

IMAGE BINARIZATION OF DEGRADED DEVANAGARI DOCUMENTS USING NIBLACK INPAINTING MASK

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Abstract: Digital image processing is the current area of research in various fields. Mainly the work is performed in the area of the digitization of various old scripts digitization. These documents are historically important and for the better management the computerization is the best alternative. While digitization there may be various problems left. The document whose digitization is being performed may be degraded document. The degradation of the document can be due to the ink dispersal or yellowish paper. While converting them to digital format the success rate for automatic digitization will be reduced. In current research paper the Niblack based technique is used for the identification of the Devanagari text from old degraded documents. The technique is successful in determining the words from the degraded documents.

Keywords: Devanagari, Niblack, Digitization.

I. INTRODUCTION

1.1 IMAGE SEGMENTATION

Fig 1.1 shows the Image segmentation is the process of dividing the image into small parts based upon the intensity levels. The goal of segmentation is to provide us the large area detection in simplest way. These days segmentation of image is widely used in the field of medical imaging, context-based image retrieval, and object reorganization. [30] Segmentation helps us to understand image more effectively.

- Segmentation is performed by dividing the image on the basis of pixels and those pixels are correlated with each other.
 - The partitioning is done on different factors like gray level, color, texture, intensity etc.



a) Original Image



Fig 1 Image segmentation

Segmentation can be used to divide into different classes:

- Feature space method: It consists of feature extraction and clustering. Different features are considered during segmentation,[16] pixels having same value are clustered in one cluster and so on.
- Image domain based method: These are used to find out the boundaries in an image for the segmentation purpose. The methods include region growing etc.
- Edge detection method: Segmentation under which edge links are found and edge detection is performed.

1.2 IMAGE SEGMENTATION STEPS

There are number of steps that are followed during the process of segmentation.

- Image Acquisition: It is the process of digitizing the image in the digital format.
- Image enhancement: It is performed to enhance the quality of image so that more suitable results can be found.
- Image restoration: Image restoration is used to restore the quality of image that has been affected during image enhancement because some parts of the image may be damaged and lost during enhancement process. Point spread function (PSF) is most widely used technique of image restoration.
- Morphological process: It helps in getting those parts of the image that are useful in the describing the image.
- Image segmentation: It is used to divide the image into number of parts and even helps in differentiating the image from its foreground and background.
- Representation and description: It helps in representing the image as boundary or as complete region.
- Object reorganization: It helps in providing the label to the given image objects.

1.3 TECHNIQUE BASED ON SEGMENTATION

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

1.3.1 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 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 2 (a) Threshold for Image with one object Fig. 2 (b) Threshold for Image

1.3.2 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).

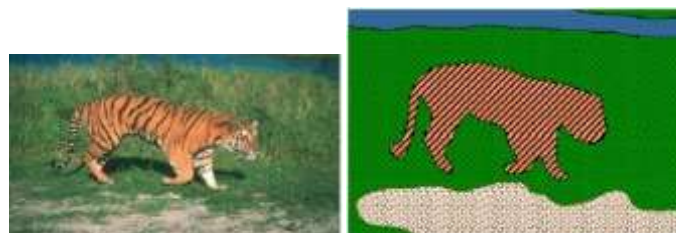


Fig.3 (a) Original Image

Fig. 3 (b) Region Segmente Image

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

- Region growing
- Region split and merge

Niblack's Method

Niblack's method implements a sliding rectangular window over a grayscale image to calculate threshold for each pixel.[2] The threshold calculation involves evaluation of the local mean μ and the standard deviation of each of the pixel present inside the window and is determined by the following equation:

$$t_{\text{nilblack}} = m + k * s$$

$$t_{\text{nilblack}} = m + k \sqrt{\frac{1}{NP} \sum (p_i - m)^2} = m + k\sqrt{B}$$

where NP denotes the number of pixels present in the grayscale image, m is the average value of the value of the pixels p_i , $k = -0.2$, by assumption. The benefit of Niblack is that it accurately identifies the text regions as foreground always but produces a huge amount of binarization noise in background regions which is the non-text region.

II. LITERATURE SURVEY

Jung won cha, et al. (2017) [18] Image segmentation can be done using conventional graph cut method technique due to its ability to find out global minimum and easy implementation. It is an intensity-based method that helps in segmentation using the contrasts of object and background we add shape prior and motion information as its enhancement. Shape prior information is obtained using Active shape model (ASM) along with its signed function by not allowing the neighboring tissues being the part of segmentation. To estimate the local motion optical flow method is used for extending 3D segmentation to 4D. The result for this shows that the segmentation performed on five phases of CT images and took approximately ten minutes and 32GB memory and determined high accuracy.

Negar Farzaneh, et al.(2017)[19] Internal organs injury can be caused by Traumas and illness. The liver is the one that gets easily injured by trauma. To check whether any internal organ is injured we make use of medical images like CT images by radiologist and checks the interior of the body due to the large mouth of neighboring organs being overlapped and noise and different intensity levels it become difficult to visualize the actual cause and the process become slime consuming and difficult. Therefore an automatic segmentation approach is good for this purpose. The paper gives us the fully automated Bayesian based method for 3D liver segmentation and this method provide us with high performance of 93.5% and 87.9% .

Vimtha.G.Sekhar, et al.,(2016)[20] Disease diagnosis is done with the help of different medical image processing techniques used these days like CT/PET medical images. The technique of CT/PET for tumor segmentation present in the liver. Median filter and binary tree quantization algorithm are used to perform pre-processing and segmentation. In the process of segmentation the pre-processed input images are provide to the binary tree quantization algorithm that represent the liver with the tumor in the form of cluster. According to this paper binary tree quantization method provided us with better results than the conventional K-mean algorithm. The researcher has put up a dataset of 10 images with 60 slices each which ends up with the result rate of 90%.

T.M.Hassan,et al.(2015)[21] CAD is a technology that is important for the doctors to decrease observational oversight and to understand medical images also by decreasing false negative rates. Detection /diagnosis of various diseases have been improved by using CAD system. Classification framework is purposed for CAD system to diagnose three classes of focal liver disease that are Cyst, Hemangioma (HEM), and Hepatocellular using ultrasound(US) In this, pre-processing is done using median filter to enhance and remove the noise from ultrasound images followed by segmentation of liver region done by level set method .Algorithm used is fuzzy c-mean and multi-support vector machine (multi-SVM) is used to diagnose classes of focal liver disease .Researcher has used 10-fold cross validation methods and obtained classification accuracy of 96.5%

III. ALGORITHM

Step1 Input the image scanned suing 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.

Step5 Extract the text from the image.

IV. FLOWCHART

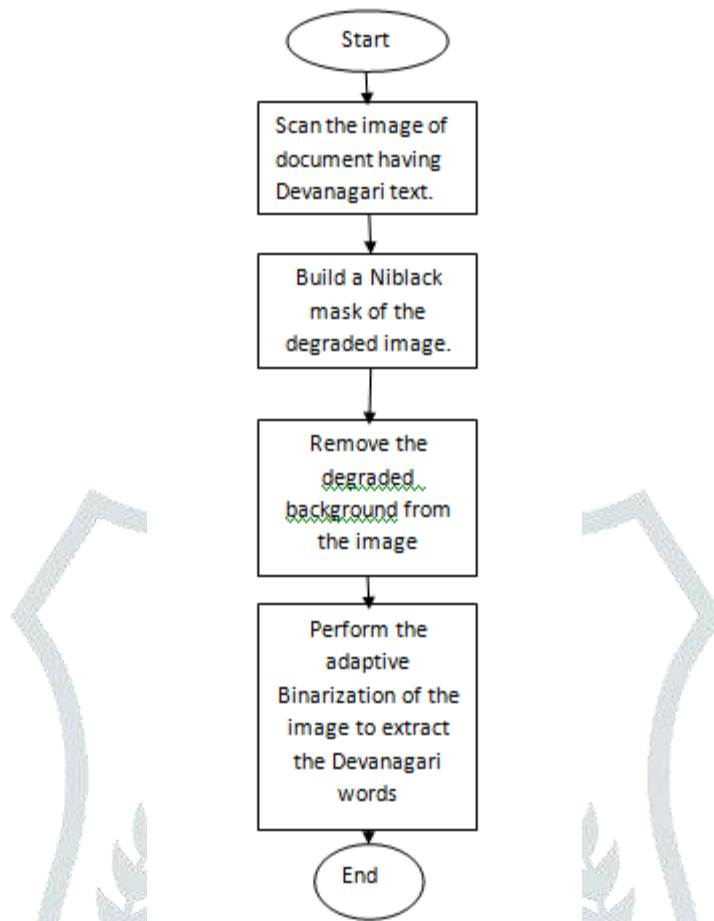


Fig. 4 Flowchart

V. RESULTS AND DISCUSIONS

5.1 Dataset



Fig. 5 Dataset 1

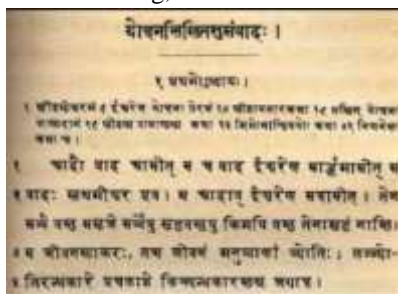


Fig. 6 Dataset 2

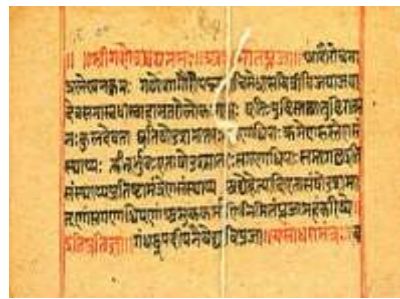


Fig. 7 Dataset 3

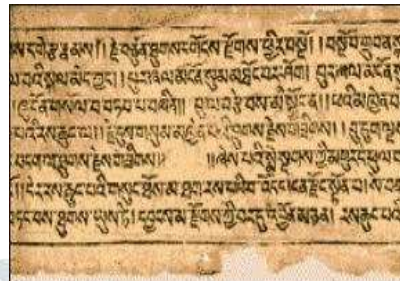


Fig. 8 Dataset 4

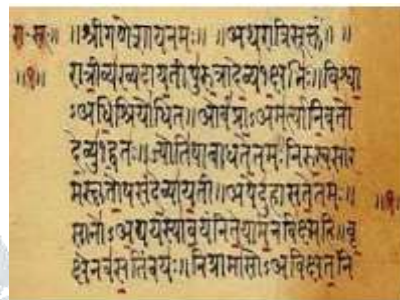


Fig. 9 Dataset 5

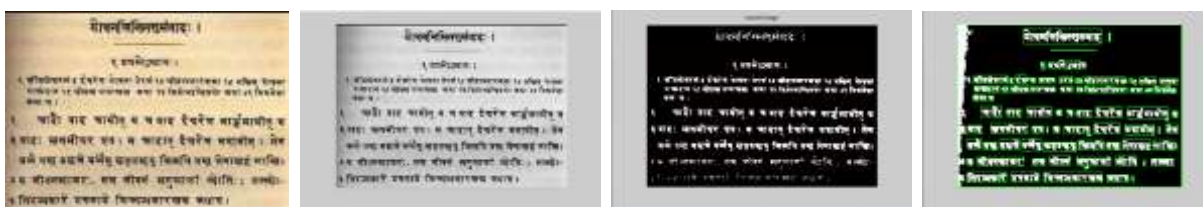
5.2 Results Output



Fig. 10 Case 1

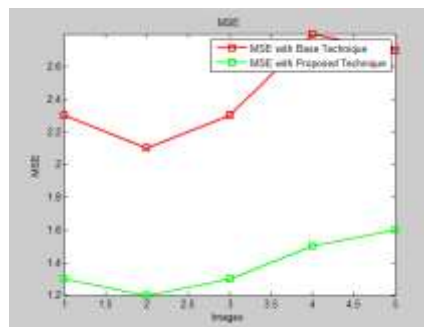


Fig. 11 Case 2



Fig, 12 Case 3

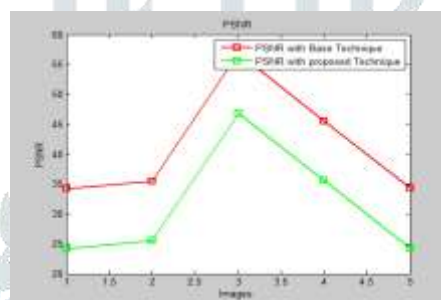
5.3 MSE Comparison



Fig, 13 MSE Comparison

Fig. 13 shows the MSE comparison for both base and the proposed technique. The proposed technique has better MSE value compare to the Base Technique

5.4 PSNR Comparison



Fig, 14 PSNR Comparison

Fig 14 shows the PSNR comparison for the base and the proposed technique. The proposed technique has better PSNR compared to the base technique.

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 technique. It provides the higher success rate for the scanned Devanagari documents. The proposed technique has lower MSE and PSNR ratio. 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. In future the technique can be applied for other types of scripts like Gurumukhi etc.

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