

Target Detection in Images Using Dynamic Threshold Algorithm

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ABSTRACT: The process of detection of a target image in an input image is difficult by using traditional segmentation methods. So in order to increase the efficiency of detecting a target image, a new method is proposed in this paper. In the proposed method, dynamic segmentation algorithm is used. Mathematical morphology method is used in the image which is segmented by the dynamic threshold algorithm to make the output more accurate. Experimental result shows that the proposed algorithm could detect the target area of the image across large number of test cases. This proposed method can overcome the limitations of traditional segmentation method more effectively.

KEYWORDS: Target Detection, Dynamic Threshold, Mathematical Morphology, Segmentation.

I. INTRODUCTION

Target detection refers to the detection of the required target image in the given input image by image processing techniques. The accuracy of the system can be determined by extracting the target area. In most of the automatic target detection systems, the problem of low accuracy occurs. Hence, in order to improve the accuracy effectively, the study of high precision target region extraction is important in the field of image processing. The disadvantages of traditional segmentation method are overcome by the proposed method. In the proposed method, dynamic threshold algorithm is used. To make the output more accurate, techniques of mathematical morphology are also used. The process of finding sharp discontinuities in an image is called as edge detection, which is the main key in target recognition. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in an image.

II. RELATED WORK

S.P.Zhu, *et al* [1] states that, the threshold of a pixel in an image is estimated by calculating the average of the grayscale values of its neighbor pixels, and the square variance of the gray scale values of the neighbor pixels are also calculated as an additional judge condition, so that the result of the proposed algorithm is the edge of the image. But if there is noise in the background image complexity, it is not possible to achieve effective image segmentation. Owing to the above segmentation algorithm cannot take account into the actual situation of the various areas of the image, and image processing method of single can't meet the detection accuracy requirements. Shiping Zhu, *et al* [2] proposes a new segmentation algorithm that each pixel in the image has its own threshold. The threshold of each pixel is estimated by calculating the mean of the grayscale values of the neighbor pixels. Apostolos P. Leros, *et al* [3] presents two target detection methods with improved accuracy in side scan sonar images. In the first method, target detection is based on morphological operations. The second method combines Empirical Mode Decomposition (EMD) with morphological operations. Both methods are enhanced with edge detection filtering. Ferdous Hossain, *et al* [4] presents that, a pixel will be marked as an edge if its gradient lies in between of lower and upper threshold values. A pixel will be discarded if its gradient below the lower or beyond the upper threshold values. Eventually, the pixels gradient is between the two threshold values will be connected as marked edge. Neeta Nain, *et al* [5] presents that the presence of an edge within a grayscale image indicates that there is a change in the grayscale from one region to another. The

derivative of the grayscale levels within an image as a function of the (x, y) position provides a means of detecting the presence of an edge. A large number of vision applications like matching and tracking use edges and lines as primitives. The process of edge detection is usually followed (preceded) by the thresholding of the edge detected image. The process of thresholding provides a means of separating weak edges from strong edges.

III.EXPERIMENTAL MATERIALS

The images used for target detection are bitmap images, since the quality does not degrade when saved multiple times and easy to translate into dot format. It is supported by virtually every device. A bitmap is a mapping from some domain to bits (values which are zeros and ones). It is also called as bit array or bit map index. The bitmap images are represented in BMP file format. The BMP file format is capable of storing two-dimensional digital images both monochrome and colour, in various colour depths. 24-bit bitmap images are used for detection. The images are stored upside down. The first line in the file is the bottom line of the image and the last line in the file is the first line of the image[6]. Hence, in 24-bit images RGB values are stored in Blue, Green, Red order. The number of colours that can be assigned to a pixel in 24-bit images is 2^{24} (16,777,216) colours.

IV.METHODS

In this paper, a new segmentation method named as dynamic threshold segmentation is proposed. To make the output more accurate, mathematical morphology techniques are used. The color images are first converted into gray scale images and then it is segmented by dynamic threshold segmentation algorithm method. The flow diagram of the proposed technique is shown in fig.1

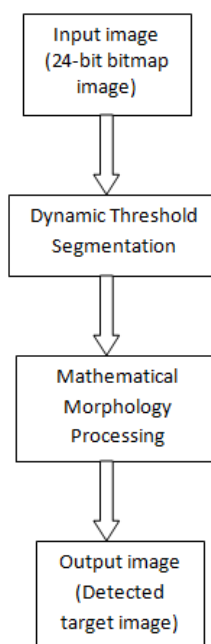


Fig 1: Flow diagram of the proposed algorithm

DYNAMIC THRESHOLD ALGORITHM

The simplest method of image segmentation is thresholding the image. In this image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify or change the

representation of an image into that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries in images. According to the principle of dynamic threshold segmentation algorithm, the basic idea is to get the gray background of the image by the image smoothing method, then to get the target area by subtracting the original image and the background image. And, the idea need set a gray value greater or less than the target area, too [7]. Dynamic thresholding depends on the position in the image. The image is divided into overlapping sections which are thresholded one by one.

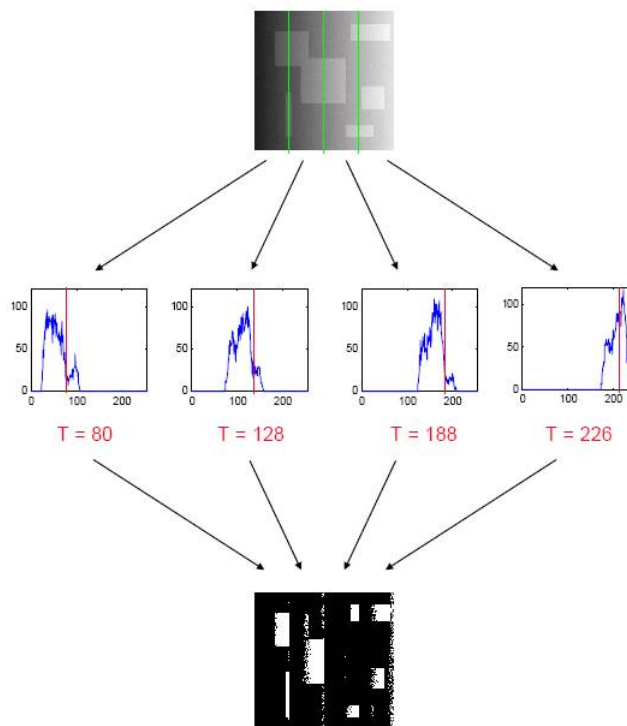


Fig 2: Dynamic Threshold Segmentation

In fig. 2, the gray level image is subjected to dynamic threshold segmentation. The image is segmented into various segments. The threshold value is computed by implementing an equation on each pixel and its neighborhood pixels[8]. Then binary image, $B(x,y)$ is computed by comparing each detail subband 'eds' with threshold 'Th'. Following equation is utilized for calculation of threshold 'Th'.

$$Th = \frac{\sum(eds(x,y)|s(x,y))}{\sum s(x,y)} \quad \dots(1)$$

where $s(x,y) = \max(|m1 ** s(x,y)|, |m2 ** s(x,y)|)$, $m1 = [-1,0,1]$ and $m2 = [-1,0,1]^T$. '**' represents two dimensional linear convolution. The values of $x = 1,2,3,\dots,P$ and $y = 1,2,3,\dots,Q$ for $P \times Q$ subband. Then the binary image can be obtained from following equation.

$$B(x,y) = \begin{cases} 1 & \text{if } eds(x,y) \geq Th \\ 0 & \text{if } eds(x,y) < Th \end{cases} \quad \dots(2)$$

The results of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image.

MATHEMATICAL MORPHOLOGY PROCESSING

Mathematical morphology mostly deals with the mathematical theory of describing shapes using sets. In image processing, mathematical morphology is used to investigate the interaction between an image and a certain chosen structuring element using the basic operations. The structuring element is usually small relative to the image. In the case of digital images, we typically use simple binary structuring elements like a cross or a square. Mathematical morphology stands somewhat apart from traditional linear image processing, since the basic operations of morphology are non-linear in nature. The basic morphological operations are erosion, dilation, opening and closing.

Erosion removes pixels on the boundaries of objects in an image. The value of the output pixel is the minimum value of all the pixels in the input pixel's neighborhood. In a binary image, if any of the pixels is set to 0, the output pixel is set to 0. The positions where a given structure element fits

$$\epsilon_B(X) = \{x | B_x \subseteq X\} \quad \dots(3)$$

where $\epsilon_B(X)$ is the erosion of the structure element, B_x means B translated with x, X is the image, and B is the structure element. The erosion process is shown in fig. 3

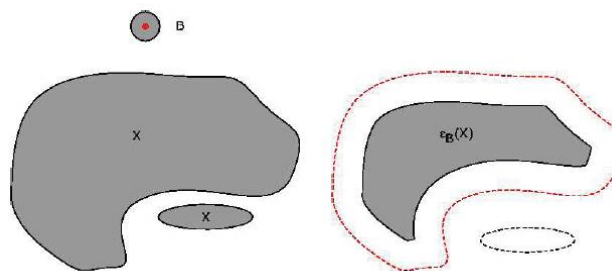


Fig 3: Erosion in binary image

Dilation adds pixels to the boundaries of objects in an image. The value of the output pixel is the maximum value of all the pixels in the input pixel's neighborhood. In a binary image, if any of the pixels is set to 1, the output pixel is set to 1. The positions where a given structure element fits

$$\delta_B(X) = \{x | B_x \cap X \neq \emptyset\} \quad \dots(4)$$

where $\delta_B(X)$ is the dilation of the structure element, B_x means B translated with x, X is the image, and B is the structure element. The dilation process is shown in fig. 4

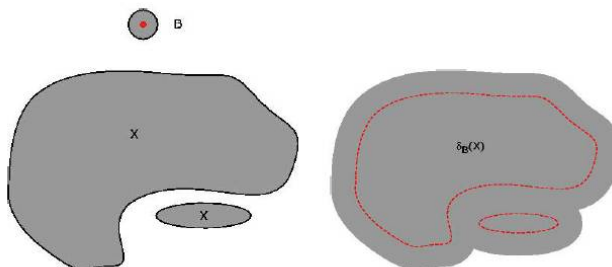


Fig 4: Dilation in binary image

The number of pixels added or removed from an object in an image depends on the size and shape of the structuring element used to process the image. In the morphological dilation and erosion operations, the state of any given pixels in the output image is determined by applying a rule to the corresponding pixel and its neighbors in the input image.

V. RESULTS AND DISCUSSION

The results obtained using the proposed technique are shown in Fig. 5(a) and 5(b). Fig. 5(a) is the target image which is to be detected and Fig. 5(b) is the image where the target is found. The results show that the proposed algorithm is highly efficient when compared to the traditional segmentation method.



Fig. 5(a)

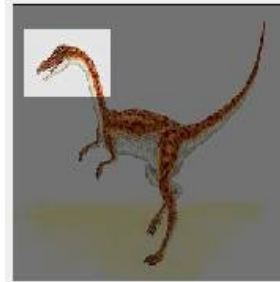


Fig. 5(b)

The correlation is calculated between the two images. If the correlation is positive, the target is detected. If the correlation is zero or negative, the target is not detected.

VI. CONCLUSION

In this paper an effective method for target detection in images using dynamic threshold algorithm is proposed. This method can be used as an alternative to the traditional segmentation methods. The results of experiment shows that the improved method can detect the target area more accurate than traditional segmentation method and it has advantages of fast detection speed, stable robustness and high efficiency.

REFERENCES

- [1] S.P. Zhu, X. Xia, Q.R. Zhang, Belloulata. K, "An Image Segmentation Algorithm in Image Processing Based on Threshold Segmentation," IEEE Transactions on Signal-Image Technologies and Internet-Based System, pp. 673-678, 2007.
- [2] Shiping Zhu, Xi Xia, Qingrong Zhang.(2008). "An Image Segmentation Algorithm in Image Processing Based on Threshold Segmentation" IEEE Signal Image Technology and Internet based System.
- [3] Apostolos P. Leros, Antonious S. Andreatos(2016). "Target Detection in Sonar Images Using Morphological Operations and Empirical Mode Decomposition" Journal of applied mathematics and bioinformatics vol.6, no.3.
- [4] Ferdous Hossain, Mina Asaduzzaman, Mohammad Abu Yousuf (2016) "Dynamic Thresholding based Adaptive Canny Edge Detection" International Journal of Computer Applications (0975 – 8887) Volume 135 – No.4.
- [5] Neeta Nain, Gaurav Jindal, Ashish Garg and Anshul Jain (2008) "Dynamic Thresholding Based Edge Detection" Proceedings of the World Congress on Engineering 2008 Vol I.
- [6] https://www.siggraph.org/education/materials/HyperVis/asp_data/compimag/bmpfile.htm
- [7] Gaoliang Li., Van Zhao, Falin Wu, Shuo Zhang (2014). "An Improved Technology for Target Detection in Images" IEEE Imaging Systems and Techniques doi: 10.1109/IST.2014.6958435.
- [8] Akhilesh Sharma, Malay Kishore Dutta, Anushikha Singh & M.Parthasarathi (2014). "Dynamic Thresholding Technique for Detection of Haemorrhages in Retinal Images".