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Using Binarization Method Rebuilding of Historic Document Images

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Abstract: The segmentation of the text from the historical degraded image documents is a very challenging task because the variations between the foreground text and background text are hard to determine. In this paper we have implemented a new segmentation algorithm to analyze and extract the words from a degraded image; the process carried here is the image contrast which is adaptively found to solve the issue. Initially the contrast map is taken from the degraded document images. The combination of local image gradient and the local image contrast is the adaptive image contrast, and then it is converted to binary level and combined with canny edge detecting algorithm to extract text edge pixels. The document text is further segmented by a local threshold that is estimated based on the intensities of detected text stroke edge pixels within a local window.

Keywords: Binarization, Otsu threshold, canny edge detector, document enhancement.

I. INTRODUCTION

Images now-a-days consists of large textual information. Let us consider more and more documents that are easily digitalized through devices like scanner, camera and by other devices. These images consist of information in form of text and data regarding our history. We can convert characters present in these images to textual format by using OCR known as optical character recognition. It will be very useful to store the information present in those images. But in some cases we face complications in retrieving text from these image documents.

Some of the reasons for facing these complications especially in historical documents include smear, ink bleeding through, and material used to prepare the documents and also intensity variations. Other reasons include small sized web images and effects used on images to attract visual attention.

Image Enhancement may provide solution to some extent, but may not be applicable to all types of images and the proposed binarization method comes handy then.

The conversion of a gray scale image into black or white, so called binary image is called binarization. The simplest way of binarization is thresholding**;** setting pixels to white (or 1) if the gray value is equal or greater than the threshold or setting to black (0) if smaller. When using adaptive thresholding, the level of threshold is determined automatically based on the content of the image or image sequence. A well-established way of automatic threshold determination is Otsu's method and by edge detector. An alternative method is using a given percentile of the intensity histogram as threshold value. In contrast locally adaptive thresholding uses a level that varies object by object in the image. This can distinguish bright spots, shapes over varying background.

Based on the difficulties faced in previous methods binarization provides a perfect solution for upgrading corrupted reports.

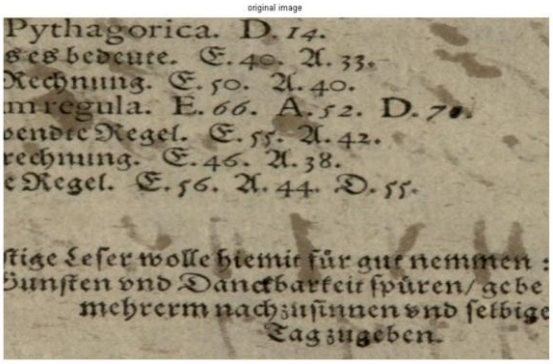

Fig.1: Sample degraded historic document image

The above figure is an example for the historical document.

II. LITERATURE REVIEW

In this section, we describe some of the binarization methods.

A.Curve based image segmentation algorithm:

Its main role is object extraction. Morphological edge detector is implemented with area growing techniques. Here each pixel in the image is affected based on the neighbouring pixels under the structuring element placed on the given pixel. Therefore erosion and dilation shrinks and grows objects (of one's) by the radius of the structuring element.

- Dilation: It adds pixels to the boundaries of objects in an image. The value of the output pixel is the maximum value of all the pixels in the input pixel's neighbourhood. In a binary image, if any of the pixels is set to the value 1, the output pixel is set to 1.
- Erosion: It removes pixels on object boundaries. The value of the output pixel is the minimum value of all

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the pixels in the input pixel's neighbourhood. In a binary image, if any of the pixels is set to 0, the output pixel is set to 0.

By using merging techniques segmentation is implemented and a clear form of image is obtained.

B. Thresholding by empirical method selection:
The image is processed by utilizing the thresholding output; here we utilized a commonplace thresholding technique which depends on pixel distributing in a picture into two clusters. In this paper they utilize experimental mode disintegration which is the exceptional technique to distinguish the optical edge level in a picture.

This EMD calculation is used to deteriorate any non straight and non stationary information into numerical mode capacities. The primary procedure included in this EMD investigation is the deterioration of information into limited inherent mode capacities. This EMD utilizes straightforwardly to temporal space what's more, does not work in recurrence space which is an instinctive what's more, versatile to portrayed the information with high effectiveness. In this paper, the execution utilizing this thresholding approach with different manufactured and genuine images is tested. This proposed approach upgrades a troupe exact deterioration so as to investigate the histogram of the picture. This EMD calculation can be utilized to disintegrate any nonlinear and non stationary information is changed over into a limited intrinsic mode function.

III. PROPOSED METHOD

The problems faced in previous methods can be easily over comed by the proposed method i.e., binarization method.Binarization of the degraded documents is performed as per the following steps.

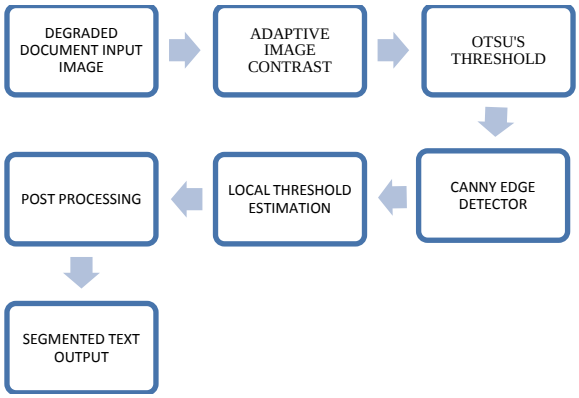

Fig 2: Flowchart of proposed binarization method.

A. Image based on combination of contrast and gradient:
The blend of local image contrast and local image gradient is known as adaptive image contrast to know the content and background variations brought by distinctive sorts of document debasements.

B. Binarization using Otsu thresholding: Converting a greyscale image to monochrome is a common image processing task. Otsu's method, named after its inventor Nobuyuki Otsu, is one of many binarization algorithms.

Otsu's thresholding method involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels each side of the threshold, i.e. the pixels that either falls in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum.

(a) (b) (c)

Fig.3: (a) Grey scale Image, (b) Binary Image & (c) Histogram

The method is used for automatic binarization level decision, based on the shape of histogram. The different images along with histogram are represented in Fig.3.

C. Canny Edge Detector:
The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images.

The main aims of the Canny Edge Detector are as follows:

- Error rate should be less – The probability of pointing non edges should be less. The edges detected should be close to true edges.
- Localization of edge points - The distance between the edges marked and true edges should be minimum.
- Minimal response the multiple edge pixels should not be detected where a single edge point exists.

The algorithm runs in 5 separate steps:

- Smoothing: Blurring of the image to remove noise.
- Finding gradients: The edges should be marked where the gradients of the image has large magnitudes.
- Non-maximum suppression: Only local maxima should be marked as edges.
- Double thresholding: Potential edges are determined by thresholding.
- Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

(a) (b)

Fig.4: (a) Original input, (b) Output of canny edge detector

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D. Local threshold estimation:
The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one.

The problem faced in global thresholding is that changes in illumination across the scene may cause some parts to be brighter (in the light) and some parts darker (in shadow) in ways that have nothing to do with the objects in the image. We can deal, at least in part, with such uneven illumination by determining thresholds locally. That is, instead of having a single global threshold, we allow the threshold itself to smoothly vary across the image and in such a way local thresholding is estimated.

E. Post processing:
The binarization result is further enhanced by post processing. The segregated forefront pixels that don't interface with other forefront pixels are sifted through to make the edge pixel set exactly. The pixel pair that lies in neighborhood and on symmetric sides of a content stroke edge pixel should fit in with various classes (i.e., either the report foundation or the frontal area content). One pixel of the pixel pair is in this way marked to the next classification if both of the two pixels have a place with the same class. At last, some single pixel ancient rarities along the content stroke limits are separated out by utilizing a few sensible operators and henceforth the picture is divided.

III.RESULTS

The various results of this binarization method are shown in below figures. The below is the original image that is given as input.

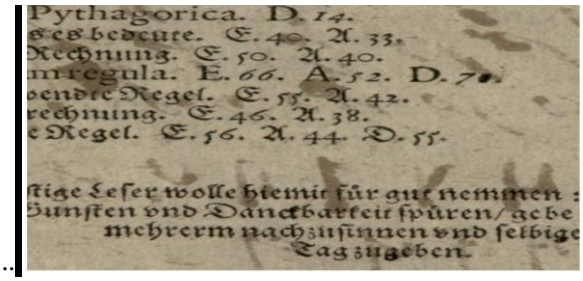

Fig.5.1: Original input

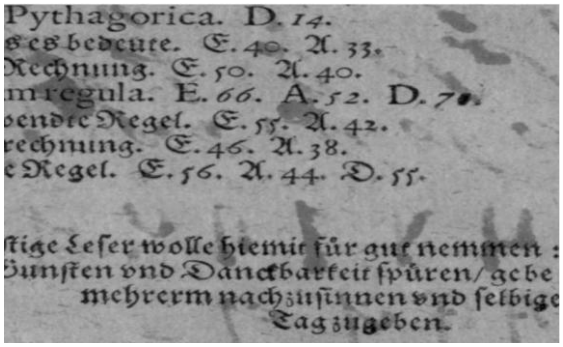

Fig.5.2: RGB to grey scale

The historical document is converted from RGB to a grayscale image as shown above. After conversion low contrast and low gradient is applied on the image.

Contrast based variations such as adaptive contrast is applied on the image.

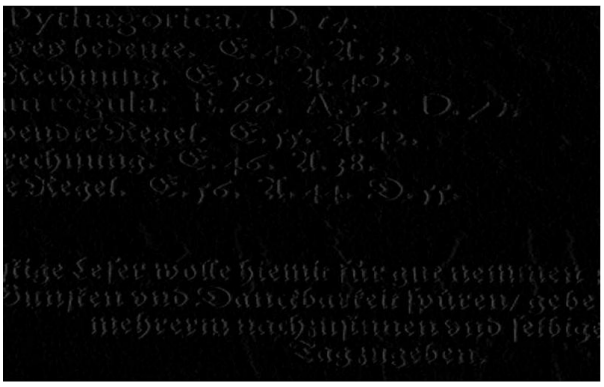

Fig.5.3: Adaptive contrast image

Otsu is redirected from Operational Test Support Unit. It is automated through threshold value in the image. This Otsu thresholding is based on the histogram of the input image.

Otsu thresholding is a simple yet effective global automatic thresholding method for binarizing gray scale images such as foregrounds and backgrounds.

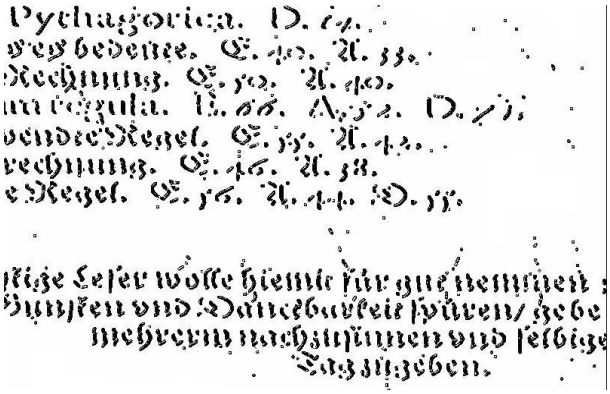

Fig.5.4: Otsu Thresholding

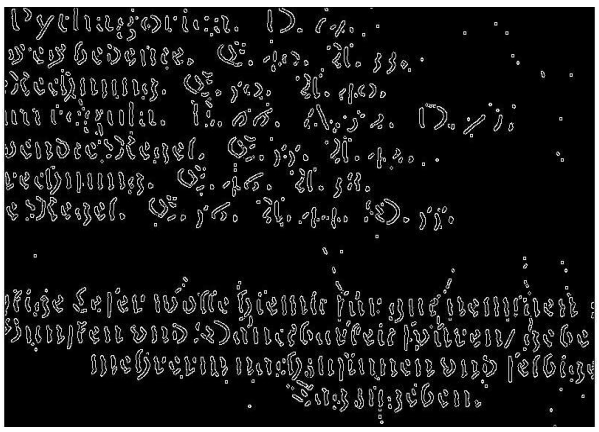

Fig.5.5: Canny edge detector

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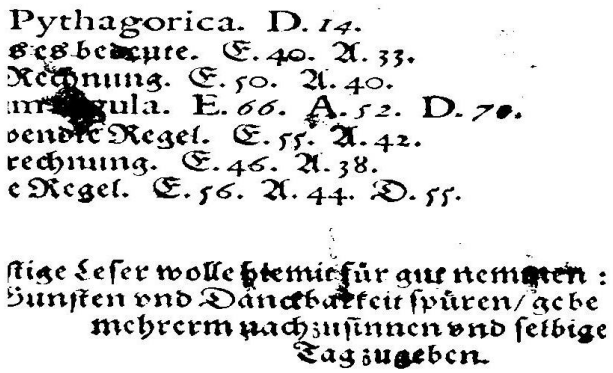

Fig.5.6: Output

The result of canny edge detector and the final output are shown in above figures.

IV. CONCLUSION & FUTURE WORK

In this paper, we introduced an image binarization method that uses the adaptive image contrast based document image binarization technique and is applicable for various types of degradation documents. Simple parameters are used for implementation of this technique. The output is still to be improved which is our future scope and make it applicable for even badly degraded ancient documents.

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BIOGRAPHIES

Sireesha R received her Master's Degree in Embedded Systems from Geethanjali College of Engineering and Technology. She has ten years of teaching experience at various colleges and she is a life time member of ISTE. Presently she is working as an Assistant professor in Brindavan Institute of Technology & Science, Kurnool. Her research areas of interests are Image processing and Embedded systems.

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