

An Improved Method for Degraded Image through Region Based Adaptive Binarization

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Abstract: In this paper a New Binarization technique has been proposed for the image had not uniformly illuminated due to the degradation that may be caused due to the Image corrupted by Noise ,smear etc. Which leads to the poor quality of the image .To overcome from these, Pre processing that performs the certain operations for the degraded image by using Region Based Approach which uses the Global, Local thresholding for the image analysis .The Ni-Black method had been used for the enhancement of the Image.The Enhanced Ni-Black has can be used in the documents and images that had affected with uncertain transition terms of pixels, Intensity Values.The experimental results are shown in terms of the Accuracy, and the Processing speed which gives the better performance than the previous method.

Index Terms: Degradation, Local Binarization, Non - uniform illumination , Region Based Approach.

I. INTRODUCTION

In the recent years the usage of the digitally generated documents using the scanners, mobile phones has been increased, That makes the image analysis as the most important aspect that have to be take into account during the extraction of information from image by using digital image techniques.

Binarization is the crucial step that has to be performed during the Pre-Processing of the image , Which converts the grayscale image (0,255) to the binary image(0,1) where '0' represents "Dark" and '1' represents "white". During the image analysis the image foreground and the background should be good, For the Non Uniform illuminated image the separation are not better there should be substantial decrease of the degree of the performance in this case. For the increase of the processing Global and Local thresholding has used in the region based approach.

II. RELATED WORK

In the literature , Binarization can be done through Global or locally. Global Binarization[4] are only useful in the case that image have the uniform illumination throughout the image, then it provides the better results .

In the global Thresholding it uses a single threshold value all over the image foreground or background. It also referred as "Global Fixed Threshold".

$$b_i = 1 \text{ if } x_i \geq 0.5, \text{or}$$

$$b_i = 0 \text{ if } x_i < 0.5, \quad (1)$$

However this Global thresholding may not be sufficient for the image analysis the image which may be degraded because of the non uniform illumination, low contrast, smear etc. for that local binarization methods are suitable in the background changing and the pixels are calculated according to the image . Among all the binarization methods through local thresholding , Ni-Black method[12] are the simple approach.In the NiBlack the pixel wise threshold had done by shifting the rectangular window[2] across the image the expression had given as

$$T = m + k. s, T=m+k.s, \quad (2)$$

Where 'k' is a negative constant, T is the Threshold surface, s is the standard deviation. This algorithm doesn't provide better results if the text object had not present in the image but also produces large amount binarization noise Savoula[13] proposed an enhanced version of the NiBlack algorithm by adding a hypothesis parameter o the gray value of text and background on which text pixel have gray level near '0' and background pixels have gray value near 255 and the formula had given by

$$T = m + (1 - k \left(1 - \frac{s}{R}\right)) T=m+(1-k1-s/R), \quad (3)$$

Where 'k' is the positive constant, 'R' is the standard deviation fixed to 128 , 'm ' is the mean. This method provides better results for document images which was well scanned and faces difficulties during the dealing of images which don't correspond s with hypothesis.

III. PROPOSED METHODOLOGY

The information can't be extracted especially in the non uniformly illuminated[10] ,Undesired shadowed images. To extract that we should have a new approach and reliable binarization technique for the fast processing of the images.

Pre-processing :

In the proposed methodology the original image N*N has divided into different regions, Each region of image is termed as "Block". The Blocks in the image have the information (pixels).Then in the pre-processing the Image ,First the mean for each block has to be calculated and then different operations also performed. The mean which will be used as the 'Local Binarization Thresholding ' for whole Region in the simplest Approach.

In this two coefficients has been used for the Enhancement of degraded image due to Non-Uniform

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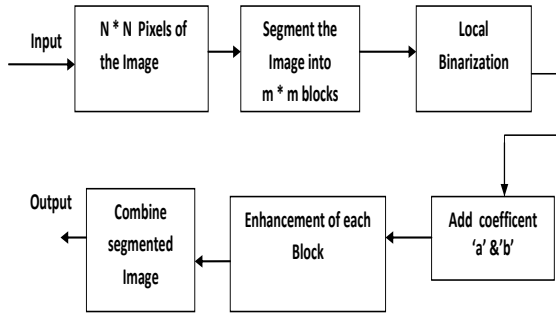


Fig. 1: Block Diagram of Proposed Methodology

illumination.

Addition of Correction Coefficients:

Adding of these correction coefficient lowers the Threshold value and will provide better results for the Fast Adaptive Thresholding Images , Which may not gives the desired results . For that in addition to the *multiplicative coefficient* (a), *Addition coefficient* (b) has been added for the better improvement of the details that had present I the image.

Restoration:

In this two coefficients has been used for the Enhancement of degraded image due to Non-Uniform illumination. Adding of these correction coefficient lowers the Threshold value and will provide better results for the *Fast Adaptive Thresholding Images* ,[5] Which may not gives the desired results . For that in addition to the multiplicative coefficient (a), *Addition coefficient* (b) has been added for the better improvement of the details that had present in the image.

The measurement of the image results has taken in terms of F-Measure among all the different measures. The F- Meseure has defined as

$$FM = 2 \cdot \frac{PR \cdot RC}{PR + RC} \times 100\% = 2 \cdot PR \cdot RC / PR + RC \times 100\%, \quad (4)$$

Where Precision (PR) can be given as the ratios of the true positives to the sum of all positives, Recall (RC) also given as true positives to the sum of true positives and false negatives.

For an efficient method the *Precision* should be '1', that means the FP should be nearly equal to 'zero'. For *Recall* the FN should be equal to zero.

IV. RESULTS

From the proposed method we have applied for the different images with various sizes, quality the desired results are obtained . In the Fig.2 In the Figure, We have to depend on Three parameters normally

1. Block size 64*64
2. Correction Coefficients
 - i. Multiplicative coefficient $a = 0.95$
 - ii. Addition coefficient(Offset) $b = 7$

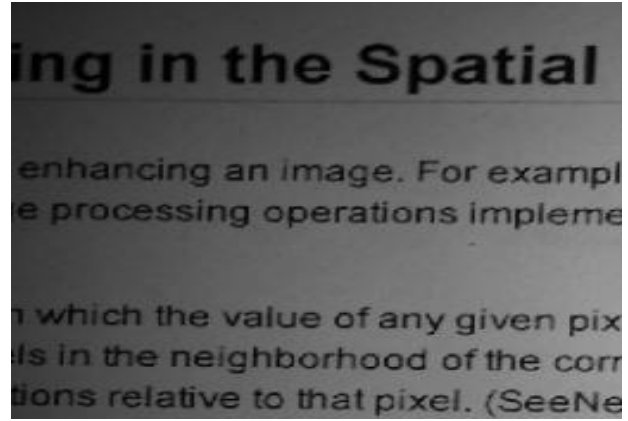


Fig. 2: Original Input Image

In the proposed method the results obtained are better in terms of the F-Measure as we expected it gets around 97 and the execution time increases due to the increase of blocks in the Image.

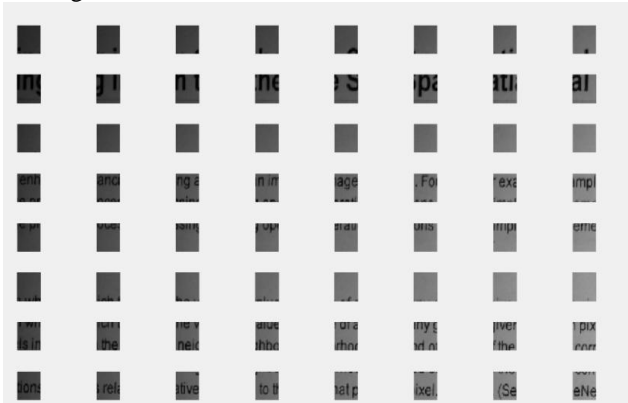


Fig. 3a: Segmented into 64-Blocks

From the Fig.3a which is an image segmented into blocks based on the size of image and the No of the Block written as

$$N_b = \frac{N \cdot N}{m \cdot m}, \quad (5)$$

For example : Let $N=256, m=64$ Then $N_b = 16$ Blocks. In the above figure the image has divided into 64 block and the image contains the 8 rows and 8 columns. The pixel in the image are segmented and then the different operations had done to get the information that had been lost due to the noise or another issues.

In the Fig.3b the each segmented blocks are shown which had their pixel values. In the segmentation the image simply changes its representation which makes into meaningful for the easy analysis. The main objective of the segmentation is to locate the objects like its lines and curves. The image segmentation assigns a label for the pixel having the similar characteristics.

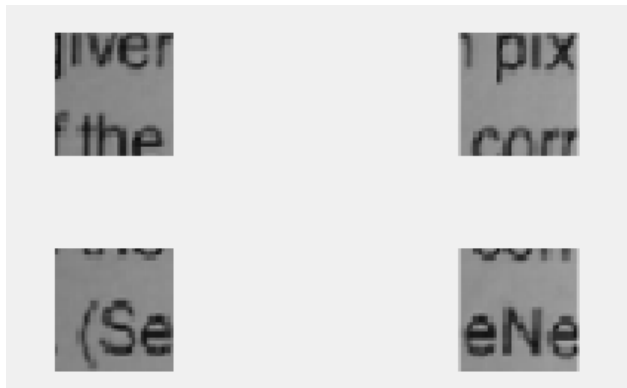


Fig.3b : Segmented Blocks contains Text

Fig : 3 shows that the segmented image had converted into binary image and the binarization technique to collect the information of the pixels then the image has been enhanced due to the Unamplified noise and the illumination changes in the image, The enhancement has done by adding the correction coefficients which reduces the Threshold, the two coefficients provides the better information when compared with the Ni-Black which has slow processing technique.

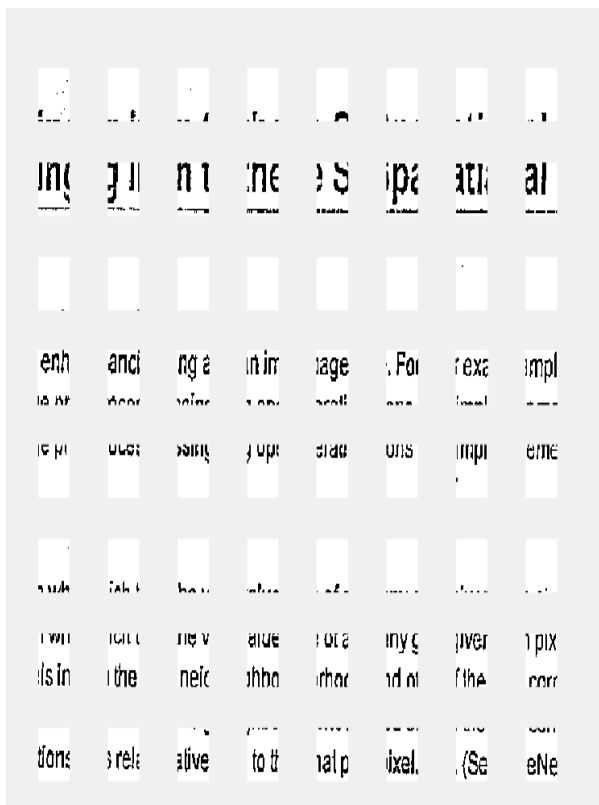


Fig.4 : Enhancement of Image by Correction Coefficients

In the enhanced image, where all the blocks in the image are desegmented to obtained the desired information from the image. The information which has extracted from the degraded image due to Non Uniform illumination and has an increase of the Accuracy and the Noise that had amplified during the binarization technique that we have applied. The Enhanced version of the Ni-Black had shown in the Fig 4. The output of the proposed one gives the much more efficient performance.

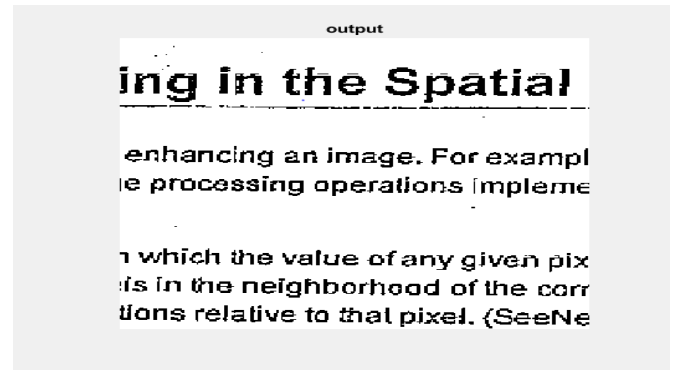


Fig.5 : Output of the Degraded Image

Table 1.Comparison of Performance in different Methods

Binarization Method	F-Measure	Execution Time(sec)
None	45.9	10.6
Ni-Black	89.4	15.4
Enhanced Niblack	96.2	9.7
Proposed	97.6	12.2

From the Table 1, the execution time of the proposed system had increased due to the segmentation process image into blocks, Image Analysis for each block for calculation of mean etc. The Performance of our method has more efficiency then the other methods that had been used in many images. And also the F-Measure[1] parameters like Precision, Recall and Sensitivity has calculated and given as

Precision	Recall	Sensitivity	Accuracy
1	1	0.278	97.6

V.CONCLUSION & FUTURE WORK

In this paper an efficient binarization technique has been proposed for the image that had degraded. The Image can restores its information using this technique. Thus the F-Measure which gives improved performance that can be comparable to the different methods[7]. After the pre processing the image had improved due to the correction coefficients which had not taken in the binarization techniques that were used before this method. Along with the F-Measure the sensitivity, PSNR of the image can also be calculated. In this method a different types of images that had encounters the illumination changes and the noise had tested for the effectiveness of this method.

During the extraction of information like text the execution had been increased due to the similar text that had used in the image and also the empty blocks which didn't contains any pixel. If these can be reduced than the information accuracy and time also increases.

REFERENCES

1. Michalak, H., &Okarma, K. (2018). “ Region based adaptive binarization for optical character recognition purposes”.2018 International Interdisciplinary PhD Workshop (IIPhDW).
2. B. Bataineh, S. N. H. S. Abdullah, and K. Omar, “An adaptive local binarization method for document images based on a novel thresholding method and dynamic windows,” Pattern Recognition Letters, vol. 32, no. 14, pp. 1805–1813, 2011.
3. O. A. Samorodova and A. V. Samorodov, “Fast implementation of the Niblack binarization algorithm for microscope image segmentation,” Pattern Recognition and Image Analysis, vol. 26, no. 3, pp. 548–551, 2016.
4. P. Lech, K. Okarma, and D. Wojnar, “Binarization of document images using the modified local-global Otsu and Kapur algorithms,” Przegląd Elektrotechniczny, vol. 91, no. 1, pp. 71–74, 2015.
5. H. Michalak and K. Okarma, “Fast adaptive image binarization using the region based approach,” in Proceedings of the 7th Computer Science On-line Conference 2018 (CSOC2018), ser. Advances in Intelligent Systems and Computing, R. Silhavy, R. Senkerik, Z. KominkovaOplatkova, Z. Prokopova, and P. Silhavy, Eds. Springer International Publishing, 2018, accepted for publication.
6. Chou, C.H., Lin, W.H., Chang, F.: A binarization method with learning-built rules for document images produced by cameras. Pattern Recognit. **43**(4), 1518–1530 (2010).
7. Khurshid, K., Siddiqi, I., Faure, C., Vincent, N.: Comparison of Niblack inspired binarization methods for ancient documents. In: Document Recognition and Retrieval XVI, vol. 7247, pp. 7247–7247-9 (2009).
8. Moghaddam, R.F., Cheriet, M.: AdOtsu: an adaptive and parameterless generalization of Otsu’s method for document image binarization. Pattern Recognit. **45**(6), 2419–2431 (2012).
9. Shrivastava, A., Srivastava, D.K.: A review on pixel-based .binarization of gray images. Advances in Intelligent Systems and Computing, vol. 439, pp. 357–364. Springer, Singapore (2016)
10. Wen, J., Li, S., Sun, J.: A new binarization method for non-uniform illuminated document images. Pattern Recognition. **46**(6), 1670–1690 (2013)
11. Roe, E.; Mello, C.A.B. Binarization of Color Historical Document Images Using Local Image Equalization and XDoG. In Proceedings of the 12th International Conference on Document Analysis and Recognition, Washington, DC, USA, 25–28 August 2013; pp. 205–209.
12. W. Niblack. An Introduction to Digital Image Processing. Prentice-Hall, Englewood Cliffs, New Jersey, 1986.
13. [13]J. Sauvola and M. Pietikainen, "Adaptive Document Image Binarization," The Journal of the Pattern Recognition Society, PR 33 (2000) 225-236. 1999

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