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Localization Method for Package Bill in Camera Captured Images Based on Otsu Thresholding and Morphological Operation

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Abstract: In order to develop a package sorting system, we must locate the package bill area first. In this case, the package image is obtained under restricted environment(Less background interference). this paper proposes an efficient method for locating package bill based on Otsu thresholding and morphological operation. Firstly, turning colored images into grey images make it easier to locate the package bill area. Then, according to the brightness difference between package bill and background, package bill area is obtained by using thresh Otsu method, morphological operation and connected domain selection. Experimental comparison results show that the results by the proposed method are accurate and complete, with background noise being suppressed effectively.

Keywords: binarization processing, adaptive threshold, morphological Operation.

1. Introduction

In the process of receiving, sorting and delivering the package, the information of the package bill needs to be recognited. The image of the package collected by the image acquisition device often contains background information. Therefore, before the information of the package bill is recognized, the package bill area must be accurately located in the image. Considering that the recognition algorithm takes a long time, the package bill localization method must be simple and efficient. the package bill localization method is mainly divided into two major steps, image binarization and noise area removal. image binarization methods mainly categorized into two categories namely Otsu method[1], and Mode method[2]. the proposed method combines the otsu method with the morphological Operation method and got good results.

2. Image Pretreatment

2.1 Transform to Gray image

Color images contain a lot of color information, which not only has a large overhead on storage, but also reduces the execution speed of the system in processing. Color images are often transformed to gray images in processes such as recognizing images to speed up processing. The Fig.1 shows An image of a package bill collected by smartphone and the Fig.2 is gray image transformed by it.

Fig.1the original image

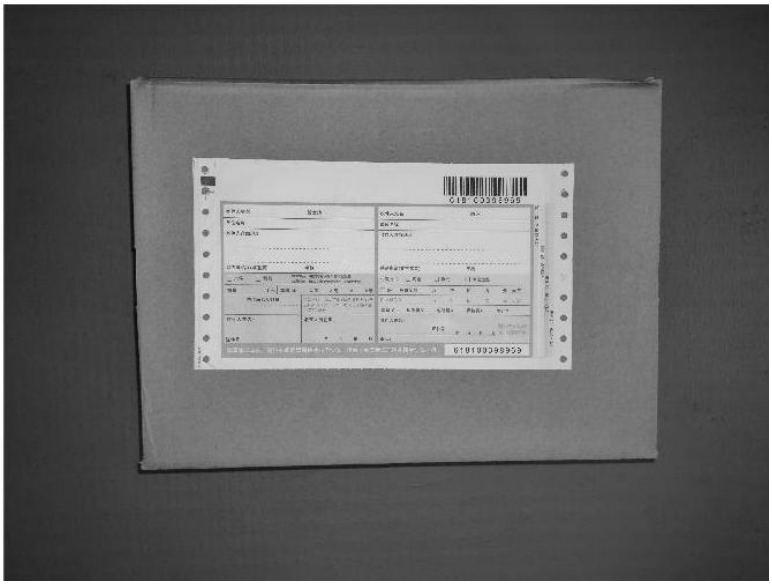

Fig.2Gray image

2.2 Image binarization

Binarization is one of the simplest methods of grayscale image segmentation. This method assumes that objects and background can be distinguished by differences in

gray values. By carefully selecting the grayscale threshold between the object and the background, a grayscale image can be converted to a binary image, value of a pixel larger than the threshold will be marked as 1, smaller than the threshold will be marked as 0. Although this method is very simple, but it is very important and fundamental, and has a wide range of practicalities. For a W×H grayscale image I and a threshold T, the thresholding result is defined as：

$$B_{i,\ j} = \begin{cases} 0, & I_{i,\ j} \le T \\ 1, & I_{i,\ j} > T \end{cases}, (i = 1,2 \ldots w;\ \ j = 1,2 \ldots h)$$

The package bill occupies a large area in the image, and the package bill is in big difference with the color of the package. This section attempts to use the brightness feature to binarize the image and separate the package bill from the image.

The threshold is the key to threshold segmentation, and a good threshold can completely separate the target object from the background. Usually to determine the appropriate threshold, you need to analyze the grayscale Histogram of image.The grayscale histogram (shown in Fig. 3) can count the grayscale distribution of the entire image by counting the total number of pixels in each grayscale range of an image, so as to select an appropriate threshold.

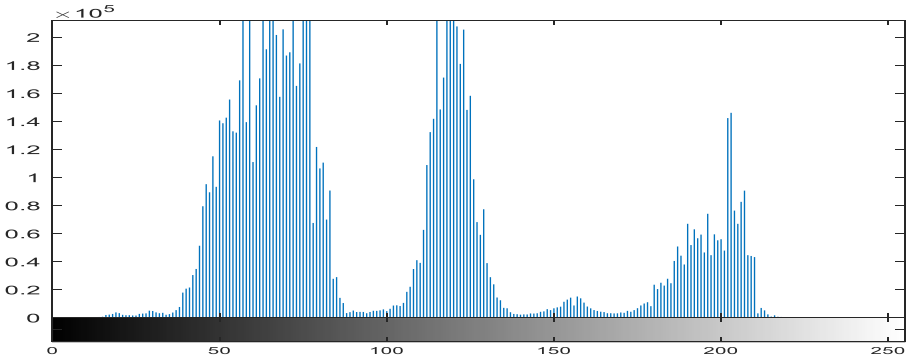

Fig.3 Grayscale histogram

The mode method is simply used valley value between two peak as a threshold. It is easy to misjudge when the double peak is relatively flat or multiple peaks may occur. So in the package bill image, this method is not suitable. By analyzing The grayscale histogram of Figure.3 above, it is more appropriate to use the Otsu method to binarize the courier document image. As one of the adaptive threshold methods, As one of the adaptive threshold methods, the Otsu method is mainly used to distinguish between background information and regions of interest in an image. The results of the binarized image processed by the Otsu method are shown in Fig. 4. Compared with the mode method, the otsu method has better performance.

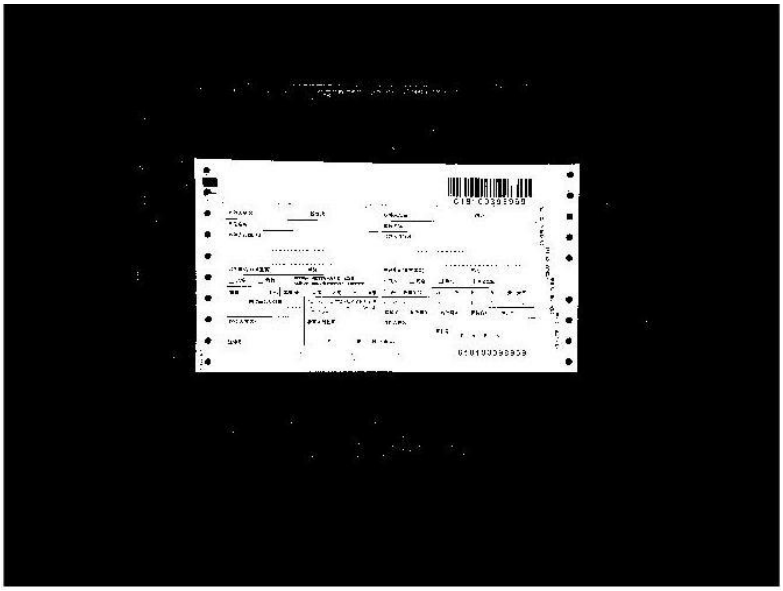

Fig.4 Binarized image

3. localization of Package Bill

3.1 Morphological operation

Morphological nonlinear filtering can be used to suppress noise and process image problems such as feature extraction, edge detection, and image segmentation. erosion shrinks or thins objects in a binary image. In fact, we can view erosion as a morphological filtering operation in which image details smaller than the structuring element are filtered (removed) from the image. Unlike erosion, which is a shrinking or thinning operation, dilation "grows" or "thickens" objects in a binary image. The specific manner and extent of this thickening is controlled by the shape of the structuring element used. The process of first eroding then dilationg is called the opening operation. Opening generally smoothes the contour of an object, breaks narrow isthmuses, and eliminates thin protrusions. The process of first dilationg then eroding is called the Closing operation. Closing also tends to smooth sections of contours but, as opposed to opening, it generally fuses narrow breaks and long thin gulfs, eliminates small holes, and fills gaps in the contour.the result of binarized image after first one closing operation and then two opening operations is shown in the figure.5.

3.2 Extracting the package bill area

When there is interference around the package bill area, after the above steps are processed, multiple connected domains may appear in the image(shown in Fig. 5). the areas of interference need to be excluded, and the package bill area is reserved. By analyzing these connected domains, the package bill area is rectangular, and the aspect ratio is about 1.8:1. If it is calculated that the aspect ratio of the connected

domain is not near this ratio, it can be deleted. the area of the package bill area is largest in the image, so,the connected domain with the largest area is taken as the final choice. The result is shown in the figure. After getting the package bill area, we can compute the minimal bounding rectangle of the package bill area in the plane(shown in Fig. 6)

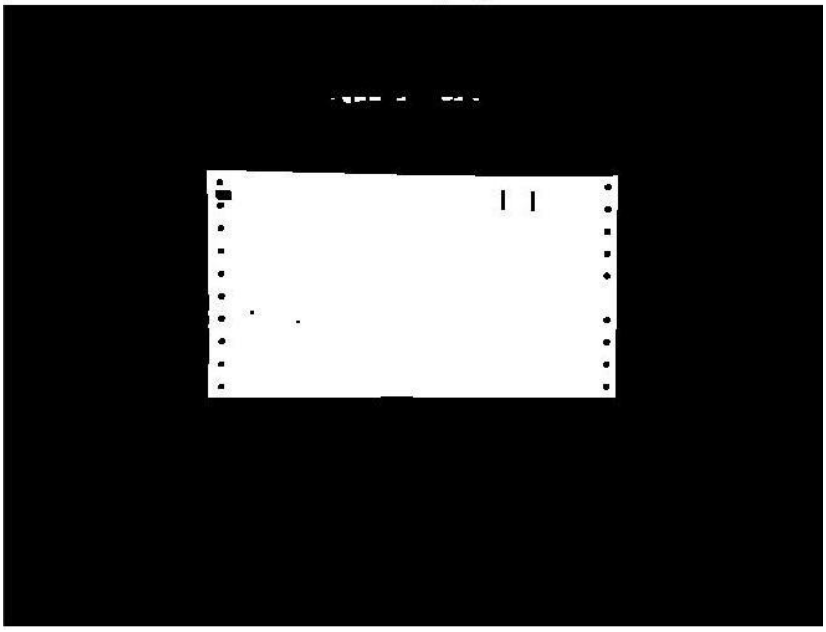

Fig.5 Morphological operation

4. Conclusion

The package bill area locating method based on Otsu Thresholding and Morphological Operation has good performance, it is simple and accurate ,the extracted package bill area is clear and background noise is suppressed effectively. method flow chart as shown in Figure.7.

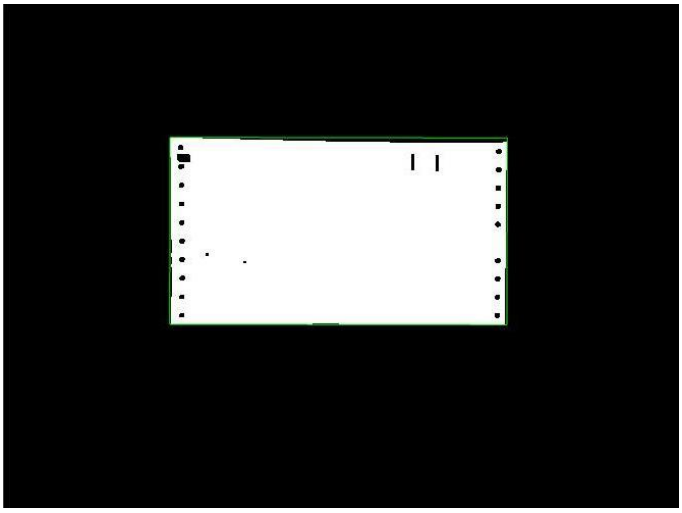

Fig.6 Localization of the package bill area

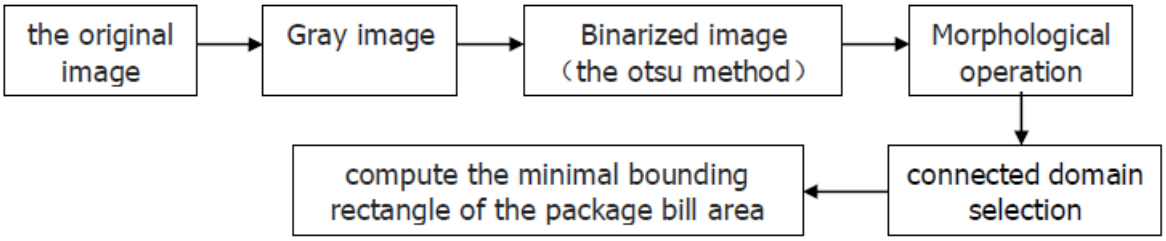

Fig.7 Method flow chart

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