small", "medium", "big" and "very big" are defined, three terms for the neighborhood are defined: "few", ''medium" and "many". Finally the inside variable uses also the three terms "low", "medium" and "high". Whereas the neighborhood and gray value variable can deal with absolute input values (gray value $g \in [0,. . . , 255]$ and neighbors $n \in [0,1,2,3]$ the inside variable is normalized. We can use trapezoidal function for the representation of fuzzy sets, they can be defined by two or four values. As fuzzy output variable the membership to the object "belongs to object" has been selected, which is normalized? It has the terms "no", "maybe" and "yes". Fuzzy flood fill algorithm is given below:

VARIABLE gray-value

START

very-small=TRIANGULAR (0,30,50)

small= TRIANGULAR (35,100)

medium= TRIANGULAR (75,180)

big= TRIANGULAR (155,230)

very-big= TRIANGULAR (215, 230, 255, 255)

END

VARIABLE neighbors

START

few= TRIANGULAR (0,0,15,20)

medium= TRIANGULAR (16,25)

many= TRIANGULAR (23,25,26,26)

END

IF neighbors==few

AND inside=low

THEN belongs to=no

IF neighbors==medium

AND inside=low

AND gray-value==small

THEN belongs to=yes

IF neighbors==few

AND inside=medium

AND gray-value=very-small

THEN belongs to=no

IF neighbors==medium

AND inside=medium

AND gray-value=big

THEN belongs to=yes

IF neighbors==many

AND inside=high

THEN belongs to=yes

7. PROPOSED METHODOLOGY

In the search for color regions, the most important tasks are to find out which pixels belong to which regions how many regions are in the image and where these regions are located. These steps usually take place as part of a process called region labeling or region coloring. During this process neighboring pixels is pieced together in a stepwise manner to build regions in which all pixels within that region are assigned a unique number ("label") for identification. Flow chart figure 1 represents the proposed method in our project.

In this flow chart in step one select input image from the database then perform low segmentation, for low level segmentation we use different exiting segmentation techniques e.g. mean shift, superpixels and watershed. In our proposed method we use mean shift segmentation. Low segmentation is also called grouping of homogeneous pixels on the basis of color, texture and shape. After low segmentation applying similarity measures on different regions using Bhattacharya this method which tells us similarity between two regions. In next step construct object contour in form of 0-1 image or also called curve of object. Then we are applying Fuzzy flood fill method for retrieving object from the contour images.

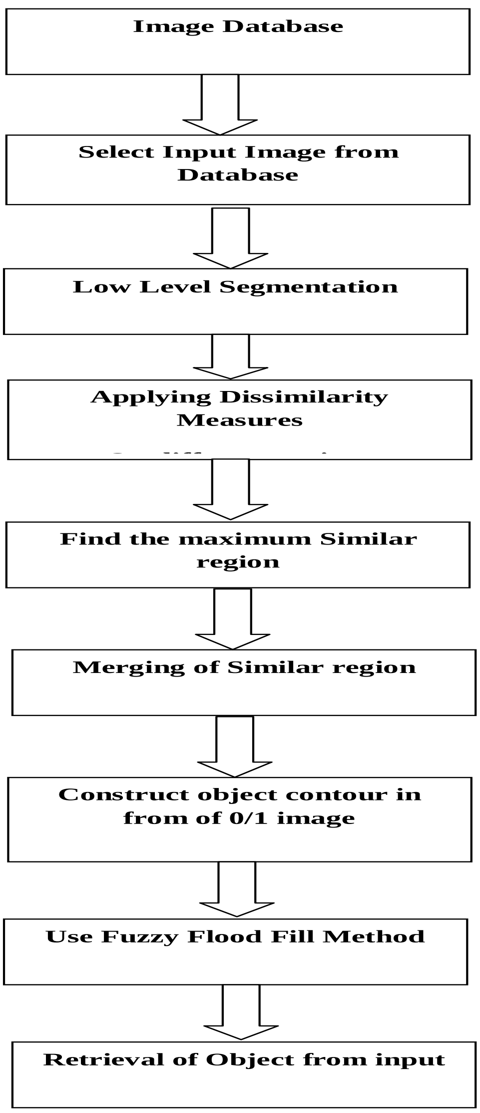


Figure 1 Flow chart of our proposed method

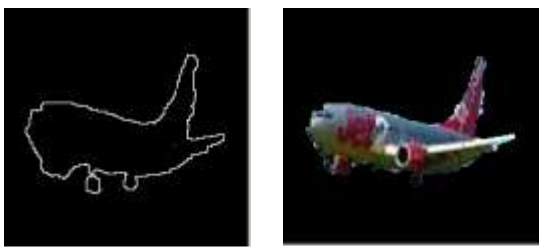
8. TESTING AND RESULTS

Figure (2) shows an example of how unsupervised similarity region merging method extract object contour in complex segmentation. After initial segmentation by mean shift, automatic segmentation merging starts and after every step we test our merging results and also after which stage of merging we want to use flood fill method. Figure 2(a) is the initial segmented regions cover only small part but representative features of object and background regions. As shown in figure 2 the unsupervised similar region merging steps via iterative implementation. Figure 2(a), 2(b), 2 (c), 2(d) and 2(e) shows that different steps of well extract object contour from the image and figure 2(f) is object mask. Figure 2(g) shows the extracted object using the two steps object retrieval method.

a b

e f g

Figure 2 Region merging Process (a) Initial segmentation (b) 2nd stage merging (c) 3rd stage merging (d) 4th stage merging (e) object contour



(f) object mask (g) object

In the second experiment, we want to separate a bird from background. Figure 3(a) shows that the initial mean shift segmentation results are serve our segmentation for extraction of object contour from complex background. Figure 3(b) to 3(e) shows that different step of fully extracted object contour from input image. Figure 3(g) shows the extracted object using the two steps object retrieval method. The execution time object retrieval using unsupervised similar region merging and flood fill depends upon a number of factors, including size of image, the initial mean shift segmentation results etc. We implement unsupervised similar region merging and flood fill algorithm in the MATLAB (R 2008a) 7.6 programming environment and run it on a PC with P4 2.80 GHz CPU and 1.0 GB RAM. Table 1 shows the running time of proposed method on testing different types of images e.g. bird and airplanes etc.

Table-1

Image	Size of image	Number of regions after initial Segmentation	Running Time (in Sec)
Birds	200 x 200	396	7.0988
Planes	200 x 200	338	6.2885
Horses	200 x 200	565	9.03111
Dogs	200 x 200	623	11.4329


a


b


c


d


e

Figure 3 Region merging Process (a) Initial segmentation (b) 2nd stage merging (c) 3rd stage merging (d) 4th stage merging (e) 5th stage merging


(f) object mask


(g) object

To see the effect of combining the symmetric and asymmetric relationships in FF, we also implement an approach that can be easily conceived: a Min-Cut of the directed sub graph plus the Min-Cut of the undirected sub graph. We shall call this merging for the Min-cuts of both directed and undirected sub graphs the naïve nHGM. We can see from Table 1 that the performance of proposed method is quite satisfactory, while N-Cut and nHGM cannot perform well on these segmentation tasks.

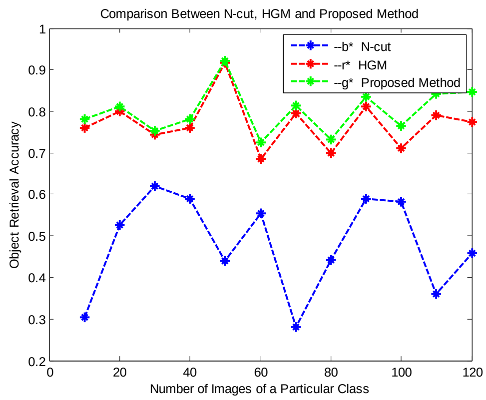


Figure 4 Graphical representation of comparison among N-cut, HGM and Proposed Method for object retrieval.

9. CONCLUSION AND FUTURE WORK

In this paper proposed a class specific object segmentation method using unsupervised similar region merging and flood fill algorithm. The image is initially segmented using mean-shift segmentation and automatic start of merging with any random segmented region and after each merging we check whether the object contour is obtained or not, if at any particular stage of merging object contour is obtained then use flood fill algorithm and click with mouse which object we want to extract. The proposed scheme is simple yet powerful and it is image content adaptive.

In future we can extract multiple objects from input image by using unsupervised method as well as supervised method by merging similar regions using some metric. Extensive experiments were conducted to validate the proposed method of extracting single object from complex scenes. The proposed method is efficiently exploits the color similarity of the target. The proposed method provides a general region merging framework, it does not depend initially mean shift segmentation method or other color image segmentation methods [7] can also be used for segmentation. Also we can use appending the different object part to obtaining complete object from complex scene, and also we can use some supervised technique also.

REFERENCES :

[1] E. Sharon, A. Brandt, and R. Basri "Segmentation and Boundary Detection using Multiscale Intensity mesurements" *Proc. IEEE conf. Computer Vision and Pattern Recognition*, pp.469-476, 2001.

[2] M. Galun, E.sharon, R. Basri and A. Brandt "Texture Segmentation by Multiscale Aggregation of Filter Responses and Shape Elements" *Proc. IEEE Int'l conf. Computer Vision and Pattern Recognition*, pp. 716-723, 2003.

[3] E. Sharon, M. Galun, D. Sharon, R. Basri and A. Brandt, "Hierarchy and Adaptivity in Segmenting Visual Scenes," Nature vol. 442, no. 7104, pp. 810-813, june 2006.

[4] J. Shi and J. Malik, "Normalized Cuts and Image Segmentation," *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 22, no. 8, pp. 888-905, August 2000.

[5] D.A. Forsyth, J.ponce, Computer Vision: A Morden Approch, Prentice-Hall Englewood Cliffs, NJ, 2002.

[6] N.Bonnet, J.Cutrona, M.Herbin, A no Threshold Histogrm Based Image Segmentation Method, Pattern Recognition vol. 35, no.10, pp. 2319-2322, 2002.

[7] E.Navon, O.Miller, A.Averbunch, "Color Image Segmentation Based on Adaptive Local Thresholds," Image *and Vision Computing vol. 23*, no.1, pp. 69-85, 2005.

[8] S. Osher, N. Paragios, "Geometric Level Set Methods in Imaging," *Vision and Graphics, Springer*, New York, 2003.

[9] Y. Boykov, G. Funka-Lei, "Graph cuts and efficient n-d image segmentation" *International Journal of Computer vision, vol 70. no.2*, pp.109-131,2006.

[10] D. Martin, C.Folwkes, D. Tal, J.Malik, "A Database of Human Segmented Natural Images and its Application to Evaluating Segmentation Algorithms and Measuring Ecological Statistics," *Internatinal Conference on Computer Vision*, pp. 416-423, 2001.

[11] M. Kass, A. Witkin, D. Terzopoulos, "Snake: Active Contour Models," *International Journal of Computer Vision*, vol.1, no.4, pp. 321-331, 1987.

[12] F. Meyer, S. Beucher, "Morphological Segmentation," *Journal of Visual Communication and Image representation*, vol.1, no. 1, pp. 21-46, 1990.

[13] P. Felzenszwalb, D. Huttenlocher, "Efficient Graph Based Image Segmentation," *International Journal of Computer Vision*, vol. 59, no. 2,

pp. 167-181, 2004.

[14] Q. Yang, C.Wang, X. Tang, M. Chang and Z. Ye, "Progressive cut and Image Cutout Algorithm That Models User Intention," *IEEE Multimedia* vol.14, no.3, pp. 56-66, 2007.

[15] Y. Li, J. Sun, C. Tang, H. Shum, "Lazy Snapping" *SIGGRAPH* vol. 23, pp.303-308, 2004.

[16] S.X. Yu, R. Gross and J.shi, "Concurrent Object Recognition and Segmentation by Graph Partitioning," *Proc. Neural Information Processing System*, pp. 1383-1390, 2002.