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Analysis of images using various Techniques

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ABSTRACT

Image segmentation is a key fundamental step in a modern computational system .It is a process to decompose an image into various parts, called regions & each is asset of pixels. So its goal is to produce an simple and meaningful image with better quality. To segment an image various image segmentation techniques are used like Region Based Technique, watershed, Discontinuity based techniques etc. In this paper we analyses the image by using all these methods and giving the results & comparison b/t all them.

Keywords

Image segmentation, Thresholding segmentation, Region based segmentation

1. INTRODUCTION

Image segmentation is a fundamental step in the modern computational vision systems and its goal is to produce a more simple and meaningful representation of the image making it easier to analyze. Image segmentation is a subcategory of image processing of digital images and, basically, it divides a given image into two parts: the object(s) of interest and the background. Image segmentation is typically used to locate objects and boundaries in images and its applicability extends to other methods such as classification, feature extraction and pattern recognition. Most methods are based on histogram analysis, edge detection and region-growing. Currently, other approaches are presented such as segmentation by graph partition, using genetic algorithms and genetic programming. This paper presents a review of this area, starting with a taxonomy of the methods followed by a discussion of the most relevant ones.

1.1 IMAGE SEGMENTATION

Segmentation is a pre-processing step where images are partitioned into several distinct regions and each is a set of pixels. Mathematically, image segmentation may be represented as *Pn* representing the regions of pixels *Rn*. With *n* pixels the region can be described as union of all pixels connected, satisfying equation 1:

$$R_n = \cup_{i=1}^{n} P_i \quad (1)$$

Several image segmentation methods were proposed in the literature. However, a single method may not be efficient for a specific image class. Frequently, it is necessary to combine more than one method to solve interesting real-world problems. The main methods for image segmentation are based on histogram analysis, edge detection and segmentation by regions.

2. Methods of Image Segmentation

There are various methods of image segmentation that are used to segment the image into various parts calls regions.

2.1 Thresholding based segmentation

Thresholding-based segmentation technique has received extensive interest from researchers for many years. This technique is simple but effective for segmentation of images where it subdivides an image into meaningful non-overlapping regions or classes based on gray levels of images. The grayscale image was used because it allows further exploitation on the image in an efficient and easy approach where it can consistently partition the image into two classes. The thresholding technique classifies each of image pixels into two classes which correspond to object class and background class. One of the thresholding-based techniques that was widely used is Otsu method. This method works on gray scale image and selects an optimal threshold value automatically from a gray level histogram. The optimal threshold value was selected by maximing the between-class variance or minimizing the within-class variance. Otsu method was extensively adapted because of several reasons. First, it is simple and has the ability to process the gray level images directly. Second, it is able to work with a global threshold values due to its low sensitivity to dark areas [14]. Finally, the method covers a wide scope of unsupervised decision procedure where it does not require training images in order to get prior knowledge about the histogram shape. However, this method has few disadvantages. One of the drawbacks is that the method was inefficient in determining the optimal threshold value due the fact that it involves a large number of repetitious computations of the zero and first order cumulative moments of the gray level histogram. This process requires high computational time especially for images that were classified into a large number of classes. Furthermore, the usage of Otsu technique alone in the application was not enough to produce accurate segmentation result especially for images under uneven lighting condition.

2.1 An improved thresholding-based segmentation technique for natural images (TsTN)

In this section, an improved segmentation technique for images captured under natural environments was described. The improvement to the segmentation technique was achieved by integrating modified threshold value algorithm with an inversion technique (TsTN). The flowchart of the improved technique is shown in Fig.

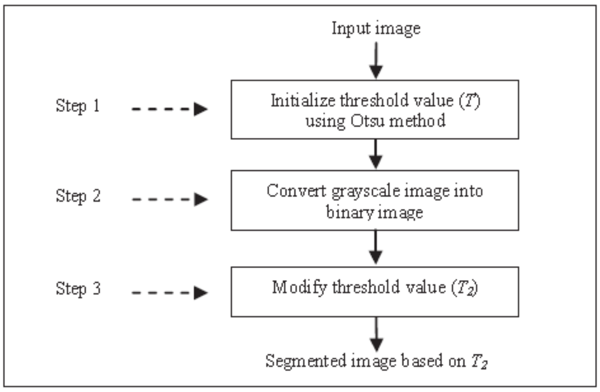

Figure: Flowchart of the Improved Segmentation Technique (TsTN)

Step 1 refers to the initializing an optimal global threshold value (*T*) using Otsu method. The Otsu was applied on the image to obtain the initial value automatically and rapidly. The initial value was calculated to acquire a set of disjoint regions that corresponds to interest object and background. This process was done to ensure that at least part of the object being investigated can be extracted. Step 2 refers to the converting of the grayscale image into binary image based on the existing *T*. The binary image represented the separable area between investigated object and background. The transformation process from grayscale image into the binary image is defined in Eq. 1.

$$g(x,y) = \begin{cases} 1(white) & if \quad f(x,y) > T \\ 0(black) & if \quad f(x,y) \le T \end{cases} \quad ; \qquad (1)$$

where *g(x,y)* and *f(x,y)* are pixel values of binary image and grayscale image, respectively. However, the global threshold value (*T*) produced by Otsu is insufficient to produce cceptable segmented images for some objects. Therefore, in the improved algorithm, a modified global threshold value (T_2) was introduced. In order to generate the best value of T_2, several improvements were made to the segmentation algorithm in Step 3. First, the middle element of binary images produced must be examined to identify the pixel value. If the pixel value point was not '1', an inverse process was required to inverse each pixel in the image from value '1' to '0' and vice verse by executing Eq.

$$g(x,y) = \begin{cases} 1(white) & if \quad g(x,y) = 0 \\ 0(black) & if \quad g(x,y) = 0 \end{cases} \quad ; \qquad (2)$$

where *g(x,y)* is pixel values of binary image.

The inversion process was often needed for cases where investigated objects were darker than the background. Due to the dark images that conceal the shape of the objects, the inversion operation was required so that the background appears black and the investigated image appears white. The second improvement was the expansion of the segmented area by modifying *T* in order to obtain the best T_2. The modification to the threshold value was done based on Eq. 3

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$$T_2 = \begin{cases} T_2 - 0.01(area \uparrow) & \\ T_2 + 0.01(area \downarrow) & if \quad inverse = 0 \\ T_2 + 0.01(area \uparrow) & \\ T_2 - 0.01(area \downarrow) & if \quad inverse = 1 \end{cases} \quad ; \qquad (3)$$

where T_2 is modified threshold value. The current T_2 is updated and the segmentation process is iterated until the best segmented image was achieved.

2.2 Region Based Image Segmentation

Region growing is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points. This approach to segmentation examines neighboring pixels of initial seed points and determines whether the pixel neighbors should be added to the region. The process is iterated on, in the same manner as general data clustering algorithms. The main goal of segmentation is to partition an image into regions. Some segmentation methods such as thresholding achieve this goal by looking for the boundaries between regions based on discontinuities in gray scale or color properties. Region-based segmentation is a technique for determining the region directly.

Basic concept of seed points

The first step in region growing is to select a set of seed points. Seed point selection is based on some user criterion (for example, pixels in a certain gray scale range, pixels evenly spaced on a grid, etc.). The initial region begins as the exact location of these seeds. The regions are then grown from these seed points to adjacent points depending on a region membership criterion. The criterion could be, for example, pixel intensity, gray scale texture, or color. Since the regions are grown on the basis of the criterion, the image information itself is important. For example, if the criterion were a pixel intensity threshold value, knowledge of the histogram of the image would be of use, as one could use it to determine a suitable threshold value for the region membership criterion.

There is a very simple example followed below. Here we use 4-connected neighborhood to grow from the seed points. We can also choose 8-connected neighborhood for our pixels adjacent relationship. And the criteria we make here is the same pixel value. That is, we keep examining the adjacent pixels of seed points. If they have the same intensity value with the seed points, we classify them into the seed points. It is an iterated process until there are no change in two successive iterative stages. Of course, we can make other criteria, but the main goal is to classify the similarity of the image into regions.

The proposed segmentation algorithm

Let A1; A2;.; Ai denote initial seeds and Si denote the region corresponding to Ai. The mean of all seed pixels in Si in terms of Y, Cb, and Cr components. Our proposed segmentation algorithm is described as follows:

(1) Perform automatic seed selection.

(2) Assign a label to each seed region.

(3) Record neighbors of all regions in a sorted list T in a decreasing order of distances.

(4) While T is not empty, remove the first point p and check its 4-neighbors. If all labeled neighbors of p have a same

label, set p to this label. If the labeled neighbors of p have different labels, calculate the distances between p and all neighboring regions and classify p to the nearest region. Then update the mean of this region, and add 4-neighbors of p, which are neither classified yet nor in T, to T in a decreasing order of distances.
(5) Perform region-merging.

3. REFERENCES

1. Wen-Bing Tao *, Jin-Wen Tian, Jian Liu," Image segmentation by three-level thresholding based on maximum fuzzy entropy and genetic algorithm", 14 January 2003.
2. Huang Yourui1, Wang Shuang **Multilevel thresholding methods for image segmentation with Otsu based on QPSO, 2008.**
3. R.A.A. Raof, Zaleha Salleh, S.I. Sahidan, M.Y.Mashor, S.S. Md Noor, F. Mohamad Idris and H. Hasan, **Color Thresholding Method For Image Segmentation Algorithm Of Ziehl-Neelsen Sputum Slide Images,2008.**
4. S. Arora, J. Acharya, A. Verma, Prasanta K. Panigrahi, Multilevel thresholding for image segmentation through a fast statistical recursive algorithm, 2008.
5. Salem Saleh Al-amri, N.V. Kalyankar and Khamitkar S.D **Image Segmentation by Using Thershod Techniques, 2010**
6. Rolf Adams and Leanne Bischof, **Seeded Region Growing,** VOL. **16,** NO. 6, JUNE 1994.
7. **Andrew Mehnert, Paul Jackway, An improved seeded region growing algorithm, 1997.**
8. Alakuijala, **J.** Laitinen, **S.** Sallinen, H. Hehinen, **NEW EFFICIENT IMAGE SEGMENTATION ALGORITHM:COMPETITIVE REGION GROWING OF INITIAL REGIONS, 1997.**
9. ALAIN TREMEAU and NATHALIE BOREL REGION GROWING AND MERGING ALGORITHM TO COLOR SEGMENTATION, 1997.
10. S. A. Hojjatoleslami and J. Kittler, **Region Growing: A New Approach. 1998.**
11. AHLEM MELOUAH, RADIA AMIROUCHE, **Comparative study of automatic seed selection methods for medical image segmentation by region growing technique, 2003.**
12. Jianping Fan, Guihua Zeng, Mathurin Body, Mohand-Said Hacid, Seeded region growing: an extensive and comparative study, 2005.
13. Jun Tang, **A Color Image Segmentation algorithm Based on Region Growing, 2010.**
14. Gang Li and Youchuan Wan, **Adaptive Seeded Region Growing for Image Segmentation Based on Edge Detection, Texture Extraction and Cloud Model**
15. Om Prakash Verma, Madasu Hanmandlu, Seba Susan, Muralidhar Kulkarni and Puneet Kumar Jain, A Simple Single Seeded Region Growing Algorithm for Color Image Segmentation using Adaptive Thresholding, 2011.
16. MMary Synthuja Jain Preetha, Dr.L.Padma Suresh, MJohn Bosco, Image Segmentation Using Seeded Region Growing, 2012.
17. **Yashpal G. Mul, A.V. Gokhale , Smt. Radhikatai Pandav , Yeshwantrao Chavan,** Color Image Segmentation Based on Automatic Seed Pixel Selection, 2012.
18. Chung-Chia Kanga, Wen-June Wanga, Chung-Hao Kang, Image segmentation with complicated background by using seeded region growing, 2012.
19. Puneet Kumar Jain, Seba Susan, An Adaptive Single Seed Based Region Growing Algorithm for Color Imag Segmentation, 2013.
20. M.Mary Synthuja Jain Preetha, L.Padma Suresh, **An Integrated approach for color Image Segmentation using edge and color information, 2013.**
21. A.Kalaivani, S.Chitrakala, **A SURVEY ON COLOR IMAGE SEGMENTATION BY AUTOMATIC SEEDED REGION GROWING, 2013.**
22. Kewal Krishan, Sukhjit Singh, **Color Image Segmentation Using Improved Region Growing and K-Means Method, 2014.**
23. Shilpa Dantulwar (Kamdi), Prof. R.K.Krishna PERFORMANCE ANALYSIS USING SINGLE SEEDED REGION GROWING ALGORITHM, 2014.
24. **Bo Cai1, A new image segmentation algorithm based on SRG and ACM, 2014.**