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Capital Letter Recognition in Non Cursive Handwritten Documents

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Abstract: In this paper, we here a new text line detection method for handwritten documents. The projected technique is based on a stratagem that consists of three distinct steps. The first step includes image binarization and enhancement, associated component extraction, partitioning of the connected element domain into three spatial sub-domains and typical character height estimation. In the second step, a block-based Hough transform is worn for the detection of potential text lines while a third step is used to correct potential splitting, to detect text lines that the previous step did not reveal and lastly, to separate vertically connected characters and assign them to text lines. The presentation evaluation of the proposed approach is based on a consistent and concrete estimation methodology. This paper models text line detection as an image segmentation predicament by enhancing text line structure using a Gaussian window, and adopting the level set method to progress text line boundaries.

Keywords: Image segmentation, Histogram based Algorithm, Edge Detection algorithm Preprocessing, Image acquisition

I. INTRODUCTION

The Segmentation subdivides an image into its basic region or objects. The level to which the subdivision is carried depends on the problem being solved. That is segmentation should stop when the object of concentration in an application have been isolated. The segmentation of nontrivial Images is one of the most complicated tasks in image processing. Segmentation truthfulness determines the eventual success or failure of programmed analysis procedures. The text character contain in the document image can be any gray scale value, low resolutions, variable size and surrounded in complex background. many problems encountered in the segmentation, these includes the dissimilarity in the skew angle between lines, characters or even along the same text line, adjacent text line, overlapping words and moving characters.

*1.1 **proposed***

In this paper the segmentation is projected in three stages:

- Line segmentation in which we recognize the line in the documents
- Word segmentation in which we recognize the words in the documents
- Character segmentation in which we recognize the character in the documents

The goal of the segmentation is to complicate or change the representation of the image into something that is more significant and easier to analyze.

*1.2 **Scope***

There are many algorithms are introduced for document image segmentation. This paper presents two algorithms for Document image segmentation, explicitly

- Direction based line segmentation algorithm.
- Clustering Based nearest neighbor method

II. RELATED WORK

There are many document image segmentation algorithms some of those are:

*2.1 **Compression Based Algorithm***

Compression based algorithms assume that the optimal segmentation is the one that minimizes the overall possible segmentation, coding length of the data. The relationship between these two concepts is that segmentation tries to find patterns in an image and any reliability in the image can be used to compares it. The algorithm illustrates each segment by its texture and boundary shape. This algorithm was implemented by W.J Teahan, Yingying Wen, Rodger Mcnab and Lan H [1].

*2.2 **Histogram based Algorithm***

This algorithm was implemented by Tony Histogram based methods are very capable when compared to other image segmentation methods since they typically requires only one pass through the pixel. In this technique, histogram is computed from the entire pixel in the image and the peaks and valleys in the histogram are used to situate the cluster in the image. Intensity can be used as the measure [2]. A refinement of this technique is to recursively apply the histogram-seeking method to cluster in the image in order to divide them into smaller clusters. This procedure is repeated with smaller and smaller cluster until no more cluster are fashioned. One of the disadvantages of histogram seeking method is that it may be complicated to identify significant peaks and valleys in the images. Selim Esedoglu, Chan and kangyu Ni division of mathematic, University of Michigan using Wasserstein Distance. The Wasserstein distance between two functions is the least work that is necessary to move the region lying under the graph of one of the function to that of the other [3].

2.3 Edge Detection Algorithm

Edge detection is well developed field on its own within image processing. The section Boundaries and edge are closely related, since there is often a shape adjustment in intensity at the region boundaries. Edge detection techniques have therefore been used as the base of another segmentation technique. The edge recognized by edge detection is often disconnected. To segment an object from an image though, one needs closed region boundaries. Salem Saleh Al-amril, Dr N.V kalyankar and dr.khamitkar S.D implemented image segmentation by using Edge detection .They did a proportional study using seven technique of the edge detection segement. They are sobal,Roberts,canny, laplacian, krish and edge maximum technique on the Saturn original image and originate that EMT and Perwitt techniques respectively are the best techniques for edge detection.

III. PROPOSED WORK

Graph partitioning methods can effectively be used for image segmentation. In these methods, the image is modeled as a weighted, undirected graph. Usually a pixel or a group of pixels are connected with nodes and edge weights define the (dis)similarity between the neighborhood pixels. The graph (image) is then partitioned according to a standard designed to model "good" clusters. Each partition of the nodes (pixels) output from these algorithms are measured an object segment in the image. Some popular algorithms of this grouping are normalized cuts, random walker, minimum cut, isoperimetric partitioning and minimum spanning tree-based segmentation. Aleix M. Mart_inez,a, Pradit Mittrapiyanuruk and Avinash C. Kak of Department of Electrical and Computer Engineering, The Ohio State University have implemented and suggested an alternative implementation of the k-way Ncut approach for image segmentation. The below mentioned algorithms have been implemented in the project

3.1. Partial Eight Direction Based Line Segmentation Algorithm (PEBLS)

In this section, a top down segmentation loom to segment an epigraphically document image into text lines is presented. The projected method consists of three steps. Defining Base Lines and Supplementary Reference Lines, Portioning of Core text line regions and deriving non-linear paths.

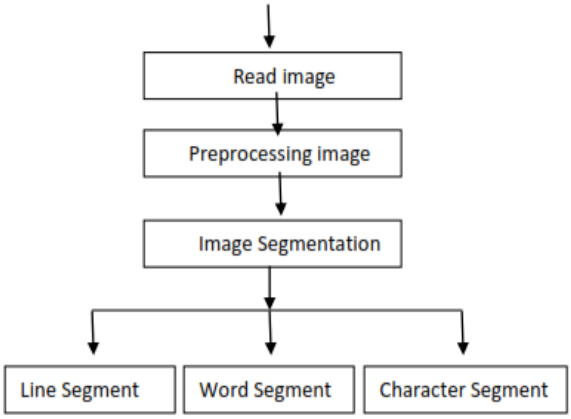
3.2. Nearest Neighbor Clustering Based Method (ININ C)

In this section, a novel approach for line and character segmentation in an epigraphically script based on nearest neighbor clustering method is presented. The projected algorithm scans the given input image from the left corner. When it encounters the first black pixel, it identifies the absolute character through connected component. This character is segmented and placed at dissimilar location. The centered of the character is computed. Similarly the second character is predictable and the centered is computed. The Euclidean distance among the centroids is computed to know whether the character belongs to the same line or next line. This is resolute based on the threshold which is based on the hypothesis that the space among the text lines is greater than that between the characters. This way, the text lines and characters are segmented which could be used for the classification process. Mr. Praveen Dasigi applied the Spectral partitioning technique to segment the documental images. The Segmentation uses a spectral partitioning loom that tries to maximize the proximities within the partitions while minimizing the proximities across them. This class of algorithms computes a pair wise correspondence matrix built over every pair of components (pixels) from the image. The idea is to find an pointer vector from the spectrum of this matrix which can be threshold to partition the set.

3.3 Steps in Image segmentation

The general steps that are involved in Image segmentation systems are,

1. Image acquisition
2. Preprocessing
3. Segmentation



Fig; Architecture for image Segmentation

3.3.1 Image Acquisition

This is the stage where the image over consideration is taken. In the case of online recognition system a dedicated hardware is implemented as explained earlier whereas for offline systems, the images are obtained either through a scanner or a camera. Whenever an image is acquired, there will be some variations in the concentration levels along the image. Also noise gets added to the image. Hence preprocessing is required for adjusting the intensity levels and to de-noise the image.

3.3.2 Preprocessing

Preprocessing is the most important part of a better performing recognition system. In this stage, the acquired image is processed to eliminate any noise that may have incurred into the image during the time of achievement or during the time of transmission. A colored image then it will be converted to a gray image before scheduled with the noise removal procedure. The de-noised image is then converted to a binary image with appropriate threshold.

3.3.3 Segmentation

Segmentation refers to a process of partitioning an image into groups of pixels which are homogeneous with esteem to some criterion. Segmentation algorithms are area

oriented instead of pixel oriented. The consequence of segmentation is the splitting up of the image into connected areas. Thus segmentation is concerned with separating an image into meaningful regions. Image segmentation can be broadly classified into two types [5]

i. Local Segmentation: It deals with the segmenting sub images which are small windows on a whole image.
ii. Global segmentation: It deals with the images consisting of relatively large number of pixels and makes estimated parameter values for global segments more robust.

For character segmentation, first the image has to be segmented row-wise (line segmentation), then each rows have to be segmented column-wise (word segmentation). Finally characters can be extracted using suitable algorithms such as edge detection technique; histogram based methods or connected component analysis Connected component analysis is an algorithmic application of graph theory, where subsets of connected components are uniquely labeled based on a given heuristic. Connected component analysis is used in computer vision to detect connected regions in binary digital images, although color images and data with higher-dimensionality can also be processed. When integrated into an image recognition system or human-computer interface, connected component labeling can operate on a variety of information method.

IV. EXPERIMENTAL RESULTS

The different types of techniques used for image segmentation are discussed in the previous chapters. In this chapter the some of the experimental results obtained are shown. Graphical User Interface (GUI) are also showed

*4.1 **Image acquisition***

The four images captured are shown in the figures 4.1, 4.2 and 4.3. The figures 4.1 is the shows the image of the printed characters (synthetic image). The printed test image is shown in the fig 4.2.These images are further processed according to the algorithm

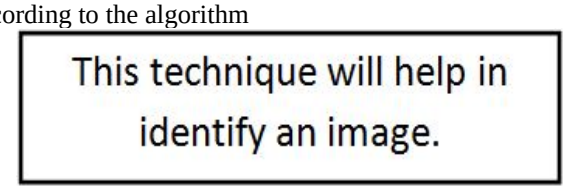


Figure 4.1: Captured image of printed text (synthetic)

Figure 4.2: Captured image of printed text (Test image)

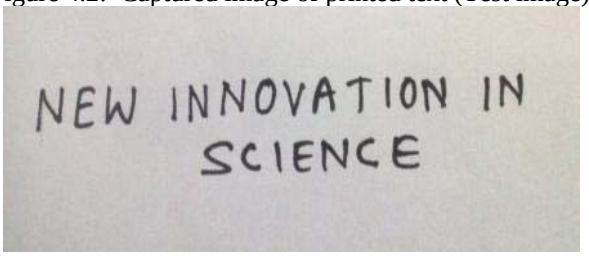


Figure 4.3: Captured image of Hand written text

*4.2 **Pre-processing***

The captured image inverted and it is cropped to the required size. The cropped image is converted into digital form. The pre-processed printed text (synthetic image) is shown in the figures 4.4. The preprocessed printed text(test image) and handwritten text images are shown in the figures 4.5 and 4.6 respectively.

Figure 4.4: Pre-processed image of printed text (synthetic image)

Figure 4.5: Pre-processed image of printed text (test image)

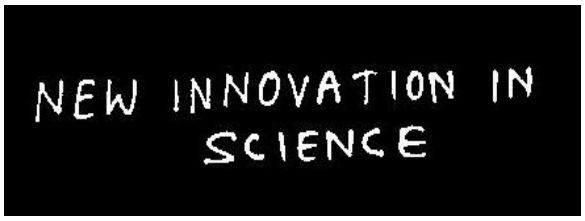


Figure 4.6: Pre-processed image of Handwritten text

*4.3 **Segmentation***

Images are segmented into line, word and character for the given preprocessing input image.

4.3.1 Line segmentation

The preprocessed images are segmented row-wise (line segmentation). The resulted images of the line segmentation for the figures 4.4, 4.5 and 4.6 are shown in the figures 4.7, 4.8 and 4.9.

Figure 4.7: Line segmented image of printed text (synthetic image)

Figure 4.8: Line segmented image of printed text (test image)

Figure 4.9: Line segmented image of Handwritten text

4.3.2 Word segmentation

In the line segmented image each word is segmented. The figure 4.10 shows the words segmented from the lines of the figure 4.7 (synthetic image of printed text). The word segmented images for the printed text (test image) and handwritten texts are shown in the figures 4.11 and 4.12.

Figure 4.10: word segmented image of Printed text (Synthetic image)

Figure 4.11: Word segmented image of Printed text (test image)

Figure 4.12: Word segmented image of Handwritten text

4.3.2 Character Extraction

The characters are extracted from the words segmented from the captured images, which are shown in figure 4.13 to 4.15. Each of these characters is extracted using connected component analysis.

Figure 4.13: character extraction from Printed text

Figure 4.14: character extraction from printed text

Figure 4.15: Character extraction from Handwritten text

V. CONCLUSION

The proposed image segmentation method has been tested on a number of documented image and hand written, printed images. We use a set of quantitative assessment measurements for the image segmentation .The system is designed in such a way that, the text in the documented image is distinguish and segmented automatically. Line segmentation is done by using horizontal protuberance profile and vertical projection profile analysis. Character segmentation is done by using Connected Component Analysis (CCA) and Vertical Projection Profile Analysis Experiments and results show that, this appliance yield 92.99% efficiency for line segmentation and 88.5% efficiency for character segmentation. Hence the future work consists of this to be implemented for an online system. Also this has to be modified so that it works for both discrete and continuous handwritten characters simultaneously.

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