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Piecewise Linear Transformation Function Using Histogram Processing for Image Enhancement

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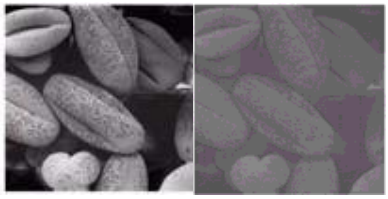
Abstract- Our goal is to enhance the images so that output is better than original image. We used digital image enhancement technique that offers choices for enhancing the vision of images. We will describe a summary of existing concepts with multiple algorithms for image enhancement. In this paper we emphases on many techniques such as Piecewise Linear Transformation Function, Histogram Equalization and Histogram Matching with Statistical approach that completely enhanced our images with good contrast and matching. We use local enhancement method to obtain the histogram of the image with various intensities. In this method we can easily compare pixel values of previous histogram to obtain new histogram. We are not getting good results with our previous techniques, so that we are proposing our new approach Piecewise Linear Transformation Using Histogram Processing. In this approach we are applying many functions randomly with histogram processing for contrast enhancement so that we achieve a good or enhanced image.

Keywords: DigitalImage processing, gray scale operation, image enhancement, Piecewise Linear Transformation Function, Histogram processing

I. INTRODUCTION

Image enhancement used to improve the picture or vision of information in images for observer and to provide better input for other image technique or method as Linear Transformation. We introduced a new technique or method as Linear Transformation function using Histogram Matching and Histogram Equalization for improving the contrast of images. We are proposing a new method Piecewise Linear Transformation function in which we can utilize arbirary user defined transformation rather than mathematical function. In Piecewise Linear Transformation we can explain user-defined functions randomly or systematically rather than mathematical functions.



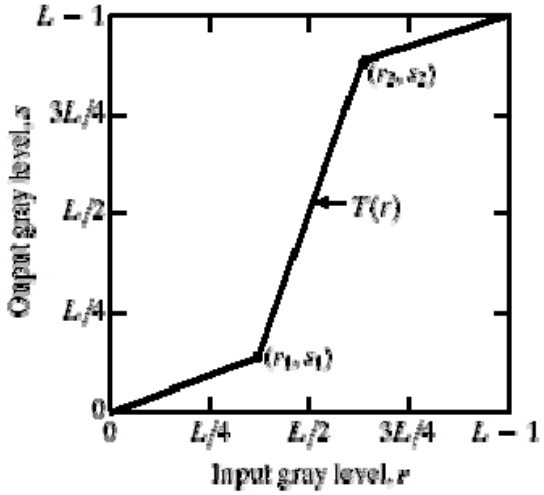


fig1. *The following image show addition of contrast to poor quality image by contrast stretching linear transform*

After proposing a Piecewise Linear Transform we introduced next two approaches as Histogram Equalization and Histogram Matching for good contrast of gray level images or digital images. We are adopting Histogram Processing using Piecewise Linear Transformation in which we use a discrete function that shows the Histogram of digital image with various pixels.

II. RELATED THEORIES

We described gray level function and image enhancement algorithms in this paper for modifying images to achieve the best or good contrast image.

Our goal is to select the best technique for image enhancement so that we can easily select a specific task, good content or information, observer characteristics and good conditions for an image viewer. We consider image segmentation or division as an extremely complex task in image processing. We found many difficulties in image segmentation such as:

1) absence of prior knowledge about the number of segments in the image. 2) Disparity of the gray scale value from one image to other image; 3) boundaries of imaging sensors.

We found uncertainties in an image analysis system. To overcome those uncertainties that may arises in image segmentation; we proposed a new method Piecewise Linear Transformation using Histogram Matching and Equalization for image enhancement. To increase the intensity level we introduced fuzzy models that are able to control the vagueness and sound in the images.

We classify fuzzy approaches into four types: separation via thresholding, separation via clustering, supervised separation, supervised and rule based separation. We proposed fuzzy set, membership functions and fuzziness measures that are helpful for better understanding about image segmentation. We described two types of fuzziness in our previous study to measure uncertainty: 1) imprecision between the objects. 2) Ambiguity between two or more substitute.

We discussed many fuzziness measures in previous paper but we don't get accuracy of images. We study many techniques for image enhancement such as Point Processing, Image Negative, Power-Law Transformations and Log Transformation but we were not fully satisfied with these techniques for image and contrast enhancement. To brightens or enhance the image we are proposing a new method Piecewise Linear Transformation using Histogram Processing in this paper.

Our New Method Piecewise Linear Transformations using Histogram gives you the important data or information related to good contrast of an image. We are explaining User-Defined Functions randomly or systematically for transformation of poor quality image into good contrast image.

He proposed a new fuzziness measure that generates relationship among fuzzy set and its complement.

III. OUR NEW APPROACH PIECEWISE LINEAR TRANSFORMATION FUNCTION USING HISTOGRAM PROCESSING

The Histogram of a digital image lies in the series [0, M-1] with a discrete function

$j(s_k) = o_k$

In this equation k^{th} is the intensity value and $o_k$is the number of pixels in the image with intensity s_k

We used pixels for the histogram normalization. We are assuming a U X V image as a normalized histogram or filtered histogram as shown below:

$P(s_k) = o_k/uv$, k=0, 1, M-1

Belongs to possibility or chance of $s_k$in the image. We are describing following methods of histogram processing in this paper:

i. Histogram Equalization

We are describing Histogram equalization [21] technique for improving the visually of images. We are introducing histogram equalization technique for skewedness towards the lower end of the grey scale and all the image detailiscompressedintothedarkendofthehistogram. We can easily produce a more uniformly distributed histogram for muchclearer image.

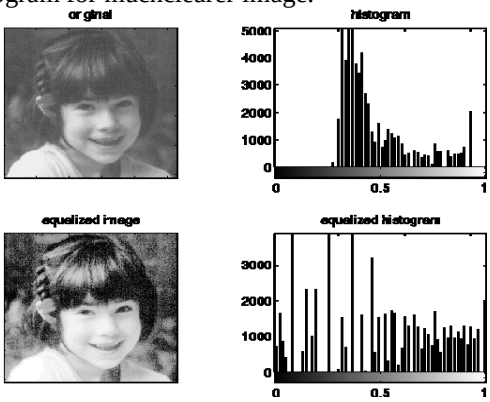


Fig2. *Comparison b/w Original image and its histogram with equal versions. Both images are quantized to 64 greylevels*

ii. Histogram Matching

We proposed a new method Piecewise Linear Transformation using Histogram Matching for improving the vision of images as well as produce a specified histogram image

1) that finds the histogram $P_s(s)$ of the image with equalization transformation as shown below:

$S = T(r) = (M-1) \int P_s(w)dw$ (1)

0

2) And use the particular $pdfp_z(s)$ to determine the following transformation function:
$H(w) = (M-1) \int P_z(t)\, d\, t = s$ (2)

3) Locate the inverse transformation as shown below
$W = H^{-1}[T(r)] = G^{-1}(s)$ (3)

We can achieve the Output image by equalizing the input image first, and then we can implement the inverse mapping to get the pixel of the output image. Though a Histogram Matching technique we can easily match then distribution of gray scale from one image to another image.

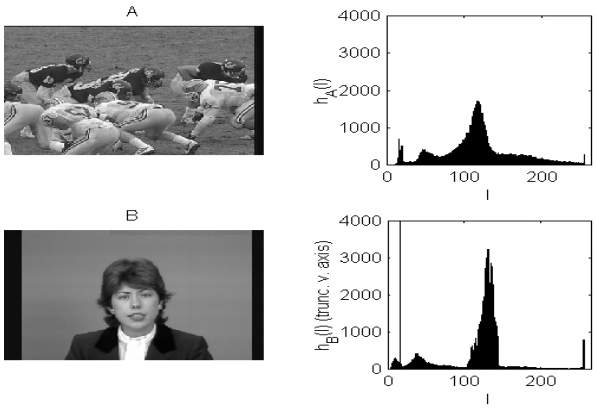


Fig3. *Screening of histogram matching with various images*

iii. Local Enhancement

We are not getting completely enhanced results with histogram equalization and matching, so that we are proposing a new approach Piecewise Linear Transformation using histogram statistics for getting a good image.

iv. Use of Histogram Statistics for Image Enhancement

To overcome the limitations in our previous techniques we are introducing a new method Histogram Statistics that defines the image with distinct intensity value who signifies a discrete r rv r in [0, M-1]. We used a normalized histogram for obtaining a pdf with intensity.
We take the n^{th}Statistical moment that is

$$\mu_s(r) = \sum_{i=0}^{M-1} (r_i - m)^n p(r_i)$$

For a sample mean for image intensities:

$$\mathbf{M = 1/ST \sum_{X=0}^{S-1} \sum_{y=0}^{T-1} f(x,y)}$$

And sample variance:

$$\mathbf{Б^2 = 1/ST \sum_{X=0}^{S-1} \sum_{y=0}^{T-1} [f(x, y) - m]^2}$$

We may identify global and local mean for the entire image and for a sub-image

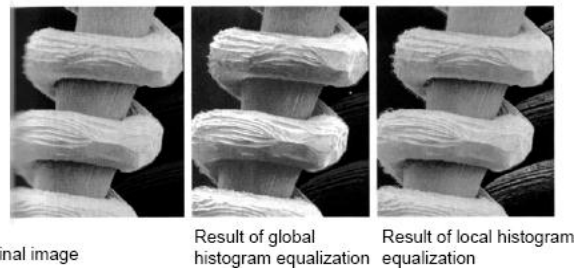


Fig4. *Showing example of using histogram statistics for image enhancement*

IV. RESULTS

We can easily judge the efficiency of our proposed method with the help of a number of tested images, but due to limitations in our previous techniques, we are proposing a new method Piecewise Linear Transformation function using Histogram processing that definitely gives the accurate image.

In this paper we are introducing two main approaches of Histogram Processing as Histogram Equalization and Matching that improves the vision of images as well as produces an old image with uniform histogram.

We are defining another specific method Histogram matching that makes a image with a specified histogram.

We can enhance the images with our proposed method. Piecewise Linear Transformation using Histogram processing is an effective and efficient tool for image enhancement. In this paper, we suggested new approach histogram equalization and matching with statistical approach for image enhancement with different intensity levels.

To overcome the limitations in our previous techniques, we introduced a new approach histogram statistics for image enhancement that shows the image with various intensity values for getting a good result with good contrast.

V. CONCLUSION AND FUTURE WORK

We concluded that many image enhancement techniques suggested a broad selection of approaches for amending images to get a suitable image.

We can define multiple features of images in our technique such as image information or data, certain task, viewer's descriptions and conditions.

We are not fully satisfied with our previous techniques, so that we are proposing a new method Piecewise Linear Transformation function using Histogram processing for getting good results.

We are introducing this new method to overcome the limitations and shortcomings in our previous techniques.

In this paper we concluded that our previous techniques such as Image Negative, gray level slicing, Power-Laws Transformations and Log Transformations used only for improving the contrast of gray level image with higher intensity Value. But for getting a more refined image, we proposed a new technique histogram processing that display the histogram of an image with gray level frequencies.

We indicated the histogram of an image with relevant data that shows the good contrast of an image.

We are introducing two types of Histogram Processing as Local Histogram equalization and Global Histogram equalization that may identify global and local mean for the entire image and sub image.

We suggested that only the global histogram equalization may be done fully automatically.

We are not getting good results when we applied previous techniques separately, but we can achieve a good result with combination of our proposed methods. We can attain or reach more efficient and effective image with the help of this new technique.

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