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Image Binarization of Degraded Devanagari Documents using Niblack Inpainting Mask

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ABSTRACT: Different methods of binarization are studied and applied to the images of degraded documents to obtain the binary image. These binary images are then applied to OCR to study the efficiency of each of the binarization techniques. In an OCR, one of the main processing stage is binarization of document images, i.e. separation of foreground from background. Binarization of a text image should give us, in an ideal case, the foreground text in black and noisy background in white. Though different thresholding methods already exist in literature, they don't give perfect results for all types of documents. Extraction of the text from the Degraded documents containing Devanagari text is the having best suited technique as Niblack. It provides the optimized results in context to MSE and PSNR values. The proposed technique can be applied for other types of scripts like Gurumukhi etc. to declare the technique to be global technique.

KEYWORDS: Discrete Cosine Transformation, Depth First, Discrete Fourier Transformation, Difference Pyramid

I. INTRODUCTION

Binarization of document images with complex backgrounds and uneven illumination is a challenging task. Even state of the art methods of binarization (i.e. Otsu's method) fail to Binarize the document images properly if they have complex backgrounds. Removing white Gaussian noise and impulse noise from the document images without losing boundary details (edges) of characters is another challenge in the preprocessing step of any OCR system. Most conventional methods blur the images in denoising process.

1.1 Technique Based On Segmentation

There are different techniques based on segmentation and all provide different means of segmenting the image.

1.1.1 Thresholding based segmentation

Fig. 1.3 shows the Thresholding is the technique which uses intensity values. In this range of intensity is considered i.e. which pixel lies under which intensity level. [34] Thresholding can be local or global in nature. It converts gray scale image to binary image. The binary image have value 0 and 1. Binary value '1' is considered as object pixel and '0' is considered as background pixel.

Thresholding values can be either taken using interactive ways or using automatic thresholding method N. [41] OTSU method is one of the most widely used method of thresholding its fast and inexpensive method. In this image is divided into different objects and background is separated and then different values of threshold are considered. It can be local

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threshold value or multi-level as they help in detecting objects separately. Some of the steps followed by multilevel thresholding are:-

- Image is divided into different parts
- Then local threshold value is decided for subparts.
- Then comparison is made with pixels of individual subparts and region is segmented



Fig. 1 (a) Threshold for Image with one object[1]

Fig. 1 (b) Threshold for Image[1]

1.1.2 Region based segmentation

Fig. 1.4 Region based segmentation is the technique that divides the image into different regions that is pixels having the same value are kept in one region. [41] Region based segmentation works on seed point and that seed point is compared to the neighboring pixels and the pixels that come out to be similar are kept under one region (comparison is done using different properties such as gray level , color texture ,shape).



Fig. 2 (a) Original Image[2]

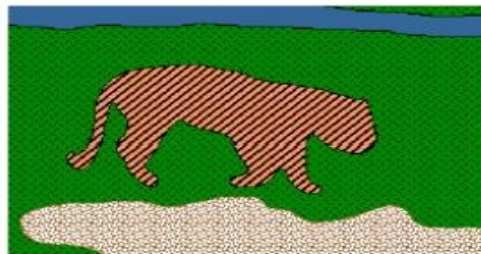


Fig. 2 (b) Region Segment Image[3]

The region can be connected, disjoint or homogenous. The region based on segmentation is divided into two parts:

- Region growing
- Region split and merge

1.1.3 Region growing method

Fig. 1.5 shows the uses of the initial seed point where entire image is considered and divided into different regions. The pixel taken as seed can be either predefined seed, randomly chosen or all pixels are considered as seed. Then we move to bottom up method of region growing in this all the pixels with the similar features are considered (gray level, texture, color) [37]seed can be either selected from the entire gray level present in the image or from the object of interest.

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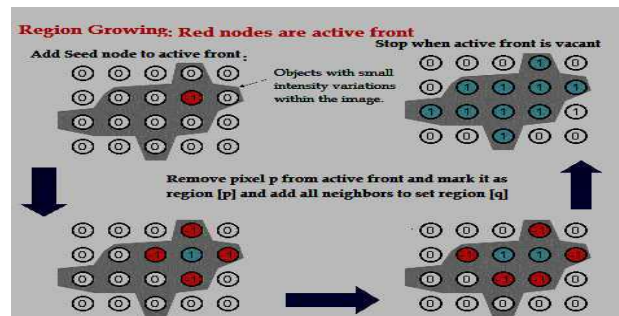


Fig 3: Seeded Region Growing[2]

1.1.4 Region split and merge

Fig. 1.6 shows the Region split and merge method is considered an entire image into a single region and that region is spitted into different quadrants on the basis of some properties. Then the regions get merge if they are similar to each other merging is carried out until no such merging is possible as all the pixels are considered as a single unique label. The method used here is “quad tree”. [4]

- First the criteria are formed to check uniform area like mean, variance, texture etc.
- Then entries image is spitted into 4 quadrants.
- Each quadrant is checked and further divided into 4 new quadrants.
- After that comparison is made at the end and similar one are merged.

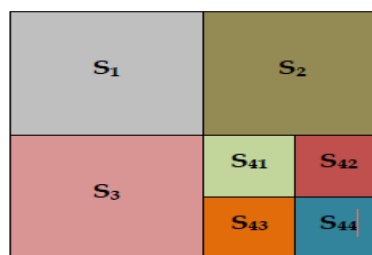


Fig. 4 Region Split and Merge method[2]

II. LITERATURE SURVEY

Shenhai zheng, et al.(2017) Segmentation of digital imaging is a difficult task due to low contrast and existence of noise it becomes an challenging task. In this paper novel variation method of automatic liver segmentation is used. First of all the shape features are extracted to make statistical shape model, then local features and global Gaussian energy are established to instruct the PCA transformation based on topological information. It is an efficient model as it includes shape information and local, global features; it helps in encountering smooth and closed boundaries for the segmentation of liver. It makes use of CV-Model for getting ravine boundaries. Experiment was performed on two dataset available and the research provide us with the result that is highly efficient and accurate[1].

Di Liu, et al.(2017) Hepatocellular carcinoma(HCC) is a presence of tumor in the liver of patients with many more liver problems and cirrhosis. Liver tumor expands and spread in such a way that it becomes cause of death. In this paper, we have different segmentation techniques that our used in combination with each other and implemented in the field HCC for segmentation of image. The techniques that are mainly used are: K-mean clustering along with region growing method, for foreground and boundary we have watershed algorithm, region growing is based on gray level .This paper also discuss the new method of region growing on the basis of LBP. It's the most reliable plan for segmentation; its accuracy and result rate make it a best plan for liver segmentation[2].

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Akshat Gotra ,et al.(2017) Liver boundaries are weak in nature so segmenting the liver in the presence of neighboring organs by using CT images (computed tomography) is challenging task. Non Subsample Shearlet Transform (NSST) is the edge enhancement technique that uses different scales for liver segmentation using CT images and also uses different intensity levels either for high or low frequency coefficients. For the accuracy Sum Modified Laplacian (SML) is used and to get accurate edge information. Using NSST we can finally get enhanced image. The accuracy of the method is measured by applying segmentation with fusion process and without it. The proposed technique for the fusion framework provides the detailed knowledge of the given image and provides us with good edge information that we can retrieve from individual images. Research has provided with 60.11% of accuracy[3].

Shraddha Sangewar, et al. (2017) Digital imaging is the process of looking inside the human body this process is carried out using different machineries which are required to get images of the different parts of the body as it is an effective way to get maximum information about the interior abnormalities of body. It is the most challenging task due to the presence of different gray levels due to the extraction of different boundary areas as they are difficult to segment due to the different intensity levels. Liver segmentation is the difficult task if done manually that's why we try to use a different methods to determine tumor and other abnormalities in liver and so to provide proper treatment to the patient.3d analysis of liver organs is done to get more detailed information of liver rather than 2D view. Comparative study has been done between k-mean and graph cut technique of segmentation for extraction of liver problems and the result gave us the accuracy of 82.23%[4].

III. FLOWCHART

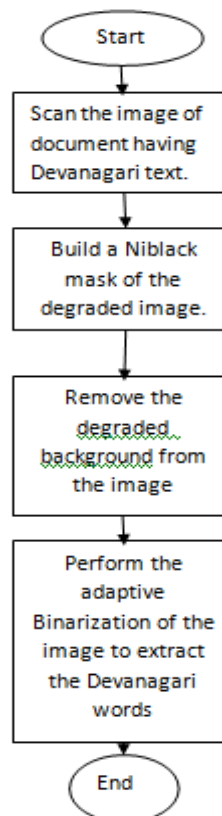


Fig. 5 Flowchart

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IV. ALGORITHM

- Step1 Input the image scanned using digital scanner.
- Step2 Prepares the Inpainting Mask of the image.
- Step3 Identify the degradation place using inpainting mask. It is done by identifying the background and foreground of the image.
- Step4 Remove the background degradation from the image.
- Step5 Binarize the image having Devanagari words.
- Step6 Extract the text from the image.

V. RESULTS OUTPUT



Fig. 6 Case 1

Fig. 6 shows the four steps for the identification of text from the image with the proposed scheme and technique. The proposed technique is used for the text identification lies in the foreground.

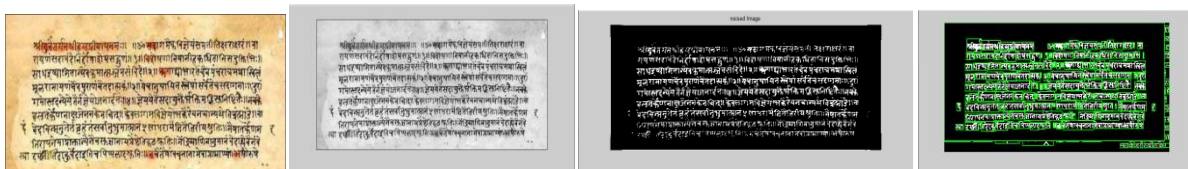


Fig. 7 Case 2

Fig. 7 shows the four steps for the identification of text from the image with the proposed scheme and technique. The proposed technique is used for the text identification lies in the foreground.

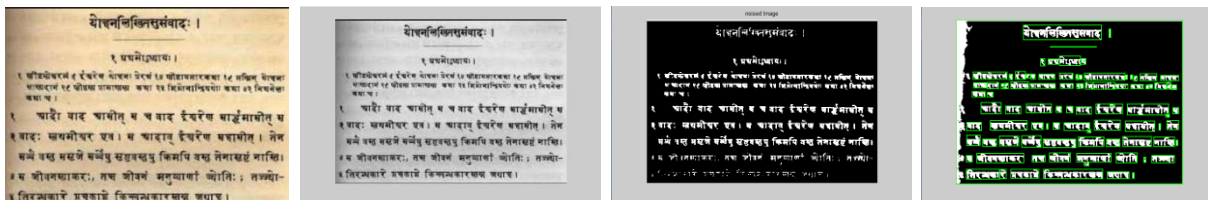


Fig. 8 Case 3

Fig. 8 shows the four steps for the identification of text from the image with the proposed scheme and technique. The proposed technique is used for the text identification lies in the foreground.

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5.1 FM COMPARISON

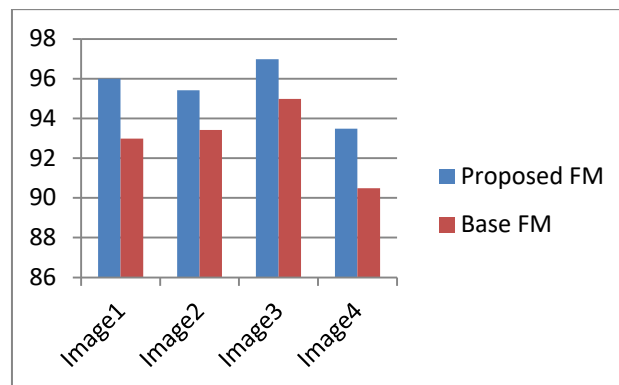


Fig. 9 FM Comparison

Fig. 9 shows the FM comparison for both base and the proposed technique. The proposed technique has higher FM value compare to the Base Technique

	Proposed	Base
	FM	FM
Image1	95.99	92.99
Image2	95.42	93.42
Image3	96.98	94.98
Image4	93.48	90.48

Table 1 FM values Table

5.2 PSNR COMPARISON

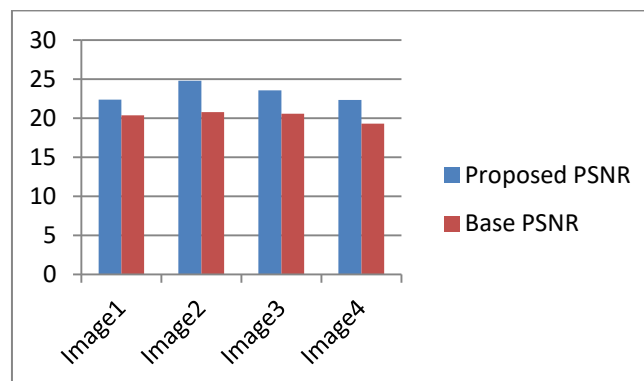


Fig 10 PSNR Comparison

Fig 10 shows the PSNR comparison for the base and the proposed technique. The proposed technique has Higher PSNR compared to the base technique.

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	Proposed	Base
	PSNR	PSNR
Image1	22.37	20.37
Image2	24.78	20.78
Image3	23.56	20.56
Image4	22.3	19.3

Table 2 PSNR Comparison Table

5.3 NRM COMPARISON

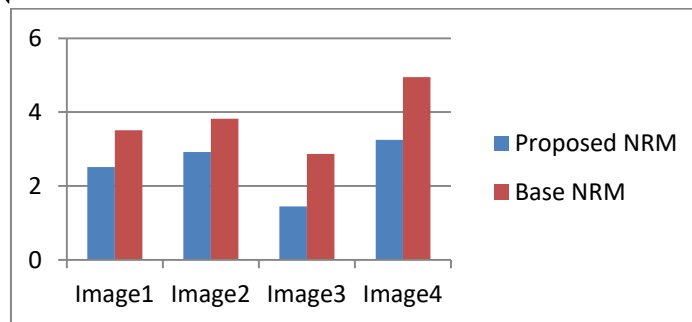


Fig. 11 NRM Comparison

Fig. 11 shows the NRM comparison for different images of the dataset. Proposed Technique has lower NRM value.

	Proposed	Base
	NRM	NRM
Image1	2.51	3.51
Image2	2.92	3.82
Image3	1.45	2.87
Image4	3.25	4.95

Table 3 NEM Comparison table

5.4 MPM COMPARISON

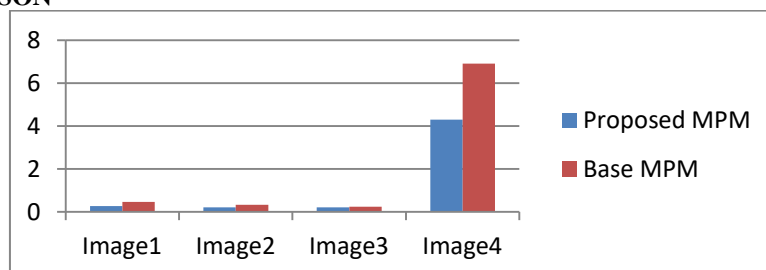


Fig. 12 MPM Comparison

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Fig. 12 shows the MPM comparison for base and proposed technique. Proposed technique has lower MPM value compare to the base technique.

	Proposed	Base
	MPM	MPM
Image1	0.26	0.46
Image2	0.21	0.33
Image3	0.2	0.23
Image4	4.3	6.9

Table 4 MPM Comparison Table

5.5 PFM COMPARISON

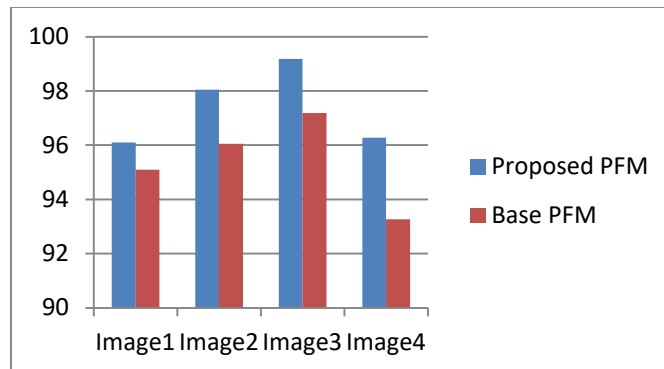


Fig. 13 PFM Comparison

Fig. 13 shows the comparison of PFM for base and proposed technique. Proposed technique has better PFM value compare to the base technique.

	Proposed	Base
	PFM	PFM
Image1	96.1	95.1
Image2	98.05	96.05
Image3	99.18	97.18
Image4	96.27	93.27

Table 5 PFM Comparison Table

VI. CONCLUSION

Image binarization for the degraded image for Devanagari text is the challenging task. Large amount of historical literature is in Devanagari script. The automatic segmentation of the image is the need of the hour. So that those document can be digitized for future generations. Also it will be very time consuming to maintain the records in manual way. Niblack based technique for the image binarization for the old degraded script document is the best suited

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technique. It provides the higher success rate for the scanned Devanagari documents. The proposed technique has better performance on all the parameters. The extracted image also shows the optimized results.

VII. FUTURE WORK

Extraction of the text from the Degraded documents containing Devanagari text is the having best suited technique as Niblack. It provides the optimized results in context to MSE and PSNR values. The proposed technique can be applied for other types of scripts like Gurumukhi etc. to declare the technique to be global; technique.

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