International Journal For Technological Research In Engineering
Volume 1, Issue 11, July-2014 *ISSN (Online): 2347 - 4718*

DEGRADED DOCUMENT IMAGE ENHANCEMENT USING GLOBAL THRESHOLDING

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Abstract: Recent years have witnessed the rapid growth of degraded images due to the increasing power of computing and the fast development of Internet. Because of this tremendous increase of quality of degraded images, there is an urgent need of image content description to facilitate automatic retrieval. Image is described by several low level image features, such as color, texture, shape or the combination of these features .Shape is an important low level image feature. In this thesis, enhancement of quality of degraded image using Global Thresholding. This thesis is primarily concerned with the extracting numerical features from binary images. Image processing is very vast field & one of the most important part of image processing is thresholding. Thresholding, which is an important pre-processing steps for the degraded image to enhance their quality & has been studies in relation to various images. There are different algorithms that have been used & studied for various factors of image analysis. The value of thresholding is based on which segmentation has been performed.

Keywords: Binarization, Noisy Documents, Threshold

I. INTRODUCTION

Degraded documents are archived and preserved in large quantities worldwide. Electronic scanning is a common approach in handling such documents in a manner which facilitates public access to them. Such document images are often hard to read, have low contrast, and are corrupted by various artifacts. Thus, given an image of a faded, washed out, damaged, crumpled or otherwise difficult to read document, one with mixed handwriting, typed or printed material, with possible pictures, tables or diagrams, it is necessary to enhance its readability and comprehensibility. Documents might have multiple languages in a single page and contain both handwritten and machine printed text. Machine printed text might have been produced using various technologies with variable quality. It is common for libraries to provide public access to historical and ancient document image collections. For such type of document images require specialized processing in order to remove background noise and become more legible. In this paper, we define a hybrid binarization approach for improving the quality of old documents using a combination of global and local thresholding. Firstly, a global thresholding technique specifically designed for old document images is applied to the entire image. Then, the image areas that still contain background noise are detected and the same technique is reapplied to each area separately. Hence, we achieve better adaptability of the algorithm in cases where various kinds of noise coexist in different areas of the same image while avoiding the computational and time cost of applying a local thresholding in the entire image. Evaluation results based on a collection of historical document images indicate that the proposed approach is effective in removing background noise and improving the quality of degraded documents while documents already in good condition are not affected.

Recognition/classification of objects and patterns independent of their position, size, orientation and other variations in geometry and colors has been the goal of much recent research. Image thresholding converts the gray level image in to binary one. The two binary levels may represent objects& background or more gerenelly to classes in an image. Pixels whose value exceeds the critical value are assignees to one category & the rest to other. The thresholding is global if the same critical value is used over the whole images. Many algorithms have been proposed for selecting the threshold appropriate for the given image. Some algorithms only used the histogram of value in the image. That is the no of pixels at each gray level. Global histogram based algorithms are the most commonly used despite the benefits that can accrue from using contextual information & allowing the threshold to vary over an image. They can simple understand & implement. Several groups of features have been used for this purpose, such as simple visual features (edges, contours, textures, etc.). The interpretation of images is still a complex problem and is primordial in lots of applications (spatial, military, industrial and medical). Since the beginning of the 80's, lots of research works have been achieved for the conception of vision systems in order to recognize objects in an image.

An essential stage concerns the strategy of object recognition because an object can appear at different places in the image or at different orientations and scales. Document images as a substitute for paper document main. It consists of common symbols as hand written or machine printed characters, symbols & graphics. In some application, we only need to keep the contents of the documents. So it is sufficient to represent the text &diagram in binary formats. It also makes further processing such as character recognition & feature extraction with shadows etc. Use of Bi-level information decreases the computational load &enables the utilization of the simplified analysis method compared to second level of gray scale & color image information.

II. METHODOLOGY

A. Intermean Method

Let I = gray level (0-255) & yi = no. of pixels with gray level I = height of level I in the histogram.

Three partial sums are calculated as :

Three partial sums are calculated as :

$$Ai \quad \sum_{I=0}^{j} yi$$

$$Bj \quad \sum_{I=0}^{j} (i * yi)$$

$$Cj \quad \sum_{I=0}^{j} (i * I * yi)$$

In this method t can be calculated as an integral part of Bn/An. This is an initial guess for t.

The mean gray levels in the two classes defined by the threshold below & above it are calculated as:

$$\mu t \quad Bt / At$$

$$\sqrt{t} = \frac{(Bn - Bt)}{(An - At)}$$

t is calculated as :

$$\sqrt{\ } \quad \mu \qquad \frac{(\mu t - \sqrt{t})}{2}$$

then & are recalculated & a new value of t is obtained. This process is repeated until convergence.

B. Minerror Method

In this method, histrogram can be viewed as an estimate of the probability density function p (g) of the mixture of the population comprising the gray levels of objects & background pixels.

P(g/I) = prob. Density function

Two components 1 – 1, 2

μi = mean of mixture

∂I= standard deviation

pi= a priori probability

Supposing gray level data is thresholding at T then:

$$Pi(T) = \sum_{g=a}^{b} h(g)$$

$$\mu i(T) = \sum_{g=a}^{b} g * h(g) / pi(T)$$

$$\&\partial i \ \& \ \partial i(T) = \left| \sum \{g - \mu i(T) * g - \mu i(T)\} * h(g) \right| / pi(T)$$

Where a = 0	i=0
T+1	i = 2
b = T	i –1
n	i – 2

C. Moment Preserving Threshold

Color image processing by using binary quaternion-moment-preserving thresholding technique. This paper presents a new moment-preserving thresholding technique, called the binary quaternion moment preserving (BQMP) thresholding, for color image data. Based on representing color data by the quaternions, the statistical parameters of color data can be expressed through the definition of quaternion moments. Analytical formulas of the BQMP thresholding can thus be determined by using the algebra of the quaternions. The computation time for the BQMP thresholding is of order of the data size. By using the BQMP thresholding, quaternion-moment-based operators are designed for the application of color image processing, such as color image compression, multiclass clustering of color data, and subpixel color edge detection. The experimental results show that the proposed operator for proposed edge operator can detect the color edge at the subpixel level. Therefore, the proposed BQMP thresholding can be used as a tool for color image processing.

Mathematical Calculations: Let p0 & p1 denote the fractions of the below & above threshold pixels in f respectively.

The first three moments of g are just:

$$Mi = \sum pj(zj)I \qquad i = 1,2,3 \ \mu$$

Zi= gray values & preserving the first three moments:

mi=mi I=1,2,3

p0+p1=1

After solving the above we get:

P0 is obtained & corresponding value of T is:

(1/n) Σ^{nj}p0

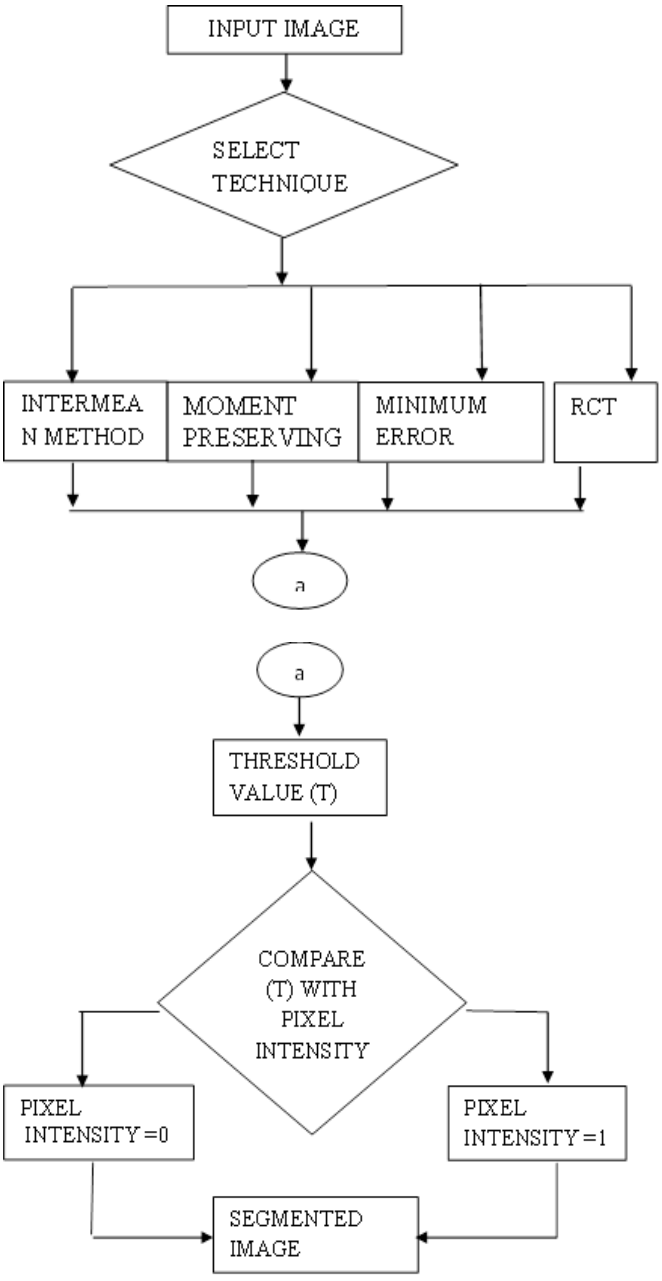
zj < 1

D. Otsu Method:

Otsu's method is used in computer vision to perform thresholding. If each pixel p of an image has been assigned an 'interest' score, f(p) then Otsu creates a histogram off over the image; and selects a threshold to maximize the between class variance. In statistics, a histogram is a graphical display of tabulated frequencies; a histogram is the graphical version of a table which shows what proportion of cases fall into each of several or many specified categories. The categories are usually specified as no overlapping intervals of some variable. The categories (bars) must be adjacent. The histogram is one of the seven basic tools of

quality control, which include the histogram. Pareto chart, check sheet, control chart, cause and effect diagram, flowchart and scatter diagram.

E. Flow Chart



III. RESULTS AND DISCUSSIONS

The propose work compare four algorithms which used to improvement the quality of degraded images using global threshold. The methods are Intermean method gives the result of improve the quality used threshold value 5.and Minerror method gives threshold value 8. and Moment preserving method improve the qualiy at threshold value 9. and last method Otsu method improve the quality at threshold value 12. Otsu's method is used in computer vision to perform thresholding. If each pixel p of an image has been assigned an 'interest' score, f(p) then Otsu creates a histogram off over the image; and selects a threshold to maximize the between-class variance. First, a global thresholding technique specifically designed for old document images is applied to the entire image. Then, the image areas that still contain background noise are detected and the same technique is reapplied to each area separately. Hence, we achieve better adaptability of the algorithm in cases where various kinds of noise coexist in different areas of the same image while avoiding the computational and time cost of applying a local thresholding in the entire image. Certain kinds of histograms, however, help decide an appropriate thresholding method that offers good result for that type of images.

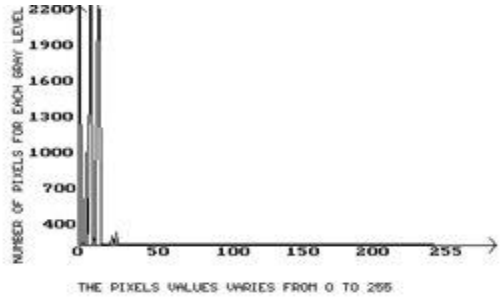
A. Intermean Method

Output 1

```
Enter the name of file with path and extension as BMP : c:\image1.bmp
open fileBM
size of image : 37526
 offset1: 0
offset_2: 0
offset start of image : 1078
offset of bmp header structure: 40
width is : 268
height is : 136
no of plane in image : 1
bytes per pixel : 8
```

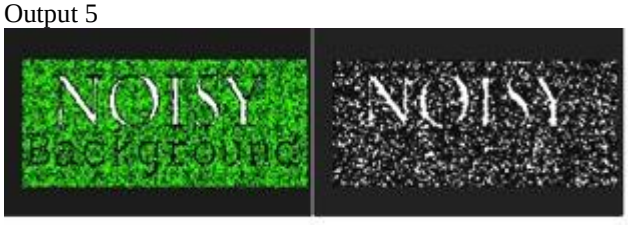
Output 2

Output 3



Output 4

Output 5



INPUT IMAGE OUTPUT IMAGE

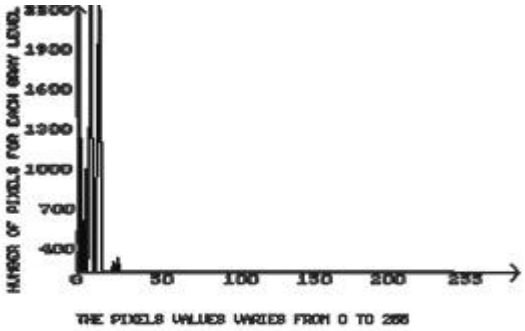
B. Moment Preserving Thresholding

Output 1

```
Enter the name of file with path and extension as BMP : c:\image1.bmp
open fileBM
size of image : 37526
 offset1: 0
offset_2: 0
offset start of image : 1078
offset of bmp header structure: 40
width is : 268
height is : 136
no of plane in image : 1
bytes per pixel : 8
```

Output 2

Output 3



Output 4

```
THE VALUE OF THRESHOLD IS : 9
```

Output 5

IV. CONCLUSIONS

The discussion of the various aspects has studies together to conclude which of these four algorithms considered is better the enhancement of the image. The algorithm used in this project solves the purpose of segmentation & enhance the quality of the image but different algorithms have different computational time. The user can use any of the algorithms depending on his ease to understand the concept. all the algorithms are applied on each part to increase its quality & in the output the gray level & the original image is shown with their respective histograms.otsu method best of blood images moment preserving best for noisy images.

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