Recognition and Identification of Container Name after Extracting and Segmenting Characters from Container Images

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ABSTRACT

Recognition of container name from container images plays an important role in the modern container management system. Some techniques have been proposed for vehicle license plate recognition in the previous. Container name recognition has more complexity than license plate recognition system because of the rigorousness of no uniform illumination and invalidation of color information. The main task of this paper is to combine some existing methodology for the extraction of texts and then recognize using template based approach. Present text recognition and extraction methods do not work efficiently in images which have noise and complex background. Text document image with simple background work accurately in OCR system. The proposed system will focus on edge detection, close operation, connected components analysis, eliminating non text areas and segmentation of characters. After segmentation template matching approach will work efficiently for the recognition of texts in container image.

General Terms

Image Processing, Pattern Recognition, OCR, Character Segmentation, Template Matching.

Keywords

Morphological Operators, Edge detection, Connected Component.

1. INTRODUCTION

Text recognition has an impact factor on our digital society. Document images can have several features, text extraction from document images is important when recognition. Segmentation of text areas from background and extracting texts is not an easy term [1, 2]. Color and gray scale images have many ranges which can be time consuming for the processing purpose [3]. Binarization of images range the image to only 0 & 1. Binarization can be performed through threshold operation [4-7].

Text areas can be segmented through some well-defined algorithm [8]. After segmenting text areas the texts are extracted.

OCR based text extraction technique works well on clean background image. Vehicle text detection is an easy term in contrast with container image text detection. It has severe illumination changes, motion and noises [9, 10]. To recognize the texts it need to preprocess nicely. Morphological operations can be performed on texts areas as the texts can be recognized [11-14].

Moreover in the recognition part we can use template matching approaches in the text areas only. The system will just say the container is in the port has been registered or not [15, 16].

The paper is organized as follows: In Section 2, the morphological operation on texts and segmentation technique is explained. Experimental results are described in Section 3. Evaluation from other existing techniques in section 4 are explained.

2. PROPOSED METHOD

Existing preprocessing methodology have some limitations as they cannot recognize the texts efficiently. For that reason combining some method in an order can give us better result. At first the RGB image need to be converted to gray scale image. Then the morphological operation is performed for the detection of edge. Edges are the most reliable features of text images irrespective of color or intensity, layout, orientation etc. [17]. Text candidate connected components can be found through the algorithm. These components have been considered to identify diverse components of the image. When the components can been identified, the variance is found. It will be helpful for each connected component considering the gray levels of those connected components. After that the text is extracted by exploring those connected components whose variance is less than defined threshold value [18, 19]. Then the template matching approach is considered for the recognition. The clean text images of containers are already stored in database. By correlation method the preprocessed image is compared with the template. If the value of every localization is almost same as the template then the system will say that it is the stored container [20 – 22]. The fill process of text extraction, segmentation and recognition is given in the flow chart in Figure 1.

2.1 Conversion to Gray Scale

The input color image consisting of RGB components are combined to find out output intensity image F as follows:

$F = 0{:}299R + 0{:}587G + 0{:}114B$

Where R, G and B denotes the red, green and blue components of the input color image, respectively. The color components may be different in a text region while it can have almost constant intensity. So, the intensity image F is managed in the following steps of the algorithm rather than the color components R, G and B.

2.2 Edge Detection

Morphological edge detection technique is applied on the input image to find out the output image having edges. The steps or processes are given in Figure 2. The steps are as follows:

Step 1:

Using open-close and close-open filters, the image can be blurred to decrease false edges [23].

Fig 1: Flow Chart for Text Extraction

The final blurred image is the middling of the outputs of these filters.

Step 2:

Morphological gradient (MG) operator is applied to the blurred image Ybl. The output resulting in an image es as follows:

$$es = \delta B(Ybl) - \varepsilon B(Ybl)$$

Where, B is connected structuring element, δB is dilation with B on Ybl , εB is erosion with B on Ybl.

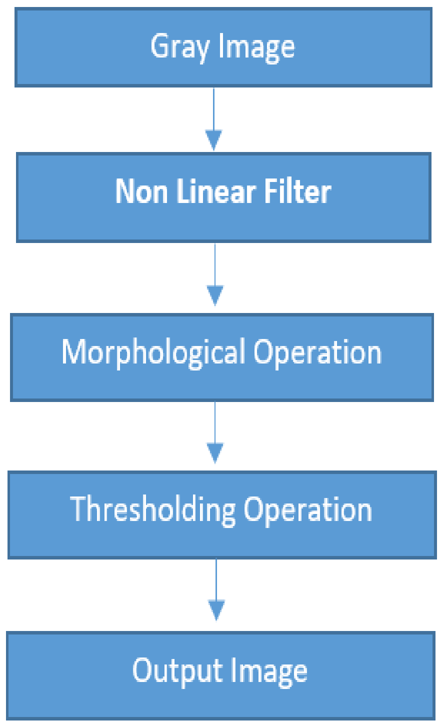

Fig 2: Flow Chart for Edge Detection

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Step 3:

The output image es is then thresholded to find out binary edge image. The threshold level ɣ is determined by:

$$ɣ = \frac{\sum(es.s)}{\sum s}$$

where "." denotes pixel-wise multiplication and s is denoted as:

$$s = \max(|g1 ** es|, |g2 ** es|)$$

Where, $1 = [-1\ 0\ 1]$, $g2 = transpose[-1\ 0\ 1]$, and "**" denotes two-dimensional linear convolution.

The binary edge image, e is then given by:

$$e = \begin{cases} 0, & Otherwise \\ 1, & es > ɣ \end{cases}$$

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(a)

(b)

Fig 3: (a) Input Image, (b) Edge detection

2.3 Close Operation

Structuring elements of eight-connected components are applied on closed edges in binary edge image [24]. By using four or six connected components, the system cannot find accurate result. Dilated image are filtered using erosion technique on smaller connected components. The output is a binary image, ec that has text candidate regions which will be used next.

Fig 4: Close Operation

2.4 Text Regions labelling

All connected components of the edge image are partitioned with their position, size and area information. In our algorithm, we can find characters from connected components if the following requirements are met:

1. 0.01<centre width of bounding box<0.95.
2. 0.2 <centre height of bounding box<0.8.
3. Width vs. height ratio<10.
4. Width of the bounding box<0.5 image width and 10 pixels.
5. Height of the bounding box>0.3 image height and 30 pixels.
6.

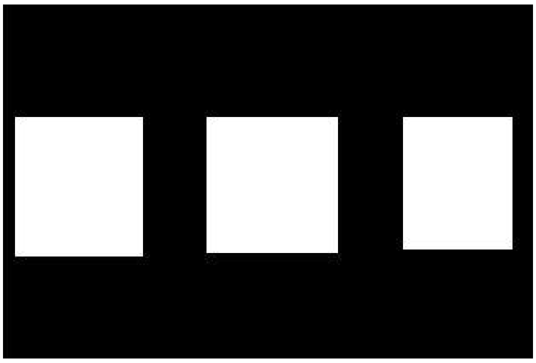

Fig 5: Text region filtering

2.5 Binarization

Finding the global thresholding value from defined algorithm. Then the threshold value is applied to fin only two types of value 0 &1. Binarization is applied for the reduction of complexity.

Fig 6: Text region binarization

2.6 Character Segmentation For Localization

The image is scanned from top to bottom [25]. If the summation of every pixels is zero then extract a line. This process is continued until the last line.

After extracting line, scan the every line from left to right. If the summation of every pixels is zero, then extract every characters from each line.

Our proposed system will just extract lines, but the characters are localized for the recognition.

Fig 7: Character Segmentation for localization

2.7 Comparison Of Characters Using Template Matching Technique

Every lines are serially compared with the stored line template. Template lines were localized in regions of characters. If the every regions are almost same as the template, then the system will say that, the container is found.

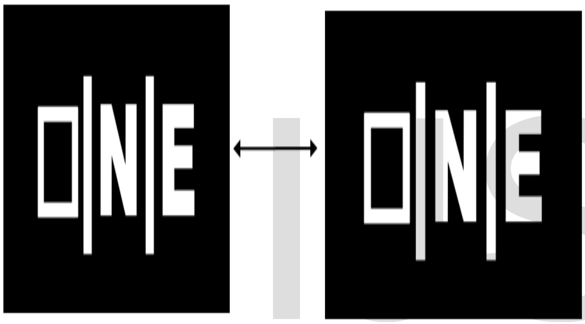

Fig 8: Template Matching

3. EXPERIMENTAL RESULTS

Total 60 container images from Chittagong Port, Bangladesh are captured to apply our proposed methodology. The container images were not same in type. Some were distorted, those types of images was restored.

The results are given in Table 1, which comprises edge detection, text regions labelling, character extraction, character segmentation and overall accuracy rate. The accuracy rate for each module is defined as:

$$\text{Accuracy rate} = \frac{\text{Number of correctly processed samples}}{\text{Number of all test samples}} \times 100\%$$

Table 1: Performance Analysis of proposed technique

Component	**Accuracy (%)**
Edge Detection	97
Text Regions Labelling	99
Character Extraction	97.5
Character Segmentation for localization	98
Overall Performance	98.5

The proposed method can precisely extract the text for varied positions, colors, illumination conditions, alignment modes and character sizes.

4. COMPARISON WITH OTHER TEXT EXTRACTION TECHNIQUES

The proposed system has already been compared with existing systems [9] and [10]**.** The first method has just focused on finding inner, outer and inner-outer corners.

The second method has taken out text by identify edge at different alignment i.e. 0, 45, 90,135 degrees and assemblage these thumps at different heights. So it is difficult to identify the edges at different orientation. By using Connected Component Variance (CCV) the problem can be reduced.

5. CONCLUSION

In this paper, we have proposed a method which is appropriate to extract the container name of different colors, sizes and different alignment modes. The overall accuracy is increased in contrast with other methods.

During moving the container image gets distorted. In our future work we'll focus on extracting container name form different positions of container with the help of multiple cameras.

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