

Degraded Document Image Binarization Using Segmentation Algorithm

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Abstract—Degraded document image binarization is very difficult process due to different types of degradation over the document. Multiple algorithms as well as methods are available to get clear image of degraded document image. Many researchers have worked in this field of image processing. Still there is scope to get more clear and upgraded document image. Image segmentation is very famous process in the image processing domain. Image segmentation can be used to binarize degraded document image. Binarization is a process to generate binary image from gray scale image. Also it is tedious to differentiate foreground and background pixel due to degradation. In this paper, Image Segmentation using thresholding is proposed for degraded document image binarization. Image segmentation gives better result than canny edge approach.

Keywords- Degraded document image binarization, Image segmentation, Thresholding, Image Processing

I. INTRODUCTION

Binarization is popular from many decades to obtain binarize image from any gray scale or color image. Document image binarization is performing in preprocessing stage to analyze document and identify background and foreground pixels. Although document binarization is under research still thresholding for degraded document is unsolved problem. Image binarization using thresholding has three types.

1. Local thresholding binarization
2. Global thresholding binarization
3. Hybrid thresholding binarization

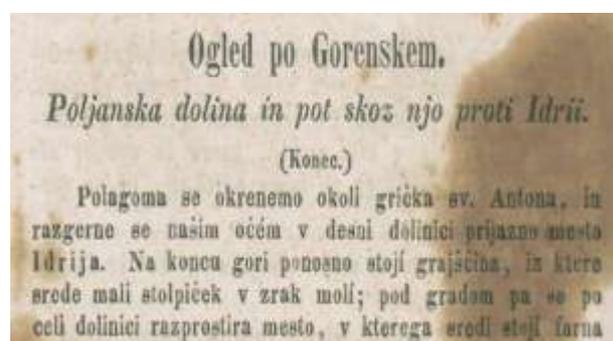
In local thresholding binarization, image divide the image into sub-images blocks either statically or dynamically and then determine the threshold value for each block and convert it into black and white image depending on its local threshold value.

Global thresholding binarization chooses a single threshold value for the whole image to convert the gray-level images into black and white image. Binary means two, thus the term binarization of the document image means the process of converting 256 levels of grayscale information into two levels (black and white) image information.

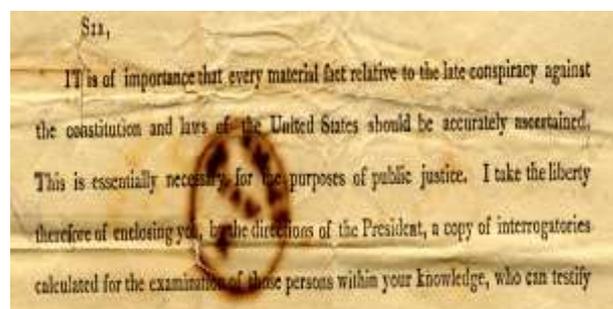
Hybrid thresholding is comparatively a new category of binarization techniques. Both the global and local thresholding binarization has their own advantages and limitations. Algorithms belong to this category tries to combine the advantages of two categories of algorithms and removes their limitation to get accurate binarize image.

This paper proposes the technique comes under the local thresholding which select threshold value according to the degradations of particular part of the image. The proposed method is very simple and capable of handling different types of degraded document images with minimum parameter. Different types of degraded document images as shown in fig. 1

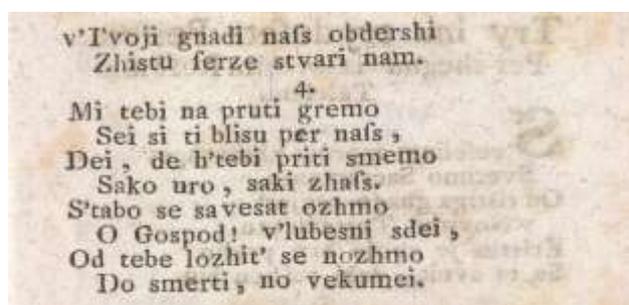
The rest of this paper is organized as follows. Section II gives reviews the different binarization methods. Proposed document binarization technique is described in Section III. Then experimental results are shown in Section IV to demonstrate the superior performance of proposed method. Section V contains conclusion, Finally Section VI contains future scope.



(a)



(b)



(c)

Fig.1. Degraded document images (a), (b) and (c) are taken from DIBCO2013 series dataset

II. LITERATURE SURVEY

Many thresholding techniques [2]–[5] have been implemented for document image binarization. Global thresholding [06]–[09] is mostly not a suitable approach for the degraded document binarization. Adaptive thresholding [10]–[16], which estimates a local threshold for each document image pixel, is a better approach for different variations within degraded document images. For example, the window-based adaptive thresholding techniques [14], [15] estimate the local threshold by using the mean and the standard variation of image pixels within a local neighborhood window [1]. The drawback of window-based thresholding techniques is that the thresholding performance depends majorly on the window size and also on the character stroke width. Combination of binarization techniques [17], [18]. These methods combine different types of image information and domain knowledge and are often complex.

Contrast map binarize and combined with canny edge map to identify the text stroke edge pixels. The document image segmented by local threshold [1]. In this paper, threshold value for each pixel is proposed.

. In this new segmentation algorithm, the threshold of a pixel in an image is calculated by calculating the mean of the grayscale values of its neighbor so that the result of the proposed algorithm is the edge of the image [20].

III. PROPOSED SYSTEM

In pre-processing of document image binarization is conversion of gray scale image from RGB image or color image. Gray scale image is required for the remove the effect of noise, also smoothing of background texture of degraded document image which is provided as input. Then on that gray scale image new image segmentation algorithm is applied to segment image into windows using threshold segmentation. System flow is as shown in fig. 2.

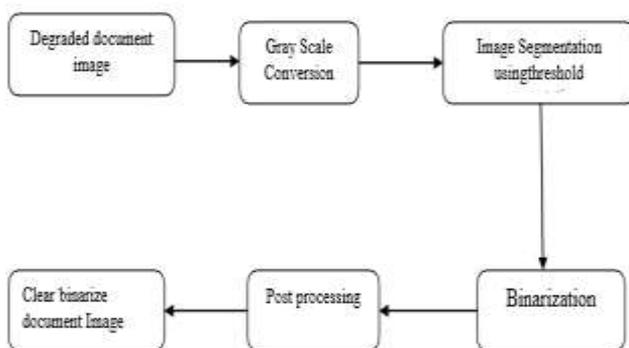


Fig.2 System flow [19]

In this method, each pixel in the image has its own threshold by calculating the static information of the grayscale values of its neighboring pixels. According to threshold value, gray scale image can convert into binarize image [19].

As given post-processing algorithm is applied on the binarize image for further processing. Where Foreground pixels can be separate out from other foreground pixels. Post-Processing connects break edges due to degradation to give more readable image. So we can generate more neat and clean

binarize image [19]. System shows the difference between automatic and manual threshold in output generated by system.

Major three modules are in this system

1. Conversion of gray scale image into binary image.
2. Processing binary image using new segmentation algorithm.
3. Post-processing on segmented binarize image.

Gray Scale Conversion algorithm

1. Input: Image (I)
2. For i = 0 to (width (I) × height (I))
Do
G[i] = (I [i×3] + I [i×3+1] + I [i×3+2])
End for
3. Output: Gray Scale image (GI).

Image segmentation using thresholding [19]

- Step 1: Input 1. 'G' is a gray scale image
2. Set threshold value 'th'
3. Set window size 'Ws'
4. 'Bz' for binarize image
- Step 2: For each row 1 to height-Ws
For column 1 to width-Ws
curr.pixel=G [row, column]
- Step 3: Check If (curr.pixel < avg-th)
Label Bz [row, column] =0;
Else
Label Bz [row, column] =1;
End;
- Step 4: End and Return Binarize image Bz.

Post Processing [1]

1. Find out all the connect components of the stroke edge pixels in edge.
2. Remove those pixels that do not connect with other pixels.
3. For Each remaining edge pixels (i, j): do
4. Get its neighborhood pairs: (i - 1, j) and (i + 1, j); (i, j - 1) and (i, j + 1)
5. if the pixels in the same pairs belong to the same class (Both text or background) then
6. Assign the pixel with lower intensity foreground class (text) and the other to background class.
7. end if
8. end for
9. Remove single-pixel artifacts along the text stroke boundaries after the document thresholding.
10. Store the new binary result.

Also in this proposed system there is a two threshold value selection provision are given.

First method is manual threshold selection according to image degradation where user can give threshold value manually. Second method is automatic threshold selection Where threshold value selection will automatically according to pixel intensity.

IV. RESULTS AND COMPARATIVE ANALYSIS

The proposed system is implemented with C#.net in visual studio. Here degraded document image is providing as an input to system shows fig. 3. First it converts into gray scale image shows fig. 4. Then proposed segmentation algorithm applied on gray scale image then binarization will perform and generates binarize image. After this stage some post-processing technique can applied on the resulted image to produce clear image shows fig. 5. So that some break character stroke will try to connect through post-processing.

1. Input image given to system

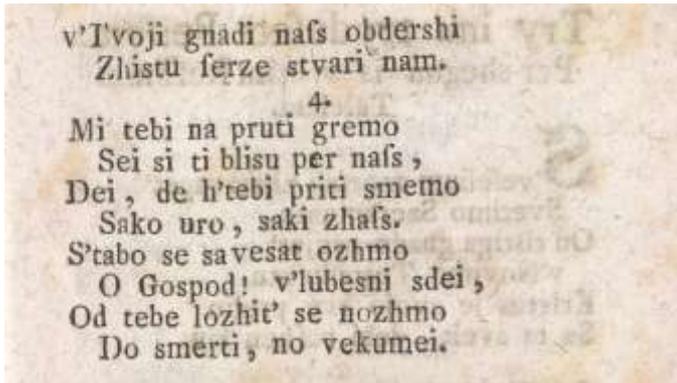


Fig.3 Degraded document image

2. Gray scale image

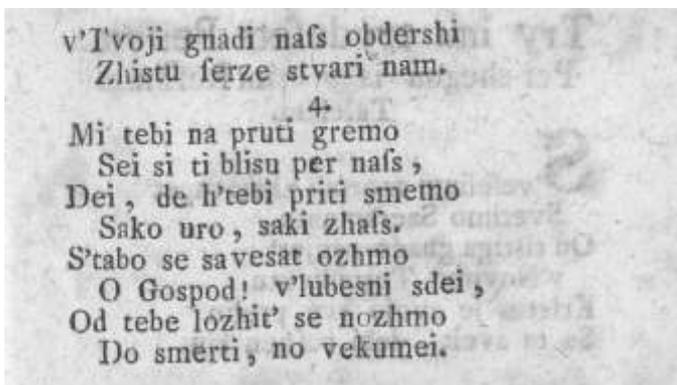


Fig.4 Gray scale image

3. Binarize image after segmentation as well as post processing

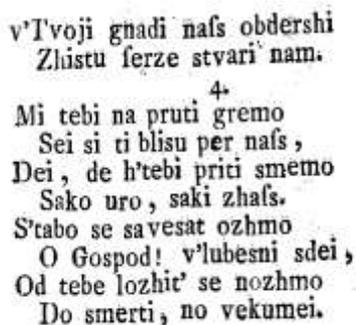


Fig.5 Output image

There are various experimental measures and formulas to evaluate and compare the binarization techniques. eg. Precision analysis measure, NMI and PSNR analysis.

Table 1 and fig. 6 are showing the comparative analysis between the proposed and the existing technique. Table 1 as well as graph has shown that the proposed technique is better than the existing technique as the value is more in the proposed approach.

Our database contains all images from DIBCO 2009, DIBCO 2011 and DIBCO 2013 dataset series taken from DIBCO website. Proposed method is giving better result than old approach and generating more clear image.

We have taken five images for analysis from DIBCO 2013 dataset. Results generated from testing five images are shown in table 1 and fig.6 as a graphical representation by using PSNR as an experimental measure.

Table 1: PSNR analysis

Image	Old approach	Proposed approach
PR01	9.6	9.62
PR02	14.5	14.64
PR03	14.24	14.34
PR04	9.47	9.92
PR05	11.34	11.78

PSNR analysis

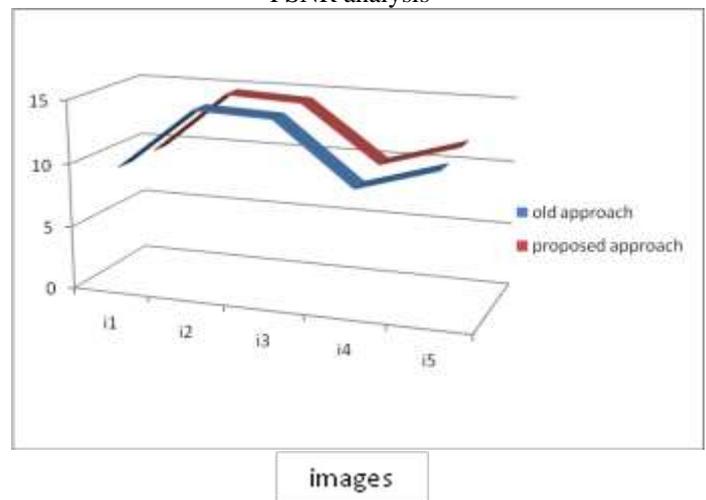


Fig. 6 Graphical representation of PSNR analysis

V. CONCLUSION

In this paper image segmentation using threshold segmentation for degraded document image binarization is proposed. The use of less parameter in the techniques makes this technique simple and good. This is suitable for different types of degraded images. The Post-Processing is contributed to generate clearer document image due to connecting break edges. So proposed method can generate good result than old approach.

VI. FUTURE SCOPE

This work can be enhanced by using various pictures to improve quality of it using combination of different algorithms. By using different upgraded techniques can make the image more clear.

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