Image Enhancement Based on Transform Wavelet Coefficient by Histogram Shifting and Shaping

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***Abstract*-- In this paper a new method of image enhancement is proposed. This method combines two very popular techniques of enhancement, Wavelet decomposition and histogram shaping & shifting. We will use this method for enhancement of commercial images as well as natural images. In this algorithm, a original image (gray scale and colour image) is first decomposed in its wavelet coefficients. Then these coefficients filtered by global thresholding. This threshold is calculated by histogram shaping & shifting method with the variable value of coefficient K. Inverse wavelet transform of filtered and modified coefficients of image give the reconstruction of original image. With this algorithm, a new and efficient algorithm for reshaping of histogram that is capable in enhancing local details as well as properly preserving the image brightness is presented. In this paper, we show that a modified version of the measurement of enhancement by entropy (EME) can be used as an image similarity measure, and thus an image quality measure. Until now, EME has generally been used to measure the level of enhancement obtained using a given enhancement algorithm and enhancement parameter. In terms of EME values, this combination will produces better results.**

Index Terms-Transform Histogram, Contrast Entropy, Image Enhancement, Contrast Measure, Discrete wavelet transform , Equalizer.

I. INTRODUCTION

Contrast Enhancement is a common operation in image processing which enhances human perception of details hidden in the scene and also improves the rapid recognition of interested targets. It makes various contents of images easily distinguishable through suitable increase in contrast. Histogram equalization effectively spreads out the most frequent intensity Values, which results in a better distribution on the histogram . Contrast shaping methods are the most popular methods used in the consumer electronics industry. Histogram modelling techniques provide sophisticated methods for modifying the dynamic range and contrast of an image by altering each individual pixel such that its intensity histogram assumes a desired shape. The goal of research in objective image quality assessment is to develop quantitative measures that can automatically predict perceived image quality. An objective image quality metric can play a variety of roles in image processing applications and calculate the rate of information of enhancement image quickly.

II. PARAMETER MEASURED

In order to test the proposed method, Simulation using MATLAB 7.7.0 (R2008b) are performed on input images. To evaluate the image enhancement performance, EME used as the criterion.

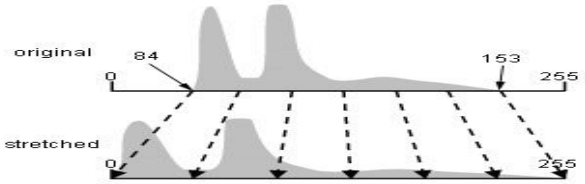
EME:-Measure of Enhancement Higher the value of EME denotes a higher contrast and information clarity in the image.

$$EME = \frac{1}{K_1 K_2} \sum_{l=1}^{K_2} \sum_{k=1}^{K_2} \frac{I_{max}(k,l)}{I_{min}(k,l)} \log \frac{I_{max}(k,l)}{I_{min}(k,l)}$$

III. PROPOSED WORK

A. *Histogram Shaping*

A histogram is a graphical representation of the brightness values that comprise an image. The brightness values (i.e. 0-255) are displayed along the x-axis of the graph. The frequency of occurrence of each of these values in the image is shown on the y-axis. The exact histogram specification is based on ordering among image pixels by calculation of local mean values for contrast enhancement.



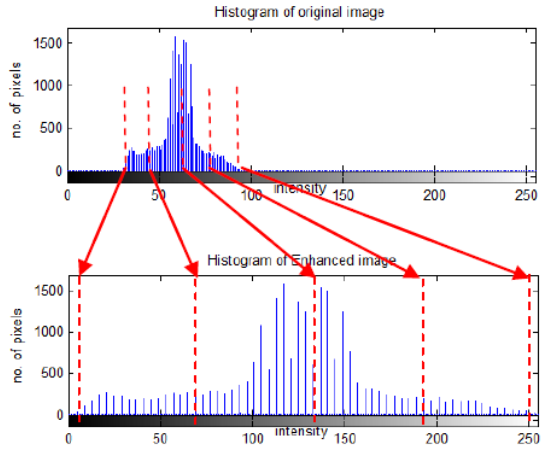


Fig 1. Setup for proposed histogram reshaping

B. Block diagram

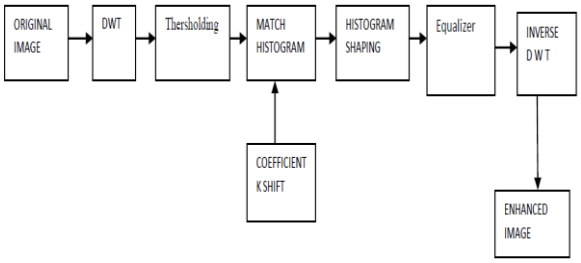


Fig 2. Proposed block diagram

C. Proposed Algorithm

The following steps are used in this algorithm:
Step 1: Load an original image in Matlab.
Step 2: Plot histogram of the original image.
Step 3: Calculate minimum and maximum value of the frequency component in the histogram
Step 4: Wavelet decomposition of load image .
Step 5: Plot LL, LH, HL, HH Histograms.
Step 6: plot LL orig+ shifted, **LH** orig+ shifted,HL orig+ shifted, HH orig+ shifted Histograms
Step 7: Take Enhanced image, if it is not met go to step 3.
Step 8: Calculate the EME of the original image.
Step 9: Calculate EME of the enhanced image.
One of the standard methods for image enhancement is histogram equalization. Histogram equalization is similar to the stretching operation. However, instead of utilizing the entire dynamic range, the goal of histogram equalization is to obtain a flat histogram. This is motivated by information theory, where it is known that a uniform probability density function (pdf) contains the largest amount of information.

IV. Simulation & Result Discussion

We have tested proposed method on various types of images.

Fig 3. original images- a) Building b) Rock c) Seed

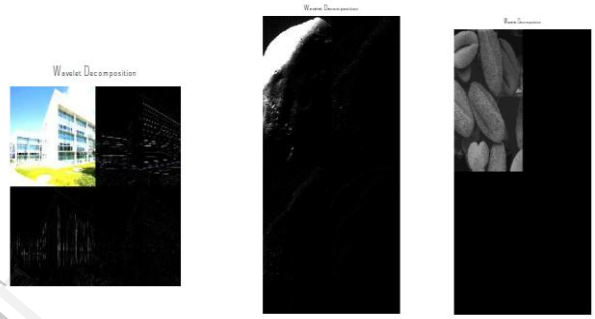


Fig 4. Wavelet Decompostion of a,b,c images respectively

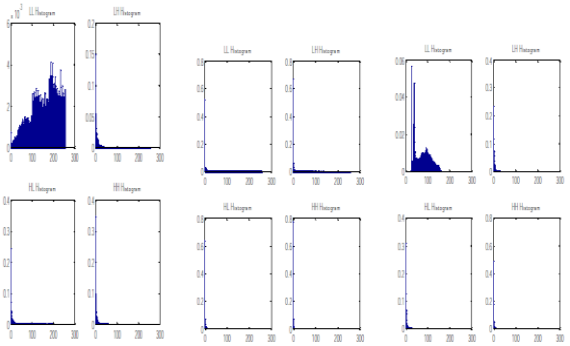


Fig 5. LL,LH,HL,HH histograms of images a,b,c respectively.

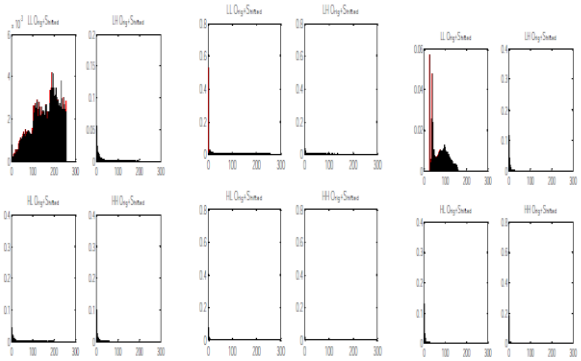


Fig 6. LL,LH,HL,HH's orig + shifted histograms of images a,b,c respectively.

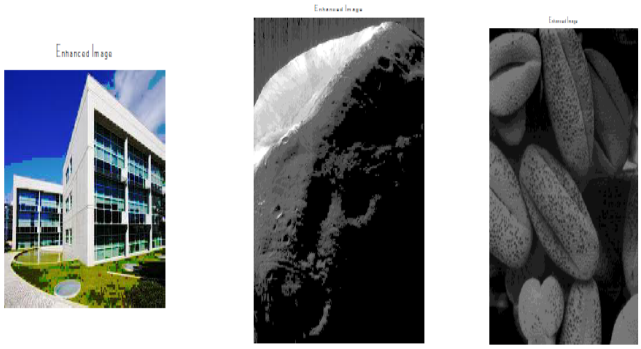


Fig 7. Enhanced version of loaded original images .

Images	***Building***	***Rock***	***Seed***
E M E	7.5837	4.1406	6.6926

V. CONCLUSION-

It is concluded from the paper that Wavelet de composition by histogram shaping & shifting method has better contrast enhancement. The final result shows the good visual quality without any inconvenient wash-out effect. It also increases the value of measurement of enhancement entropy (E M E). This work shows the comparison for different images over EME parameters. The dynamic range of the image is much improved after proposed method and the details hidden in the original image are enhanced. Transform histogram shaping is the best method presented in this paper.

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