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Enhancing Color Images Using Ant Colony Optimization Based Text Segmentation Technique

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ABSTRACT
In this paper a digitization project of cultural heritage manuscripts as well discuss the underlying problems, particularly those relative to document analysis. Considering the drawbacks of traditional methods for text line extraction in handwritten documents, we proposed to adopt a new approach for text line segmentation for solving the color images having most of the data for proficient text segmentation i.e. ant colony optimization based edge detector to distinguish the mixed regions which results in more accurate results even for complex background images. The use of color images also allows extracting the potential regions during segmentation.
Keywords: *Text Line Segmentation, Thresholding, Adaptive Thresholding, Ant Colony Optimization*

I. INTRODUCTION

Invention of new technologies leads us towards the achievement of paperless office and paperless society. Digital script analysis is first step of automating the offices. Everywhere documents are there in the form of papers like forms, check etc.Most of the documents are both handwritten and printed or combination of both. For example, railway reservation forms, bank cheques. Handwritten and printed text is most of the times interlaced at word, line and character level. So the identification of such documents is a challenging task. Separation of handwritten and printed text from such documents is very essential. Using segmentation method we can separate document at word, Character and line level which will reduce the search time and avoids the confusion. Text image segmentation is a main issue in text identification that concerns together machine writing as well as handwriting.

1.1 Text Line Segmentation

Text line segmentation can be a step simply because it provides further steps to obtain good identification rates. Furthermore, it is challenging to the text such as Indus because of uneven structures of text components as well as random background changes. Text line segmentation from Indus scripts is focused almost all of the techniques are developed determined by geometrical features including aspect ratio as well as size for text line segmentation. So, these techniques probably are not appropriate for text line segmentation from Indus document images, where one cannot expect uniform size and structure as a result of complex background. Using text line segmentation word segmentation grouping of text lines into paragraphs, characterization of text lines as titles, headings, footnotes, etc. tasks can be developed. Segmentation simplifies the image or changes the representation of an image into meaningful and easier to recognize. Segmentation can be of three type text, Line segmentation, Word segmentation, Character segmentation. As most text line segmentation algorithms, consists of several steps.

1. Pre-processing. It is the first stage of document analysis. Its idea is to get better quality of the processed image. This type of technique considerably increases the visibility of various hardly recognizable objects. Though, text on handwriting images is well clear as well as they only need noise cleaning. Therefore pre-processing utilized in the technique consists of the subsequent steps:

1. Conversion of a color image to gray scale,
2. Binarization,
3. Noise reduction

II. TECHNIQUES USED

1. Thresholding

Analyzing binary images is quiet easy as compared to gray scale but direct transformation of raw image to binary without using any of the preprocessing technique is difficult. Therefore to binaries an image using a threshold on gray scale image is done so as to classify pixels as background or foreground. Thresholding is preferred to obtain the objects from an image owing to its simplicity and effectiveness. The conceptual idea behind thresholding is that the gray levels that correspond to the foreground pixels are not same as the gray

levels that correspond to background pixels. Allocation of pixels is done in such a way that one category comprises of pixels whose values is less than threshold and the other category consists of pixels greater than the threshold, thus converting a gray scale image to binary using appropriate threshold value T.

Thresholding is categorized into three main categories: Local, global and adaptive. This classification of thresholding depends upon three main parameters namely gray level, value of a pixel and neighbourhood property. Global thresholding is that where gray level values are considered, local threshold is not only concerned with the gray level but with also the local property of an image and adaptive or dynamic is concerned with all the three parameters i.e. gray level, pixel coordinates and neighbourhood property.

$$T_{value} =$$

Where T_{value} represents the threshold value, LP specifies local property of an image and Intensity(m,n) the intensity value associated with pixel (m,n).

A) Adaptive Thresholding algorithm:

1. Obtain all the inputs: Image, Number of regions in row and column directions, Number of bins for the histograms used in building image transform function, normalized from 0 to 1.
2. Pre-process the inputs: Determine real clip limit through the normalized value if needed, pad the style before splitting it into regions.
3. Process every contextual region therefore producing gray level mappings: take out a particular image region, produce a histogram because of that area making use of the particular range of bins, clip the histogram utilizing clip limit, as well as make up a mapping of that region.
4. Interpolate gray level mappings to be able to accumulate final image: Extract cluster of four years old neighbouring mapping functions, process image region partially overlapping every single mapping tiles, extract a particular pixel, relate four mappings compared to pixel, as well as interpolate among the final results to have the output pixel; do again within the complete image.

2. Ant Colony Optimization:

ACO algorithm is based on meta-heuristic technique. This reflection is parasitical events from ant varieties provoked as well as ACO technique enhancement of random direct seek method. Such as, ants find out close route associated with the ant colony along with a food source in the form of exchange essentials of one's choice which need to adapt. If the ants undergo excavate source, which provide secretions as well as debilitated; whereas secretion follow could be useful close to ants for communicate together. Ant's possibility would elect to adapt various type of method in accordance with the total quantity from secretion. Applying simple approachable agencies permits the transfer with the natural for imaginary auld like settlement. These factors interact personally through swapping data as surrounding alterations. It is usually unreal pismire speak circuitously as imaginary secretion path. This offered near conditions this directory of ants acting forward with an image determined through a nearby picture strength valuations edition. Such type of variance ensures a secretion matrix, whenever using like sizing picture, whilst subsequently acts this boundary data every picture place. Referable for giant graphic sizing so as to cut calculation clip, this approach depicted under was severally used upon non overlapping 128*128 graphic windows. ACO can be a loop approach.

III. RELATED WORK

Yuanwang et al. (2017) [1] propose a novel algorithm, which is based on exhaustive segmentation, to detect text in scene images. Firstly, a similar structure is presented to generate character candidate regions with the exhaustive segmentation of scene image. Secondly, a well-designed two-layer filtering method is employed to filter non-character candidate regions. Aladhahalli et al. (2016) [2] proposed method filters out noise pixels by exploring Sobel and Laplacian values of pixels, which results in edges that represent text components. We then propose watershed model for studying non-linear spacing between characters based on the fact that watersheds provide information about water flow and volume of collection of water. A.S. Kavitha et al. (2016) [3] proposed technique generates skeletons for text components in enhanced images to cut back computational burdens, that often helps in studying component structures proficiently. Xiaobing Wang et al. (2015) [4] proposed a robust two-steps method in this paper predicated on multi-layer segmentation as well as higher order conditional random field (CRF). Given an insight image, the technique separates text from its background by utilizing multi-layer segmentation that decomposes the input image into nine layers. Pradipta Maji et al. (2015) [5] represented a segmentation technique, integrating judiciously the merits of rough-fuzzy computing as well as multi resolution image analysis technique, for documents having both text and graphics regions.

IV. GAPS IN LITERATURE

Following are the various gaps in earlier work on degraded document binarization techniques.
1. The consequence of diverse region on text segmentation has not been considered in the existing methods.
2. The color images contain most of the data for proficient text segmentation but no of researchers has not been considered in binarization. Color images contain 80% useful information in the image.
3. The usage of the ant colony optimization based edge detector has not been considered in the existing work on text segmentation.

V. PROPOSED METHODOLOGY

5.1 Proposed Algorithm

ACO is surely an iterative method. Each and every increases a simple solution above the remedy area by way of their own motions through modernizing pheromone information. Accomplishing this will begin through an initialization step, after which it goes intended for D iterations to build this pheromone matrix through iteratively accomplishing building improve processes. Consider that K ants have been utilized to search the best result (picture boundaries) in a space v; i.e. in a sub-image I having size M1 _ M2, in which every pixel may be shown as a sensor node, the ACO method proposed described as following:
1. Establish the heuristic info as well as assume the resulting picture Ires = 0
2. in this every original 128 _ 128 picture window
a. arbitrarily assume the locations of the K ants as well as the pheromone matrix s(0).
b. The creation position directory n = 1:N
i. The ant guide k = 1:K
1. Successively go to the kth ant for L positions, w.r.t to the possibility change matrix p (n) (having dimension M1M2 _ M1M2).
2. Local inform of the pheromone matrix
ii. End For
iii. Global inform of the pheromone matrix
c. End For
3. Allocate pheromone matrix s (N) to the another window on the resulting images
4. End s

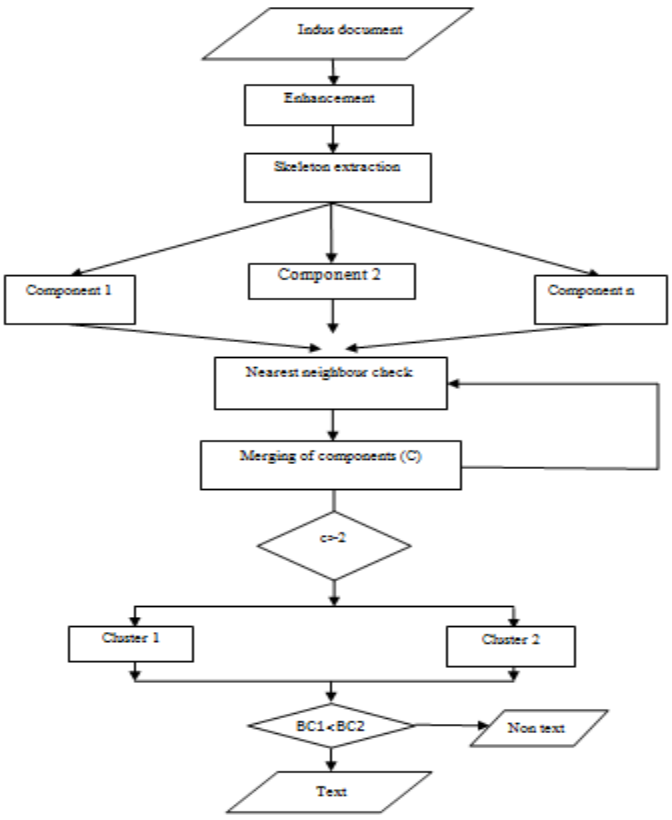
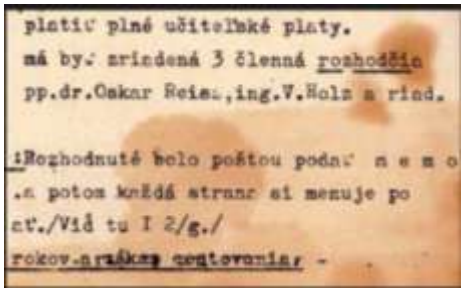
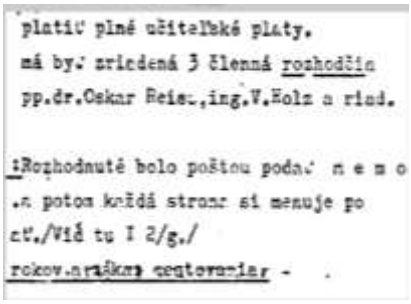
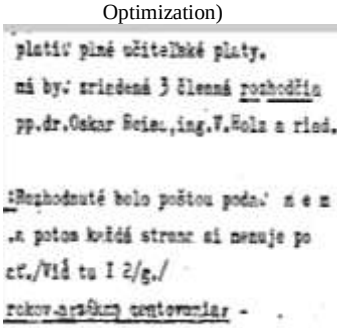


Fig 1: Flow Chart of proposed methodology

VI. ANALYSIS OF RESULTS

The proposed technique has been designed and implemented in MATLAB2010 utilizing image processing toolbox. The Proposed approach is ant colony optimization based text segmentation technique for text segmentation algorithm for color images. Results show that our proposed approach gives better results than the existing techniques based on metrics such as accuracy, peak signal to noise ratio, bit error rate and F-measure.

Table 1: Experimental Analysis by Using images

Input Images	Existing Images(Adaptive Thresholding)	Proposed Images (Ant Colony Optimization)
		
		

6.1 Accuracy

Accuracy is the measurement value that helps in describing system that estimates or analyse out a value.Accuracy basically yeilds out the error in values.Accuracy can be determined by all correctly measured instances to all instances.

It represents that the fig 2 shows the increase value by using proposed technique (Ant Colony Optimization) outperforms existing technique (Adaptive thresholding).

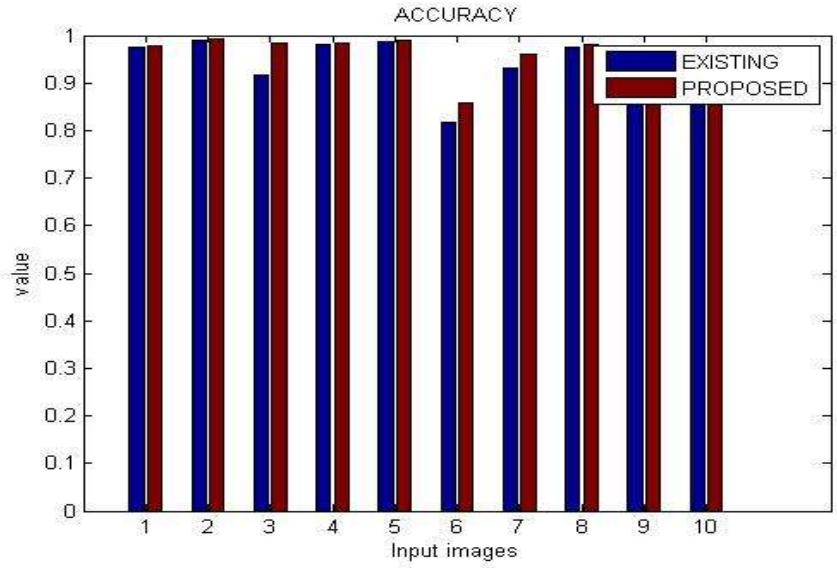


Fig 2. Accuracy

6.2 Peak signal noise ratio

Peak signal noise ratio is the ratio among the maximum possible value of the signal as well as the power of the corrupting noise. It is measured in decibels (db). It can be explained as:

PSNR

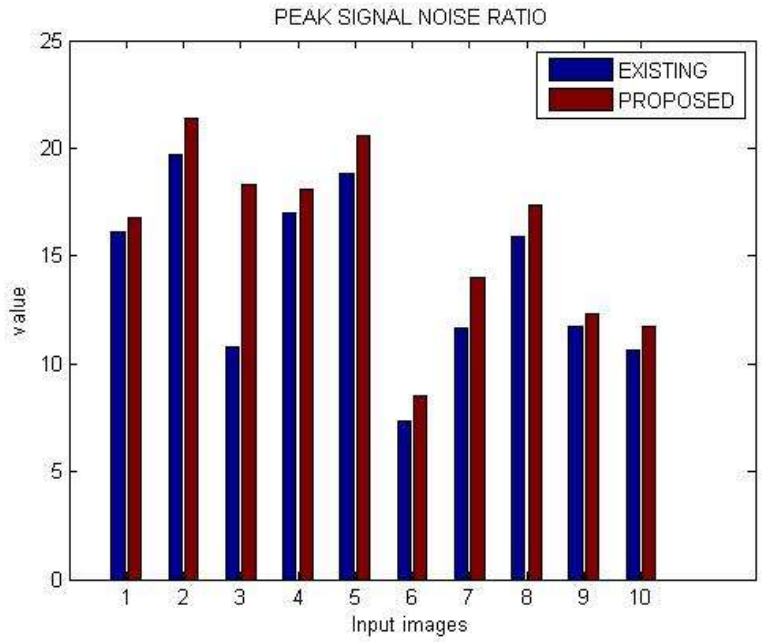


Fig 3: Peak Signal Noise Ratio

It clears that increase in PSNR value of text line segmentation images by using proposed technique over existing technique.

6.4 BIT ERROR RATE

It is called as the rate of which errors occur in a transmission system. This is directly translated into how many errors that occur in a sequence of a stated amount of bits. This is of bit error rate may be translated right into a simple formula:

$$BER = \frac{Number\ of\ errors}{Total\ number\ of\ bits\ sent}$$

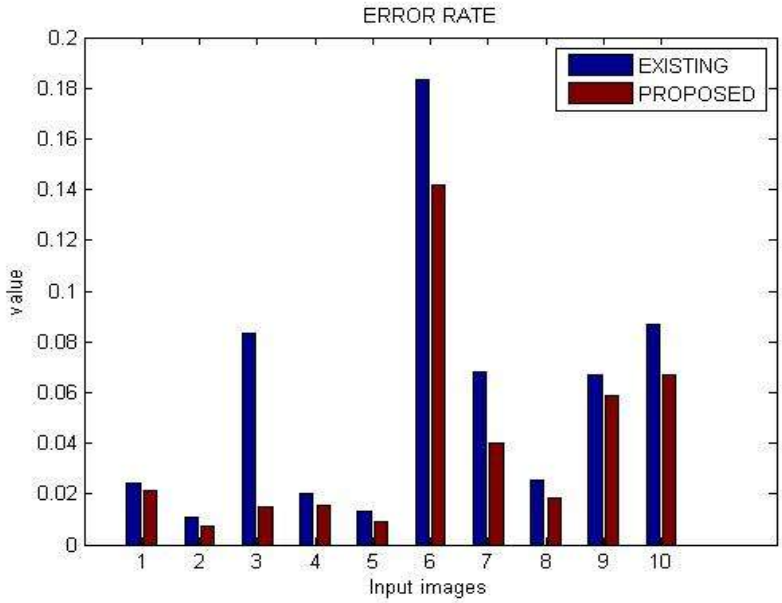


Fig 4: Bit Error Rate

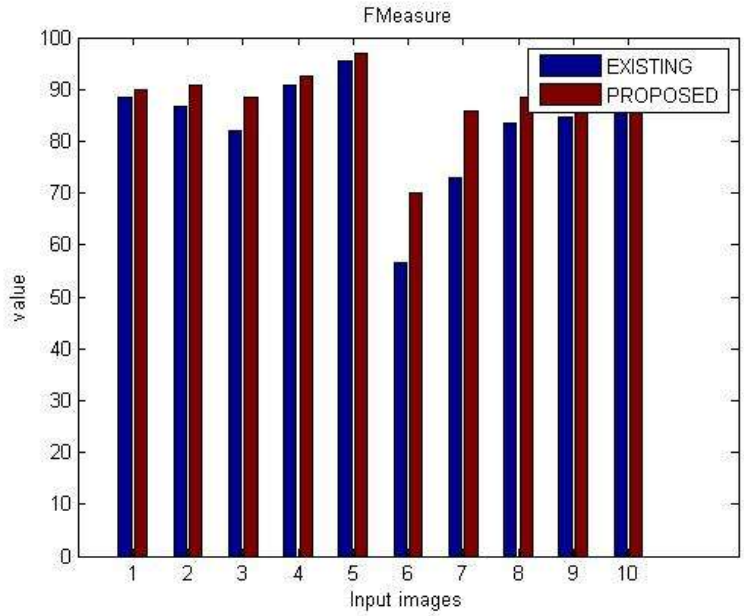
It clearly shows the plot which having the value of BER is getting reduced by using ACO technique based on text line segmentation.

6.5 F-Measure

It is usually utilize to verify the accuracy as well as reliability. It computes the mean of precision and recall. Basically, it uses as best and 0 as worst when both precision and recall are used.
F-measure can be calculated with using the formula given as:

$$F - \text{Measure} = 2 * \frac{P * R}{P + R}$$

It is very clear from the figure 5 that there is increase in F_measure value with the use of proposed method over existing methods. This increase represents providing improved accuracy and reliability.



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VII. CONCLUSION

Text segmentation is an important process of image processing and understanding. The motive of text segmentation is to basically show the illustration of an image into somewhat which is important as well as easier to know. In this paper it represents that in existing literature has not considered effect of mixed regions on text segmentation as well as color images includes maximum data for proficient text segmentation but various researchers has not considered it during text segmentation. So to improve this new method has been proposed i.e. by utilizing ant colony based edge detector to distinguish the mixed regions. The comparison has been drawn by using various metrics such as mean accuracy, peak signal to noise ratio, bit error rate and F- measure. The proposed technique is designed and implemented in the MATLAB 2013a by using signal processing toolbox. The ant colony optimization based edge detector has been used to distinguish the mixed regions which result in more accurate results even for complex background images as well as use of color images allows us to extract the potential regions during segmentation.

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