A Novel Degraded Document Image Binarazation by using Local Thresholding Segmentation

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ABSTRACT:

The proposed binarization is a scheme of parting a image pixel values into two classes black as foreground and white pixels as background then the thresholding is found for well known scheme for document image binarization. In this proposed work for the decomposition of both global and local thresholding this basic thresholding value we can use further. Here the global thresholding scheme is effectively improve the uniform contrast delivery to both foreground and background of the selected degraded document image. In some cases this global thresholding is not effortlessly categorized noise or difference of the either background or foreground. To overcome this problem the local threshold segmentation is available techniques. The scope of this paper is to binarization of degraded document images and to evaluate the different datasets.

Key words: Binarization, Pixel Classification, Local Image Contrast, Thresholding.

I. INTRODUCTION

Image biarization is the processes before that we analyze the image is degraded the document or not. Nothing but image segmentation of both background and foreground text. The several document image binarization is typically execute the pre-processing of various document image processing filed of optical character recognition (OCR) and retrieval capacity. The image can be exchanges for binarization up to 256 gray levels to black and white image. For the simple approach of image binarization is to prefer a threshold value and use all pixel values above this threshold we displayed white and other pixels as black.

The adaptive binarization is needed where an optimal threshold value is selected for each and every pixel of image. The thresholding processes is very simplest method for image segmentation from gray scale image. It can used to generated the binary images effectively. This binarization is a challenging task for renders of the degraded document image binarization. It is a significant phase in all image processing and analysis, the objective is to reduce the performance amount of information in the existing image and to visible only applicable data which displayed straight forward analysis for performance analysis of the documents depends on binarization

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algorithm. And also most of the information and details depends on presented images and then it should remove the noise superposed to the original document image.

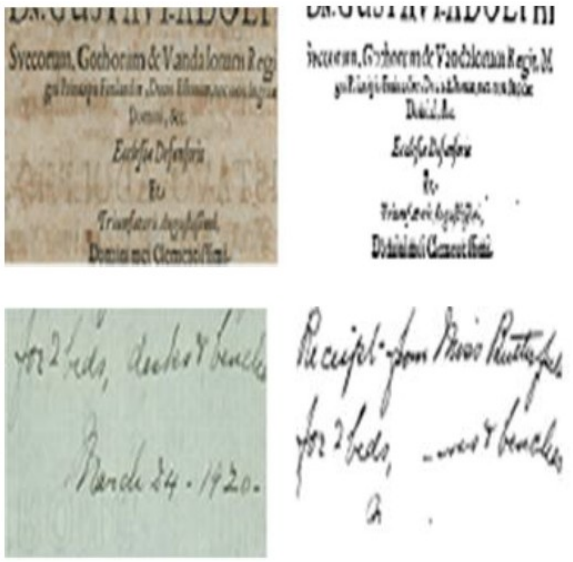

Fig.1. a) original printed data image, b) Binarized printed data image, c) Hand written original image, d) Binarized hand written image.

II. RELATED WORK

Document image binarization is the method of gray level images can categories two classes: one is global thresolding , and local thresholding. The global thrsholding is used to apply on entire image to split into two classes and the local threshold is that where the threshold value are resolute nearby pixel by pixel on entire region image. This binarization method is very confidential according to the information that utilizes the six categories based on histogram shape, entropy, clustering, object attributes, spatial methods, and local method.

Otsu method

This is global solitary well known method for image binarization. The method discover the threshold T which is split the gray level histogram into two segments. The computation of inter class and intra classes of variance is based on normalized histogram of the image. This method is routinely executed clustering based image thresholding.

ISODATA Method

This thresholding method is use to consist to discover the threshold by sorting out iteratively the gray level histogram into two classes in that that appropriate classes each one. This processes starts by isolating the period of non-null values into two central parts.

Bolan Su et al. (2013) [2] have proposed Document Image Binarization is a method to segment text out from the background region of a document image, which is a challenging task due to high intensity variations of the document foreground and background. They have proposed a self-learning classification framework that combines binary outputs of different binarization methods. The proposed framework makes used of the sparse representation to re-classify the document pixels and generate a better binary results.

Rabeux et al. (2013) [4] have proposed an approach to expect the result of binarization algorithms on a given document image according to its state of degradation. Historical documents experience from different types of degradation which result in binarization errors. They have proposed to characterize the degradation of a

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document image by using different features based on the intensity, quantity and location of the degradation. These features allow us to build prediction models of binarization algorithms that are very accurate according to R2 values and p-values. The forecast models are used to pick the best binarization algorithm for a given document image. This image-by-image strategy improves the binarization of the whole dataset.

Bolan Su et al. (2011) [12] have proposed Document image binarization has been studied for decades, and several convenient binarization techniques have been proposed for different kinds of document images. They have proposed a categorization framework to merge different thresholding methods and generate improved performance for document image binarization. Given the binarization results of some reported methods, the proposed framework separates the document image pixels into three sets, namely, foreground pixels, background pixels and uncertain pixels. A classifier is then applied to iteratively classify those doubtful pixels into foreground and background, based on the pre-selected foreground and background sets. The proposed framework out performs most state-of-the-art methods significantly.

III. PROPOSED METHOD

The proposed new algorithm for binarization of degraded images. This proposed technique consists of three parts: one is it will be responsible for improve the visibility of degraded image; therefore it is solid justification to improve the binarization results. In the second stage the adaptive image contrast is going to apply. The image contrast is a grouping of the local image contrast and the gradient that understands to the test background variation caused by dissimilar types of document degradations. In the final stage the contrast map are going to be binarized using adaptive thresholding that will be integrated with hybrid edge map, to recognize the test stroke edge pixels. The document text is more fragmented through a local threshold that may be estimated upon the intensities of identify the text stroke edge pixels within a local window. The proposed method is easy, robust , and includes least parameters tuning to create a effective results than compare to existing methods.

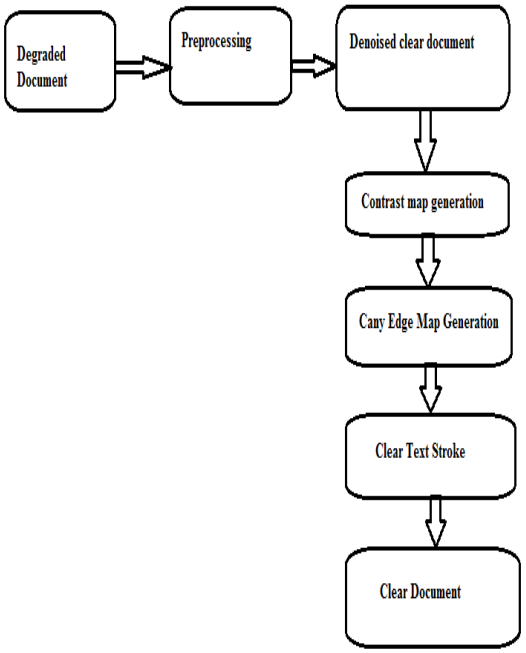

Fig.2.Block diagram of proposed method.

Although the outcome of the previous step contains most of the background pixels separated from the foreground but some parts of the foreground still need to be clearly distinguished. Since some of the background pixels were earlier detected as

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foreground, these pixels are to be assigned to background class. So there is a requirement of Local thtesholding step. Local thresholding means calculating a threshold for a particular region or a window. This method is applied to all of the non background pixels. Savoula's method [13] has been used here. This technique provides us with a local threshold within the dynamic range of R. The equation for Savoula's binarization formula is:

$$T\,x, = \mathrm{m(x,y)}.\left[1 + k.\left(\frac{s(x,y)}{R} - 1\right)\right] \qquad (2)$$

Where, m(x,y) is the local mean, s(x,y) is the local standard deviation and k is a constant. We have chosen the value of R=128, k=0.3 and window size=16. There parameters were chosen by experiments and they seem to give optimal results for Savoula's binarization in our case. This method gives better results for segmentation of background or foreground pixels.

Basically F-measure is the harmonic mean of precision and recall. This measure combines the precision and recall as follows

$$F\text{-}measure = \frac{2\times \mathrm{Precision}\ \times \mathrm{Recall}}{\mathrm{Precision}\ + \mathrm{Recall}} \qquad (3)$$

Where $Recall = \frac{\mathrm{TP}}{\mathrm{TP+FN}}$, $Precision = \frac{\mathrm{TP}}{\mathrm{TP+FP}}$

TP i.e. True Positives is the number of pixels which are classified as foreground in the binarized image and which are actually the foreground pixels in the ground truth image. FN i.e. False Negatives is the number of pixels which are classified as foreground in the binarized image but are background pixels in the ground truth image. FN i.e. False Negatives is the number of pixels classified as background in the binarized image which are actually the foreground pixels in the ground truth image.

PSNR is commonly used to measure the closeness of one image to another. A higher value of PSNR indicates the higher similarity of two images. C is considered as the difference between foreground and the background.

$$PSNR = 10log_{10}\left(\frac{C^2}{MSE}\right) \qquad (4)$$

Where, $MSE = \frac{\sum_{x=1}^{M}.\sum_{y=1}^{N}\left(I(x,y) - I'(x,y)\right)^2}{M.N}$

I(x,y) is the binarized image pixel value compared with I'(x,y) which is the ground truth image pixel value at the same pixel coordinates (x,y).

NRM is based on pixel wise mismatches between the ground truth and the predicted image. It combines the false negative rate NRFN and false positive rate NRFP.

$$NRM = \frac{\mathrm{NRFN}\ + \mathrm{NRFP}}{2} \qquad (5)$$

Where, $NRFN = \frac{N_{FN}}{N_{FN}+N_{TP}}$, $NRFP = \frac{N_{FP}}{N_{FP}+N_{FN}}$

DRD is used to measure the distortion in binary document images [13]. This measure correlates with human visual perception properly and measures the distortion for all the S flipped pixels according to following formula

$$DRD = \frac{\sum_{k=1}^{S} DRD_k}{NUBN} \qquad (6)$$

Here, DRDk is the distortion of the k-th flipped pixel. It is calculated using 5X5 normalized weight matrix WNm. *DRDk* equals to the weighted sum of the pixels in the 5x5 block of the Ground Truth ***GT*** that differ from the centered k-th flipped pixel at (x,y) in the Binarization result image ***B.***

$$DRDk = \sum_{i=-2}^{2}.\sum_{j=-2}^{2} |\mathrm{GTk2j} = -22\mathrm{i} = -2\ \mathrm{i,j}\ - \mathrm{Bk\ x,y}\ |\mathrm{WNm\ i,j}$$

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NUBN is the number of the non-uniform 8x8 blocks in the GT image. Here non-uniform means not all black or white pixels. A low value of DRD is preferable.

A prediction against the Ground Truth (GT) image is evaluated on an object-by-object basis. Misclassification pixels are penalized by their distance from the ground truth object's border providing us with a value of MPM.

$$MPM = \frac{MP_{FN} + MP_{FP}}{2} \quad (7)$$

Where, $MP_{\mathrm{FN}} = \frac{\sum_{i=1}^{N_{FN}} d_{FN}^{i}}{D}$

IV. SIMULATION RESULTS

The experimental result consists of the proposed method technique. It has been clearly shown that the outcome of the proposed techniques are quite effective than the existing methods.

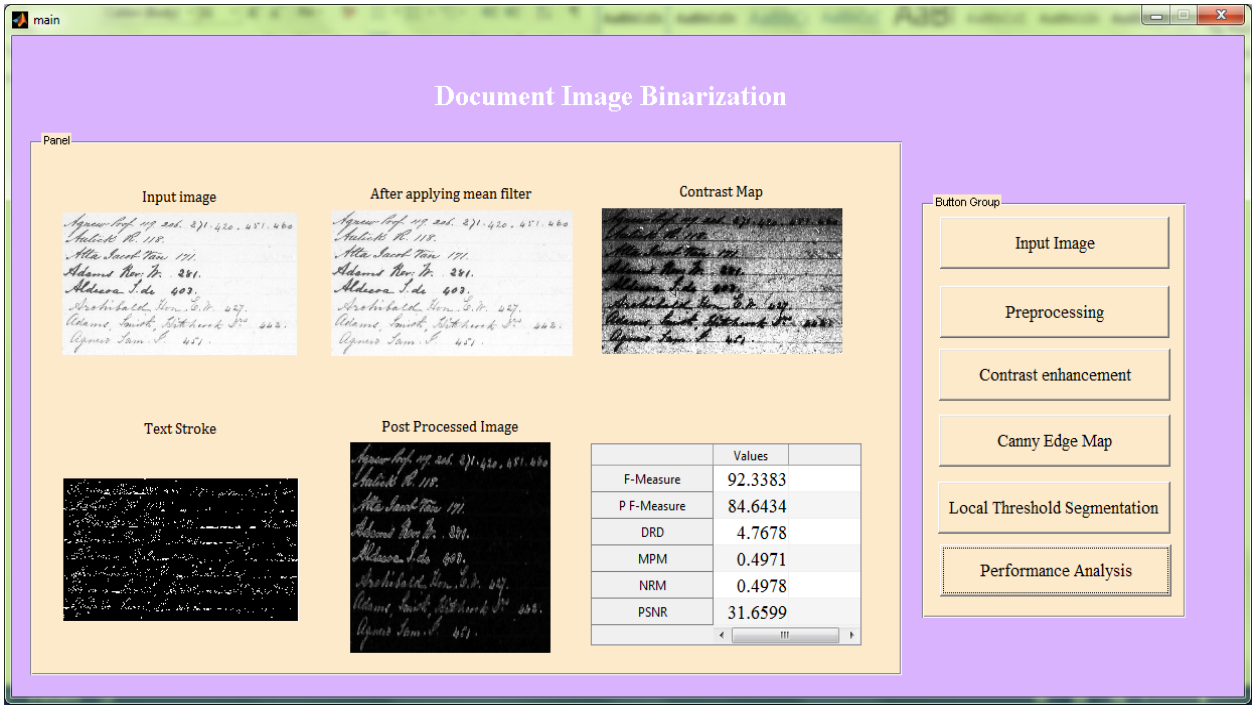

Fig.3. Result analysis.

V. CONCLUSION

This paper presents on the degraded document image binarization method on various datasets. It is an important task in degraded documents of computer vision processing. Aim of this paper is to analyze the coming algorithms for degraded document images binarization. In that each method has its own benefits and limitations. The major drawbacks of the existing system are found the low intensity and noisy images. This proposed paper has been tested on various datasets , and the experimental results shows that the proposed method outperforms the most reported document image binarization methods in terms of F-measure, Pseudo F-measure, DRD, MPM, NRM, and PSNR.

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