



Design and Implementation of Efficient Image Segmentation Algorithm based on Region Splitting

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Abstract: Image processing has been always an interesting and challenging area for researchers. Extracting image data from thousands of university admission forms with in smallest time duration is challenging. The idea of this research is to resolve this problem through image processing algorithm. We designed and implemented efficient Image Segmentation algorithm based on Region splitting procedure by which any number of Regions of interests can be extracted from university admission forms within a shortest time. The algorithm can split source image in to any number of parts in a single iteration. The proposed algorithm has been implemented in Matlab on AMU university admission data base. Results obtained, were very interesting in terms of objectives and execution time.

Keywords: Image processing, Image segmentation, Image splitting, image database, MATLAB.

I. Introduction

An image is defined as a two dimensional function, $f(x, y)$, where x and y are spatial coordinates, and the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. Pixel is a term used most widely to denote the elements of a digital image. Pixels are normally arranged in a two dimensional grid and are often represented using dots or squares. Number of pixels in an image can be called as resolution [2]. Segmentation is one of the key problems in image processing. A popular method used for image segmentation is thresholding. After thresholding a binary image is formed where all object pixels have one gray level and all background pixels have another - generally the object pixels are 'black' and the background is 'white'. The best threshold is the one that selects all the object pixels and maps them to 'black'. Thresholding can be defined as mapping of the gray scale into the binary set $\{0, 1\}$:

$$S(x,y) = \begin{cases} 0, & \text{if } g(x,y) < T(x,y) \\ 1, & \text{if } g(x,y) \geq T(x,y) \end{cases}$$

where $S(x, y)$ is the value of the segmented image, $g(x, y)$ is the gray level of the pixel (x, y) and $T(x, y)$ is the threshold value at the coordinates (x, y) [4].

In this paper we are using University Admission System as our problem domain. University admission forms are source of information for generating many useful information starting from issuing entrance admit card to roll list and many more. To increase the efficiency of admission process, the admission forms are scanned and converted as image. Image processing is a solution to handle this tedious task. The segmentation of image means to generate segments of source image in terms of objects, parts of objects, or group of objects etc. The purpose of Image segmentation is to group pixel in an image into regions, based on their similarity in terms of grey level, colour or texture. The segmentation of image does not require generation of all basic segments of source image. Partial segmentation and modification of existing partial segmentations are also possible [1]. Image segmentation plays an important role in practical application of image analysis as it is frequently a preliminary pass for object localization, recognition or tracking, etc. There are following procedures of segmentations: [1]

- Edge and line oriented segmentation and representation schemes
- Region growing methods
- Clustering
- Region splitting

In present paper we have developed and implemented an algorithm for image segmentation which is based region splitting.

According to Region splitting method, system takes a region of image, using histograms of the feature values in this region, determines a threshold to one feature to be used to split the region into sub regions. These sub regions are then further segmented if needed [1]. This paper is organised as follows: Section II gives a brief overview of image processing software MatLab, section III gives proposed algorithm. Results and discussions are presented in section IV. Conclusion and future work are given in section V and VI.

II. Image Processing with MATLAB

The MatLab environment is suitable for image processing. In particular, MATLAB is matrix-oriented language which is well suited for manipulating images. It has very easy and economical way of expressing image processing operations. In addition this software has Image Processing Toolboxes which provides a powerful and flexible environment for image processing and analysis. It has ability to have direct access to any portion of available information what in general is not possible with many commercial image analysis systems. It is also possible to stop any calculations at any time, change a portion of the calculation procedure and then restart the calculations from the point which was affected by the changes without recompiling the code. [4]

III. Proposed Algorithm

Image Segmentation Algorithm based on Region Splitting Procedure has been designed and implemented on University Admission Database. The steps of Algorithm are as follows:

Step 1:

Set up Extracted ROI Directory Structure

Step 2:

Create directory list from the image source directory

Step 3:

Number of images = length of Directory list

Step 4:

Repeat for $i = 1$ to number of images

Step 5:

Extract ROI - 1

Extract ROI - 2

Extract ROI - 3

Extract ROI - 4

.....

Extract ROI - n

Step 6:

Save the Extracted ROI's

Step 7:

End.

Symbols used:

ROI = Region of Interest

n = Total number of ROI

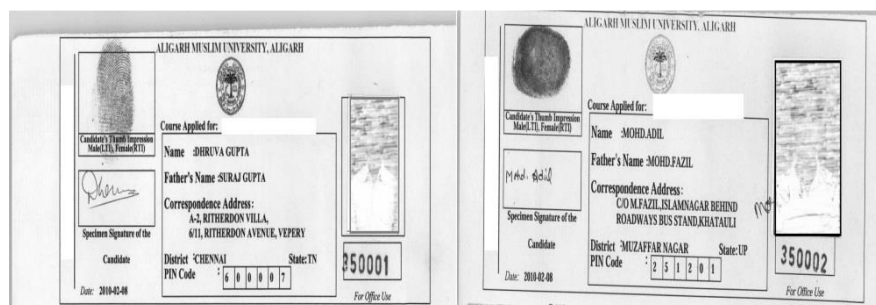
IV. Results and Discussions

The proposed algorithm was implemented in Matlab. Sample size of university admission data base was 3483 images. The program was implemented and executed on the above mentioned image database. Results were quite encouraging. Following table represents information of different number of image splitting regions and corresponding execution time involved.

No. of ROI	Execution time in sec
3	106.46
2	88.8
1	66.27

Table 1: no. of Image splitting (ROI) and Execution time

Out of 3483 images, only 06 images and their split parts are demonstrated here. To maintain confidentiality of data, pictures of identity have been hidden. The proposed algorithm was implemented initially for 3 ROI but it can be enhanced up to any number of ROI's. First 06 source images are following:



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PIN Code: 202413

Date: 2010-02-15

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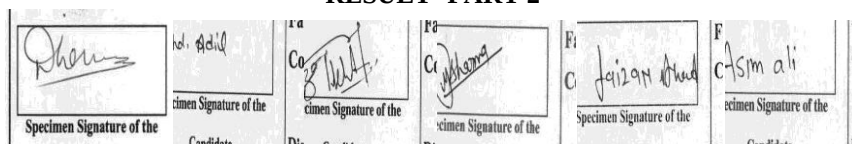
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Results after execution of proposed algorithm are mentioned below.

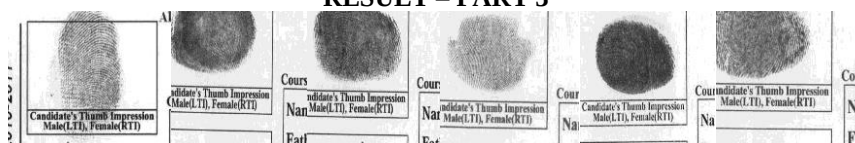
RESULT - PART 1



RESULT- PART 2



RESULT – PART 3



V. Conclusion

The proposed implemented algorithm is a solution for admission section of university. The problem of generating various information from single source information was completely resolved by designing and implementing new efficient split algorithm. It was successfully executed on university database and required results have been obtained. The algorithm extracts part of image data from source image data in sequential manner but through single iteration. The results of this algorithm were very encouraging in terms of objectives and execution time.

VI. Future Work

Proposed algorithm is based on sequential method, it means splitting of source picture will be done by single processor in sequential manner. The future work will be splitting algorithm based on parallel method.

VI. References

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