



A Novel Method of Image Segmentation Using Dynamic Merging

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Abstract: Image segmentation is an initial step in many applications of image analysis. It is the method of segmenting images into discontinuous regions. This paper describes a novel image segmentation algorithm for images. This algorithm can be used when we try to segment the image for different applications. We can apply the concept of combination of image segmentation with the image fusion algorithm. It shows that proposed image segmentation algorithm gives the better result. In this paper we have done the comparison between the existing algorithm and the proposed algorithm. After simulation we have come to the conclusion that when fuse proposed image segmentation algorithm performs better than other algorithm. It evaluates the performance of each algorithm with MATLAB R2012a. The performance evaluation is done on the basis of MSE and PSNR.

Keywords: Image Segmentation, thresholding, Image fusion, MSE, PSNR.

I. Introduction

Digital image processing is meant for processing digital computer. Is the use of computer program to perform image processing on digital images [3]. It is a widely used technology for digital image developed field on its own within image processing. Image segmentation is the first major step and also one of the most crucial tasks of image analysis, which has aim of extracting information which is represented in the form of data from image via image segmentation, feature measurement and of object representation in an image. Segmentation partitions an image into distinct regions containing each pixel with similar features [6], on which the image is describe, into meaningful parts or regions. Image segmentation may use statistical classification, thresholding techniques, and detection of edges, region detection, or any way of selecting of these techniques. Segmentation techniques are mainly region based or edge detection based and here we are focusing on the second method. The output of the segmentation step is usually a set of classified elements. Segmentation mainly draws the boundary between two different regions in an image. Goal of image segmentation is to create a line drawing of a scene from an image of that scene. - Important characteristics can be extracted from the edges of an image (e.g., corners, lines, curves). - These features are utilized by higher-level computer vision algorithms (e.g., recognition). The segmentation procedure is to find the better positions of the shape points according to the appearance information

II. Image Segmentation Techniques

Segmentation divides an image into its constituent regions or objects. Image segmentation is a difficult task in image processing. Areas of image segmentation are still under research. Segmentation allows extracting objects in images. Segmentation is unsupervised learning, various image segmentation methods are as follows:

A. Simple thresholding

Threshold is one of the widely methods used for image segmentation. It is useful in discriminating foreground from the background [2]. By choosing an adequate threshold value T , the gray level image can be transform in to binary image. The binary image must contain all of the require information about the position and shape of the objects of interest (foreground) [11]. The advantage of obtaining first a binary image is that it reduces the complexity of the data and simplifies the process of recognition and classification. The most usual way to convert a gray-level image to a binary image is to select a single threshold value (T). Then all the gray level values below this T will be classified as black (0), and those above T will be white (1). The segmentation problem becomes one of selecting the proper value for the threshold T . A persistent method used to select T is by analyzing the histograms of the type of images that want to be segmented [2]. The ideal case is when the histogram presents only two dominant modes and a clear valley which is called as bimodal [11]. In this case the value of T is selected as the valley point between the two modes. In real applications histograms are more complex, with many peaks and not clear valleys, and it is not every time easy to select the value of T [6].

B. Histogram thresholding

Automatically selected threshold value for each image by the system without human intervention or control is called an automatic threshold scheme [2]. This requires the knowledge about the intensity characteristics or

attributes of the objects, sizes of the objects, fractions of the image occupied by the objects and the number of various types of objects appearing in the image.

C. Otsu thresholding

Otsu thresholding is based on a very basic idea i.e. to find the threshold that minimizes the weighted within the class variance [11]. This turns out to be the same as maximizing the between-class variance. It operates directly on the gray level histogram, Otsu thresholding is very fast method once we calculate the histogram.

D. Adaptive thresholding

Thresholding is the simplest way to segment objects from a background. If that background is relatively uniform, then you can use a global threshold value to binary transform the image by pixel-intensity [2]. If there's large variation in the background intensity, however, adaptive thresholding (local or dynamic thresholding) may produce better results [6]. Here, we binary transform an image using the threshold adaptive function, which calculates thresholds in regions of size block size surrounding each pixel. Each threshold value is the weighted mean of the local neighborhood minus an offset value [9].

E. Polynomial Curve Fitting

We segment an image by fitting a polynomial curve to the histogram and finding point of inflection to determine the minima for thresholding [11]. Polynomial fitting based algorithm is very robust and efficient in comparison with the original ray casting algorithm based on gradient features [12].

III. Image fusion

Image fusion is the amalgamation of two or more different images to form a new image by using a certain algorithm [16]. The aim of image fusion is to generate a result which describes the scene better than any single image with respect to some relevant properties [5]. Image fusion algorithm should fulfill basic criteria that both the information source used for the fusion refers to a common underlying event.

Image fusion algorithm are desired to achieve benefits like high accuracy and reliability this can be achieved by reducing the redundant information , also high features and dimensionality this can be achieved by adding complementary information , by using simultaneous data acquisition it can be made cost effective[15].

The fused image contains higher information content of the scene of any of the individual image sources alone. Image fusion requires that images are registered first before fusing. Data fusion techniques combine data from different sources together [15]. The main reason for using fusion is to produce a result which provides the more detailed and reliable information possible. Fusing multiple sources of information together also produces a more efficient representation of the data.

A. Simple Average based Image Fusion

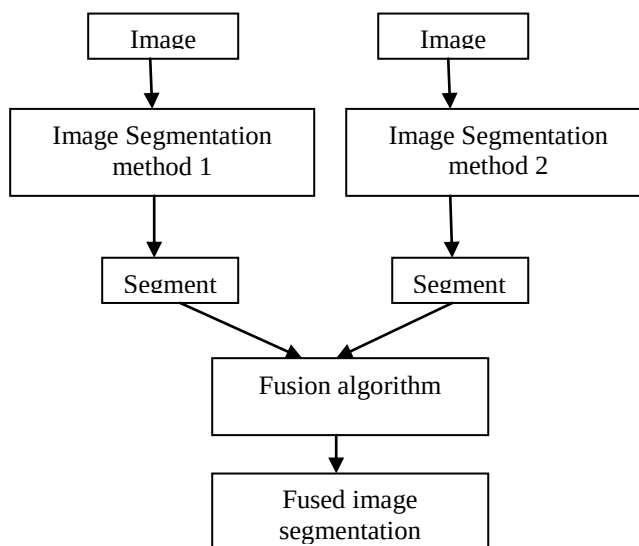
This is a one of the fundamental technique of image fusion. Image fusion could be achieved by simple averaging corresponding pixels in each input image. The value of the pixel $K(i, j)$ of both image is taken and added. This sum which we get is divided by 2 to get the average. The mean value is assigned to the corresponding pixel of the output image is given in equation (1). This is repeated for every pixel values.

$$K(i, j) = (X(i, j) + Y(i, j)) / 2 \quad (1)$$

Where $X(i, j)$ and $Y(i, j)$ are two input images

IV. Proposed Algorithm

Till now various image segmentation, in this paper we try to implement a new approach towards the image segmentation, we get the segmentation separately then we will try to fuse them using image fusion algorithm. The flow chart of the proposed step and the steps how the approach is implemented is given below.



Step1: We will take an image. We perform the read operation.

Step2: Now we apply existing image segmentation algorithms, in our case we are using Otsu and polyfitt method together.

Step3: After applying image segmentation our next step is to fuse the edges together by applying simple image fusion average algorithm.

Step4: Finally we get fused edges which are better result or outcome. It is an enhanced version of image segmentation algorithm for the image.

V. Evaluation Criteria

A. Peak Signal to Noise Ratio (PSNR)[5]

PSNR calculates the peak signal-to-noise ratio, in decibels (dB), between two images. This ratio is used as a measure of quality between the original and a reconstructed image. The larger the PSNR, the better is the quality of the edges of fused image[5]. To calculate the PSNR, we first calculate the mean squared error (MSE) using the following equation:

$$PSNR = 10 \log_{10} \left(\frac{\text{Peak}^2}{\text{MSE}} \right) \quad (2)$$

B. Mean square error (MSE)

Mean square error is a measure of image quality index [7]. The large value of mean square means that image is a poor quality. Mean square error between the reference image and the fused image is:

$$MSE = \frac{1}{mn} \sum_{i=1}^m \sum_{j=1}^n (A_{ij} - B_{ij})^2 \quad (3)$$

Assumptions made in the following equations are:

A - The perfect image, B - The edges of fused image to be assessed, i – Pixel row index, j – Pixel column index

VI. Result

The proposed algorithm and the existing edge detection algorithm are implemented on Matlab R2012a using different image. Proposed algorithm results are compared with each other by using existing image segmentation techniques. Two well known image performance parameters for digital image have been selected to prove that performance of the proposed algorithm is better than the other existing image segmentation methods.

TABLE: 6.1

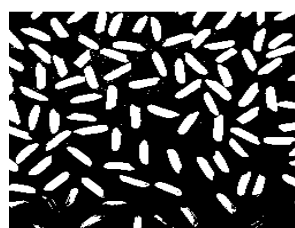
S.No	Source image Peppers	PSNR	MSE
1	Simple thresholding	53.1772	.3129
2	Otsu thresholding	53.1823	.3125
3	Adaptive thresholding	53.1912	.3119
4	Polynomial curve fitting	53.2833	.3015
5	Proposed algorithm	55.3776	.1885

TABLE: 6.2

S.No	Source image Rice	PSNR	MSE
1	Simple thresholding	52.8445	.3378
2	Otsu thresholding	53.0435	.3227
3	Adaptive thresholding	52.9761	.3284
4	Polynomial curve fitting	52.8545	.3268
5	Proposed algorithm	55.2548	.1939



(a)



(b)

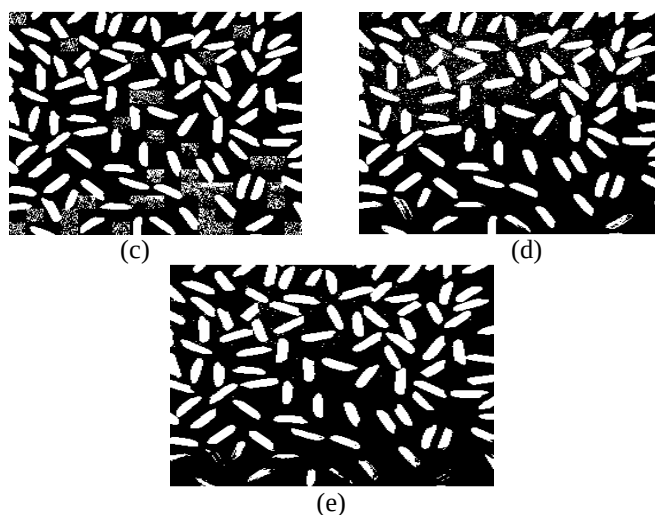


Figure.1 (a) Original image (b) Image with simple thresholding (c) Image with Otsu thresholding (d) Image with adaptive thresholding (e) Image with polynomial curve fitting (f) Proposed algorithm image.

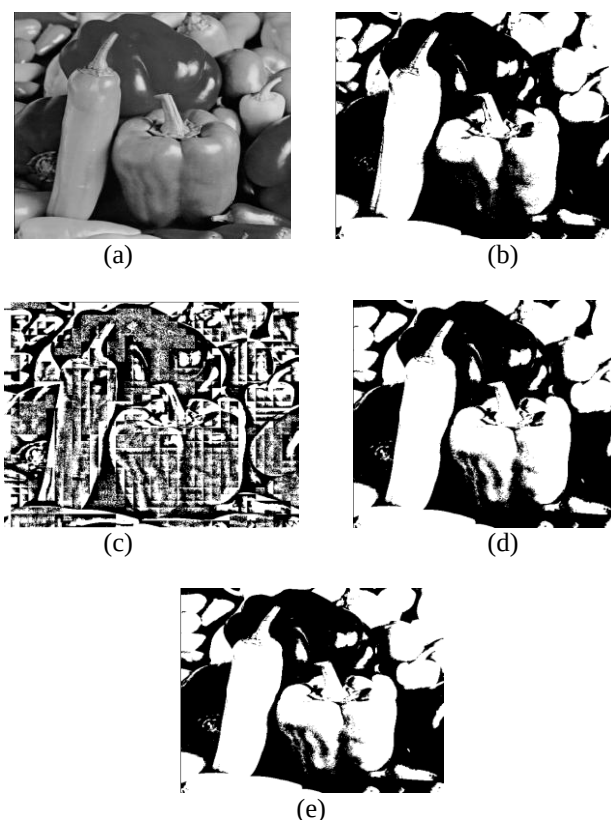


Figure.2 (a) Original image (b) Image with simple thresholding (c) Image with Otsu thresholding (d) Image with adaptive thresholding (e) Image with polynomial curve fitting (f) Proposed algorithm image

VII. Conclusion

The proposed algorithm considers the combination of image segmentation approaches. The main aim is to perform different image segmentation approach on image by combining it with image fusion to enhance the quality of resulting image. In this paper we have studied and evaluate different image segmentation techniques. We also proposed a better image segmentation technique which is based on fusion approaches. In conclusion we can say that, the ideal image segmentation method doesn't exist for image. Being given an image, there exist several possible detection methods. Therefore, a good method will always be that which provide the best interpretation of the resulting image segmentation without losing the important details but it is more difficult in case of many images. Proposed image segmentation method locates the segments better compare to other image segmentation but still some improvement is required.

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