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Text Confining and Extraction in Image Using Mathematical Morphology

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Abstract: ***Extraction of text from an image having complex background is much difficult and a challenging task. Text in any image contains very useful information. Due to difference in style, size, alignment and complex background, text extraction becomes a challenging task. In this paper we confine and extract text characters from an image. To get the text character from an image, we use mathematical morphology. It is a technique used for the analysis and processing of geometrical structures.***

Keywords: Mathematical morphology, opening, closing, dilation, erosion, structuring element

1. Introduction

Extracting and confining text in Images has become a important application in many areas like Robotics, Intelligent transport systems etc. Text printed on the billboards, indicators, signs, book covers etc. so separation of the text is an important task. so to extract text from image, text and background part must be separated. There are three main modules of such applications, which are [a].Object confining [b]. Object extraction and [c].Text recognition.

In this paper, we have presented a approach for text extraction and confining in images. First, the input image is filtered by the morphological filter to remove any noises. Then edges are detected using LOG edge detector. Then morphological dilation operation is used for object confining. Then all the connected Components are extracted and all text and non-text components are determined. Then all the non text character components are removed by a two step process. Then features values are extracted from the extracted Components. These features are used to form the feature vector for SVM. Then these features values are tested with SVM for recognizing individual characters. Then, all recognized characters are combined to form text lines. There are various methods for the text extraction from the image. But all the methods have some common problems for e.g. in some methods text cannot be extract from complex background, in some methods characters cannot be separated from the connected component analysis. . So in this paper we have to improve limitation of the Lixu Gu's approach which is based on the mathematical morphology.

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2. Related Work

The text extraction in any image is a challenging problem in the computer vision. Automatic confining and extraction of text in any images have been used in many applications. Document text confining can be used in many applications like page segmentation, address block location, document retrieving etc. Image and video indexing based on Content is one of the typical applications of text confining. Text extraction in any image can be used in various applications like vehicle license plate detection, object identification, text based land marks, etc. While studying the literature survey, I have found that non-text and text part classification is either implemented by [a] character by character or [b] taking text area as a block. For this, we use various type of approaches like region based approach, connected component based approach or edge based approach.

J. Fabrizio, M. Cord, B. Marcotegui proposed a region based approach which is based on the character by character. In this method text strings are decomposed into letters, and then combine them to restore words and text zones after the recognition using Support vector machine. This approach seems to be most efficient, such that this approach was ranked first by Retornaz and Marcotegui in 2007 but now authors accept that this method give not satisfied results because it produces a lot of false positives. We also use supervised and unsupervised techniques for recognition stage and we get better results. Connected components based and Edge based approaches also used for text confining. But there are some disadvantages of these approaches like increase of false positive, more processing time etc. but there are some techniques which are used to overcome these problems.

There is new approach in which a variation of Contourlet transform on the images is applied to divide it into set of directional sub bands with texture details. In this we use Multi–oriented Texture details at the high frequency component to separate text and non-text components regions. But this method also does not produce satisfied result for scene images with text. In the past few years, Morphology based techniques have been used for text confining and extraction from images. In 2009, J.Sushma, M.Padmaja uses mathematical morphology with the edge based. Then morphological dilation operation is applied to confine text from an image In one approach edges are detected for text confining and extraction. Then on the basis of the edges text candidate connected components has been found and labeled to identify the components of image. Then we have to find out variance of each component. Then on the behalf of this information text and background components is separated.

In the morphology methods size and shape of the structuring element is an important parameter because shape of the output image is controlled by the structuring element. In our method, we have to cope the limitation of the Lixu Gu's approach. for this we use modified morphology filter in

which morphological closing is used instead of the morphological opening. The description of our method is discussed in next sections of the paper.

3. Methodology

The whole work is categorized into four parts as shown in the figure 1.

(a) Preprocessing
(b) Text localization and extraction
(c) Text and non-text classification
(d) Character recognition/extraction

The detailed descriptions of these parts are discussed here.

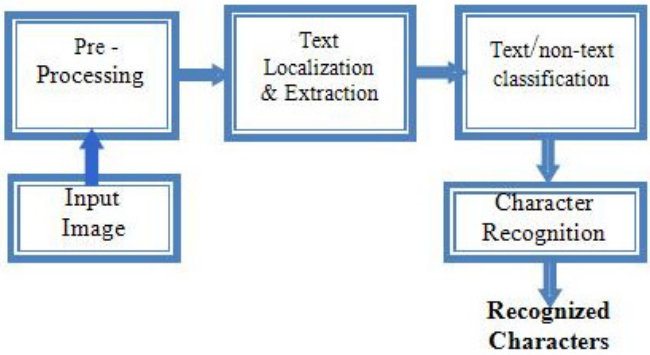

Figure 1: Methodology for text extraction from image

3.1 Preprocessing

In this step, firstly we take an input image in the RGB color image. Then this RGB input image is converted to gray-scale image. We convert RGB image into grey scale to decrease the processing overload. Then filtering is applied to this image to remove any noises present in the image. Now we use an edge detection algorithm to extract the edges from the final image. We use such a method which correctly finds out the places of edges and testing larger area around the pixel. For this, we apply non linear filter to input image. In this we use opening and closing operations to remove noise and then morphology gradient and thresholding is done.

3.2 Text localization and extraction

In this step, the input edge image received from the last step is binarised. For this Morphological dilation operation is used on this edge. Then by thresolding, text candidate regions are determined. Then we use structuring element to extract the entire connected component. And closing operation is used to connect all the edges.

3.3 Text and non-text classification

Now there are both text and non-text components presents in the extracted components. So we have to separate these text and non-text components. For this, we make the bounding box for all the objects. So to remove the non-text components we use connected components statistical metrics. We use the thresolding to remove very small components and, width & height of bounding box to remove the very big components.

3.4 Character Recognition / Extraction

This is the most important part of this work. We use the support vector machine (SVM) for the character recognition process. With the set of data units, SVM used to find an optimal hyper plane which has maximum the margin m.SVM is used for the character recognition because it can work with high dimensional data. But this method does not give the satisfied result. So, to extract character; we use the peak value in the histogram. For this we search the peak values which are larger than average of all the peak values and that selected peak is used as the threshold for the selected character region to extract the characters from it. Then we use the morphology filter to remove any noise present in it.

4. Performance Evaluation

The performance of this method is calculated using precision, recall and f-score metrics and it is also compared with other methods.

4.1 False Positive

False Positives (FP) / False alarms are those regions in the image which are actually not characters of a text, but have been detected by the algorithm as text.

4.2 False Negative

False Negatives (FN)/ Misses are those regions in the image which are actually text characters, but have not been detected by the algorithm.

4.3 Precision Rate

Precision rate (p) is defined as the ratio of correctly detected characters to the sum of correctly detected characters plus false positives as represented in equation below.

4.4 Recall Rate

Recall rate (r) is defined as the ratio of the correctly detected characters to sum of correctly detected characters plus false negatives as represented in equation below.

r = correctly detected characters / [correctly detected characters+ FN].

4.5 F-Score

F-score is the harmonic mean of the recall and precision rates. So on comparing all of these results with other methods, it is observed that this method gives better results then compared to all other techniques.

5. Result and Conclusion

In this paper, we propose an improved text confining and extraction technique from real images. This method is tested with various types of images and images with scene text and caption text. All related methods given in references are

analyzed and the drawbacks are reduced and find out the modified version of the previous work. In this paper we achieve higher RRC value and less noise as compared to all other methods. Fig.2 shows the samples of various types of images with text and performance of our method. And table 1 shows the comparison of our method with previous methods. So value of RRC is improved with our method.

Figure 2: Input images and text extracted images

Table1. Comparison of result with previous method

	Our method	Previous method
	Total clucter1 cluster2 cluster3	Total
Total character	380 317 47 16	380
Extracted character	359 296 47 16	339
RRC	94.47 93.37 100 100	89.21

So as compared to previous method, our method gives higher value of RRC and low noise.

6. Future Scope

With this method we successfully extract the text components from the complex background images. We extract text all type of cluster images. But there are some limitations with this method. This method cannot extract very small text from complex background images. In future we will try to extract very small text from color images by using vertical and horizontal projection to get the higher value of RRC and f-score and we will try to covert this extracted text into editable form.

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