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Research of Image Segmentation Based on Iterative Threshold

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Abstract. Image segmentation is the key step in image recognition,the result of segmentation affects the one of recognition directly.The article introduces the concept and detailed definition of the image segmentation. The segmentation algorithm of iterative threshold in detail. According to the intrinsic characteristics of weed images, just can use the iteration threshold segmentation method, and implements them by Matlab programme, then processes three weed images, respectively to obtain effective results , and establishes a good base for the pick-up of the target character.

Introduction

Image is a mapping of objective scenery by some system, it is often said an enrichment or generalization of the object information.Output image normally in the form of analog voltage, in order to use the computer for image processing, needs to be simulated image signal discretization, this image is digital image[1].Digital image processing in the pattern recognition process mainly includes three phases: image segmentation, feature extraction and classification.Image segmentation is the key step in image recognition, it will directly affect the results.

In the study of the image, in addition to the target image, the original image is often have larger non-goals area.Original image is direct processing on the target and non-goals area,it will increases the amount of data, operation time, noise and complexity.We can pick-up the original image of target area,then processing this area,it will greatly simplify the difficulty of dealing with problems.In order to identify and analyze the target,image must to be separated out, it is likely to increase the use of the target on the basis of this.Image segmentation is technic and the procedure which is to contain a large number of various image into each has its characteristics of information area,then extract the target[2].This feature can be grey scale,color, texture.A predefined target can correspond to a single region or multiple regions.The final result of Segmentation is that the original image segmentation into various minimum components of feature, these components will become the primitive of image.

At present, most of the image processing, analysis and target recognition is based on gray image.Gray image segmentation is generally based on image gray scale are two basic properties: pixel gray discontinuity and similarity.Pixels in the region is generally have some similarities,but between the area and the border generally have a discontinuity[3].Use this property of image, can use iteration threshold segmentation method to extract the target.

Segmentation of Threshold Method

Threshold segmentation of gray image is to determine gray threshold, then the gray value of each pixel in the image are compared with the threshold.According to the results of comparison to the corresponding pixel is divided into two categories: gray value of pixel is greater than the threshold for one class and gray value of pixel is less than the threshold for another class(the pixel of grey value is equal to the threshold can be attributed to one of the two)[4].These pixel of two types belong to two kinds of area, so image classification for image pixel to achieve the purpose of the regional segmentation.Threshold algorithm for segmentation, therefore, there are two main steps:

(i)Identify the segmentation threshold of need;

(ii)The segmentation threshold compared with gray levels of pixels, the purpose is to segmentation image pixels.Threshold segmentation process as shown in Fig. 1.

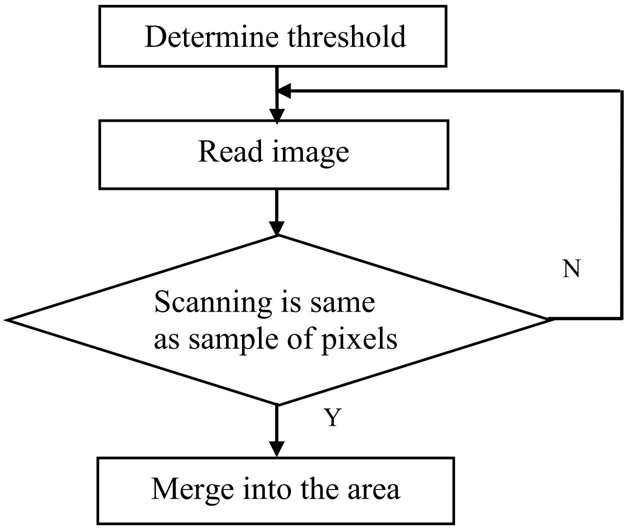

Fig. 1 The flow chart of threshold segmentation

Further,if two distribution size (amount) approximate and mean value far enough apart.The mean square error of two parts is small enough, then the general histogram should be more distinct bimodal.By analogy, if target of multiple unimodal gray distribution in the image, the histogram is likely to show more distinct bimodal.This kind of image is suitable for iterative threshold segmentation method.

Technology of Iterative Threshold Segmentation

If the foreground of interior as a uniform grey value, and the distribution in another uniform background of grey value, then gray histogram of the image should have obvious twin peaks.But in many cases, the interference of noise is difficult to determine in the position of peak valley or the result is not stable, and iterative method can effectively eliminate or reduce the noise influence on gray threshold[5~6].

Suppose we have a picture of a mixed with noise image $g(x,y)$ is superposition of original image $f(x,y)$ and $e(x,y)$:

$$g(x,y) = f(x,y) + e(x,y) \tag{1}$$

It is assumed that each point of the noise are unrelated,zero mean and standard deviation for E.Through threshold segmentation,image is divided into two parts,because the noise is applied to image pixels in random, then you can think after segment target g_1 and background g_2,the noise interference on the image is $e(x,y)$:

$$g_1(x,y) = f_1(x,y) = e(x,y) \tag{2}$$

$$g_2(x,y) = f_2(x,y) = e(x,y) \tag{3}$$

The iterative algorithm need the segmented image for the average grayscale respectively.

$$\mathrm{E}\{g_1(\mathrm{x,y})\}=\mathrm{E}\{f_1(\mathrm{x,y})+\mathrm{e(x,y)}\}=\mathrm{E}\{f_1(\mathrm{x,y})\} \tag{4}$$

$$E\{ g_2(x,y)\}=E\{ f_2(x,y)+e(x,y)\}=E\{ f_2(x,y)\} \tag{5}$$

The above formula shows that iterations has increase,average grey value will tend to true value.Therefore,using iterative algorithm to get the best threshold value is not affected by noise.Iterative algorithm is described as follows:

①Choose an estimated value of initial threshold: $T_0 = \{T_k \hat{u}\, k = 0\}$

$$T_0 = \frac{Z_{\min} + Z_{\max}}{2} \tag{6}$$

$Z_{\min}$, $Z_{\max}$ respectively the minimum and maximum grey value of image.

②Using the threshold T_k dividing the image into two groups, R_1 and R_2

$$R_1 = \{f(x,y) \hat{u}\, f(x,y) \geq T_k\} \tag{7}$$

$$R_2 = \{f(x,y) \hat{u}\, 0 < f(x,y) < T_k\} \tag{8}$$

③Calculation area of R_1 and R_2 ,average grayscale Z_1 and Z_2

$$Z_1 = \frac{\sum_{f(i,j)<T_k} f(i,j) \times N(i,j)}{\sum_{f(i,j)<T_k} N(i,j)} \tag{9}$$

$$Z_2 = \frac{\sum_{f(i,j)>T_k} f(i,j) \times N(i,j)}{\sum_{f(i,j)>T_k} N(i,j)} \tag{10}$$

The above formula, $f(i,j)$ is grey value (i,j) on the image,the weight coefficient of (i,j) is $N(i,j)$,as a general rule, $N(i,j) = 1.0$

④Choose a new threshold T_{k+1}

$$T_{k+1} = \frac{Z_1 + Z_2}{2} \tag{11}$$

⑤If $T_k = T_{k+1}$,the end; or $k = k+1$, turn to step ②.

(a)

(b)

(c)

Fig. 2 (a)&(b) Binary chart of white is the target (c)binary chart of black is the target

Experimental Results & Discussion

Because of weed image gray histogram be considered by the target and background consists of a mix of two single-peak histograms, and two parts of the mean square error is small enough, the overall histogram is a more obvious twin peaks.So this kind of image is suitable for using iterative threshold method to segment target weeds.

In accordance with the above image segmentation technology of based on iterative threshold,image segmentation procedure is compiled by Matlab,processing three weeds image and verification.Through repeated calculation and correction all kinds of parameters,images of threshold are 149.3(a),155.6(b),142.2(c).The identify results, as shown in Fig.2

The figure 2 shows that method of iterative threshold to segment the target is more clear and complete,therefore,the intersected effect of iterative threshold method is relatively better in this type of image,this method can lay a good foundation to extract features of target.

Conclusions

Image segmentation is a difficult problem in computer vision research.Although there is a lot of research on image segmentation, there is no suitable for all image of general segmentation algorithm.Using two-dimensional gray histogram of the image, gray value distribution of pixel and its neighborhood average grey value distribution of histogram iteration threshold segmentation.The advantage is computing speed is fast and easy to implement.The experimental results show that can better identify weeds goal.Defect is difficult to deal with objects of multiple foreground.But because of using the grey value of image information and spatial neighborhood information, the effect is obviously improved than traditional methods.The emergence of the fast algorithm gives a more realistic significance.Choose suitable segmentation algorithm is still a trouble thing, because it lack of appropriate criteria.Eventually choose what kind of method, evaluation pros and cons of segmentation, should be combined with the actual situation and specific requirements, considering factors such as performance, cost,then select the most appropriate method.

Therefore, to seek strong adaptability, fast and efficient method is a research focus in the future.At the same time, integrated use of a variety of image segmentation method, image processing play their respective advantages will become the development trend of this field.

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