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Enhancement of Image Using SMQT Technique

S.Krishnaveni, Jyothi Aitha, M. Veda Chary

S.Krishnaveni, CMRCET,ECE, Hyderabad, Telangana, India.(Email: skveni1231@gmail.com)
Jyothi Aitha, CMRCET,ECE, Hyderabad, Telangana, India.(Email: jyothi426@gmail.com)
M. Veda Chary, CMRCET,ECE, Hyderabad, Telangana, India.(Email: mvedachary@cmrcet.org).

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Abstract:
Successive Mean Quantization Transform (SMQT) is a technique used to increase the appearance of the image and compared the resultant parameters by using Contrast Limited Adaptive Histogram Equalization (CLAHE). For human watchers and for computerized image processing techniques, the image improvement will provide the interpretability or observation of data in images. Attributes of a picture should be modified to enhance the image, which is the main function in image processing. The Successive Mean Quantization Transform (SMQT) is a simple and efficient method to provide good quality of image by eliminating the properties like gain and bias of the image. SMQT technique have three following steps where first is it determine the mean of the image, second is quantizing the pixel values i.e. rounded to the nearest quantization level and third is it splits the image into two subsets. The obtained results are observed that there is good quality and Peak signal to quantization noise ratio (PSNR) in image as compared to existing method CLAHE.

Keywords: *SMQT, CLAHE, PSNR.*

I. INTRODUCTION

Digital Image Processing is more probable to be associated with computer era growth. Digital images require much more storage and computational energy, the use of computers and technological techniques to meet this necessity is crucial.

There are concurrent developments in space apps in the course of the few decades for various digital image processing methods have also begun to develop in various areas such as medicine, biology, geology or astronomy.

Due to technological developments in latest years, digital image processing has become crucial in order to solve issues in different apps and devices in order to achieve an optimal solution, the customer requires to know and comprehend the significance of the issue and should effectively apply the instrument available on the market. Overcome the technological obstacle and face the challenges of perceiving the paperwork that allows fresh consumers to know the functioning of digital image processing programs and method. People are giving more and more importance to color images rather than gray scale images because technology developing in a rapid fashion and the images which are captured may not be completely satisfactory for the user.

Image enhancement places a major role, to get pleasant appearance and involve human eye perception regarding any color image. Image enhancement is primarily aimed at improving image quality. Image enhancement has a range of methods that make the picture a more suitable form for human or machine assessment.

In general, there is currently no combination of image enhancement hypotheses on the basis that there is no wide image quality standard that can be seen as structural requirements for image enhancement processors.

An image is defined as a two-dimensional function f(x,y), where x and y are spatial

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coordinates at any pair of coordinates(x,y), the amplitude of the image at that coordinate point is defined as intensity or gray scale level. Where x, y co-ordinates and f amplitude values all have finite values, then we call the image a digital image, discrete quantites. Every element in a digital image has a specific location and value that is building blocks of any digital image.

As picture components, image components or pixels, these fundamental construction blocks are called pixels are the most frequently used word for the digital image components. Digital image process a two-dimensional picture in to a digital format.

Digital images are the input and output of digital image processing systems. These input and outputs are consists of an array of real and complex numbers represented by a finite number of bits. Digital image analysis is linked to digital image content description and recognition. Its input is a digital picture and its output is a description of a symbolic picture

II. CLAHE (CONTRAST LIMITED ADAPTIVE HISTOGRAM EQUALIZATION)

Customary AHE tends to over enhance the complexity in close consistent districts of the picture, since the histogram in such areas is exceedingly thought. Thus, AHE may make commotion be intensified in close steady districts. Differentiation Limited AHE (CLAHE) is a variation of versatile histogram leveling in which the difference intensification is restricted, to lessen this issue of clamor enhancement.

III. SUCCESIVE MEAN QUANTIZATION TRANSFORM (SMQT)

Unlike Histogram equalization technique to get the benefit of dynamic range of samples we use a algorithmic technique called SMQT (Successive Mean Quantization Transform).

The great difference between sensors because of gain and bias can be removed by using SMQT technique. For any predefined data with arbitrary dimension can be represented by using elaborated structure of SMQT. Eight level SMQT gives best results for eight bit image. The MQU (Mean Quantization unit) is the basic unit of SMQT, it contains mean computing module. The mean obtained from MQT can be utilized to quantize the data either in 0 or 1. From which we obtain two different data.

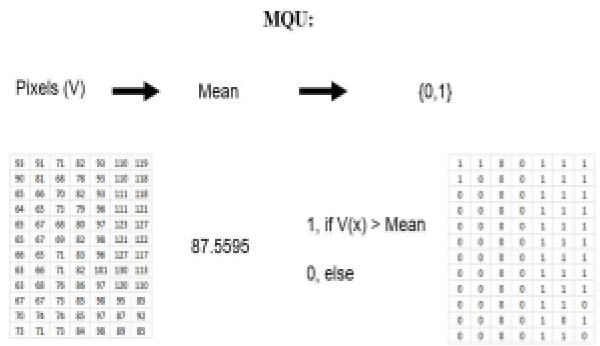

Fig 1: MQU operation

Recursive MQU operations (tree) are considered as SMQT. Hence current level of the tree effects the weight where weight is W.

Weight(W) = 2K-I

Where K is the total number of levels and I is the current level

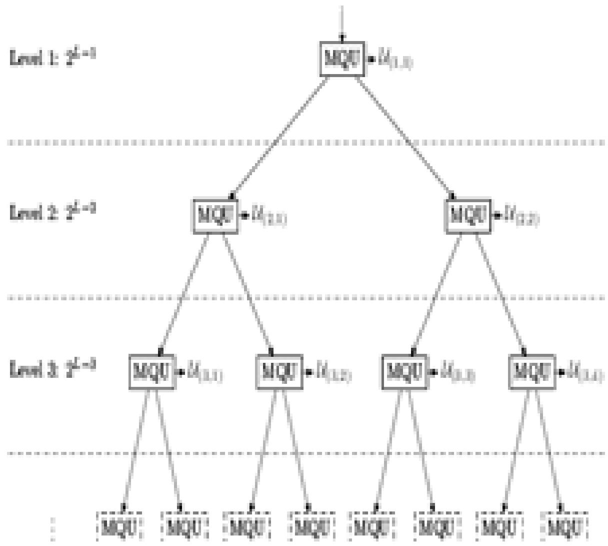

Fig 2: SMQT TREE

There are two different ways to apply SMQT method.

Method1: It can be applied to RGB channels which can be three. Regardless of channel the data values are denoted as PRGB(x). Then

SMQTL: PRGB(x)   SMRGB(x)

Contrast enhancement is observed in nonlinear manner. Hence array of RGB values for every pixel can be retained with dynamic change in distance between red, green and blue.

Method 2: It can be applied individually in every channel. The data values of RGB channels are PR(x), PG(x) and PB(x) respectively, then

SMQTL: PR(x)   SMR(x)
SMQTL: PG(x)   SMG(x)
SMQTL: PB(x)   SMB(x)

Finally concatenating the channels SMR(x), SMG(x) and SMB(x) results in enriched pixels set SMRGB(x). Hence order of RGB values can be neglected as contrast enhancement is done in nonlinear manner. Which can be explained with an example for an image, this technique reduces influence of heavily biased colors. This technique is more suitable for color correction of images. It can generate artificial color correction which amplifies original color and minimizes color saturations.

Fig 3: SMQT Operation on color image

IV. IMPLEMEMTATION

4.1 Block diagram for SMQT technique:

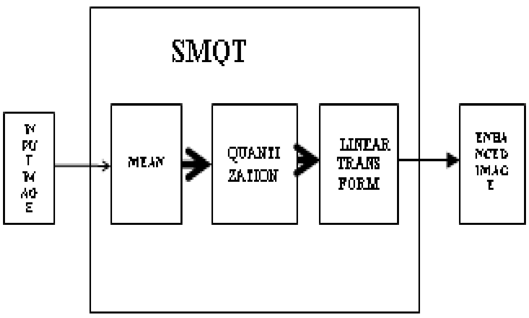

Fig: 4 Block diagram for SMQT technique

The input is read and is converted into HSV format so that enhancement can be done easily on colour image instead of splitting complete image into red, blue, green components working on each plane and then concatenating. The HSV output is as follows.

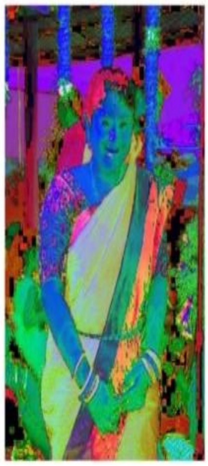

Fig: 5 RGB image converted to HSV format

Later extract intensity component from the image and then perform Successive Mean Quantization Transform by splitting the matrix into intervals. By this the brightness and contrast parameters of images get changed and finally enhanced output is obtained. The resultant output is displayed below.

Fig: 6 Enhanced output after applying SMQT

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Flow chart for SMQT

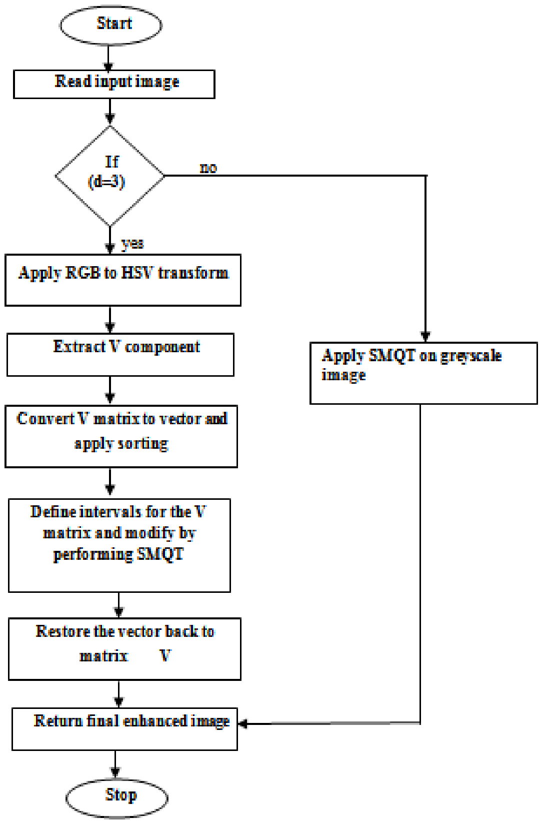

Fig: 7 Flowchart for SMQT technique

V RESULTS

Fig: 8 Input image and enhanced image after CLAHE

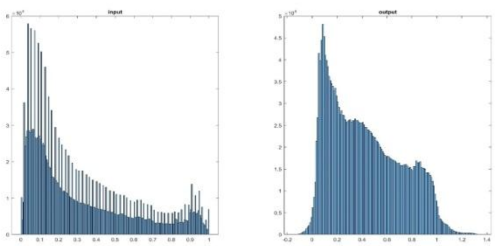

Fig: 9 Histogram plots of input and output images in case of CLAHE

Fig: 10 Input and output images after SMQT

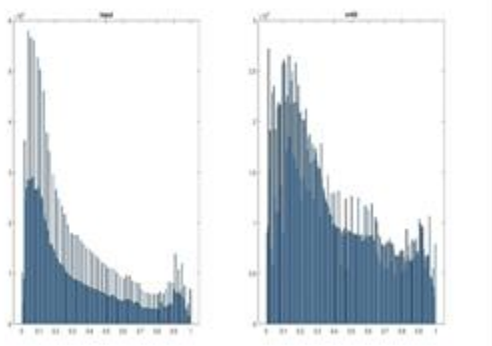

Fig: 11 Histogram plot for input and output images in case of SMQT

5.1 Comparison between CLAHE and SMQT:

5.1.1 Peak Signal to Noise Ratio (PSNR):

The ratio between the total power of the signal and total power of the quantization noise. It is defined as

PSNR = 10log10 $(2b-1)2MSE$ dB

Where b is the bitrate per pixel (bpp) of the actual image.

MSE is the mean square Error.

PSNR is the Peak signal to quantization noise ratio.

5.1.2 Maximum Absolute Error (MAE):

Absolute error is calculated by using the given equation

MAE=max (abs $((m,)-p(m,n))$)

Where l(m,n) is the input image and p(m,n) is the final image.

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5.1.3 Mean Square Error (MSE):

It returns square and mean of difference between input and output image.

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2.$$

5.1.4 Root Mean Square Error (RMSE):

Square root of MSE gives root mean square

RMSE=Sqrt (MSE)

image	MSE		RMSE		PSNR		MAE	
Sumaja. jpg	CLAHE	SMQT	CLAH E	SMQT	CLAHE	SMQT	CLAHE	SMQT
	0.0322	0.010	0.1793	0.104	63.09	67.80	0.606	0.173
	0.0277	0.008	0.1662	0.090	63.74	69.02		
	0.0268	0.008	0.1637	0.091	63.88	68.98		

Table 1: Comparison between CLAHE and SMQT using different parameters

VI.CONCLUSION

The contrast limited adaptive Histogram equalization is less suitable for enhancing the color images and its result shows unusual colors. On other our technique is SMQT which gives rich visual results for color images. Contrast and colors of the image enhanced using the SMQT

Comparing with the CLAHE technique, the SMQT method is best for images having a high brightness.The best results are obtained by using SMQT. The high accuracy and good performance can be achived by using this technique. Computational power requirement is very low in this.Finally, it is concluded that SMQT technique is better by comparing all its respective parameters.

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AUTHORS PROFILE

S.Krishnaveni, received her M. Tech degree in Systems & Signal Processing from JNTUH, Hyderabad, currently working as an Assistant Professor, ECE in CMR College of Engineering& Technology, Hyderabad.

JyothiAitha, received her M. Tech degree in Electronics & Communication Engineering from JNTU, Hyderabad, currently working as an Assistant Professor, ECE in CMR College of Engineering & Technology, Hyderabad.

M. Veda Chary received his M. Tech degree in Electronics & Communication Engineering from JNTU, Hyderabad, currently working as an Associate Professor, ECE in CMR College of Engineering & Technology, Hyderabad.