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Comparison Of Different Image Enhancement Algorithms

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Abstract **-** This project proposes different enhancement algorithms for blur images. It is useful to apply image enhancement methods to increase visual quality of the images as well as enhance interpretability and visibility. An Empirical Mode Decomposition (EMD) based blur image enhancement algorithm is presented for this purpose. EMD is a signal decomposition technique which is particularly suitable for the analysis of non-stationery and non-linear data.

An Empirical Mode Decomposition (EMD) based blur image enhancement algorithm is presented for this purpose. EMD is a signal decomposition technique which is particularly suitable for the analysis of non-stationery and non-linear data. In EMD, initially each spectral component of an blur image is decomposed into Intrinsic Mode Functions (IMFs) using EMD. The lower order IMFs capture fast oscillation modes (high spatial frequencies in images) while higher order IMFs typically represent slow spatial oscillation modes (low spatial frequencies in images).Then the enhanced image is constructed by combining the IMFs of spectral channels with different weights in order to obtain an enhanced image with increased visual quality. The weight estimation process is carried out automatically using a genetic algorithm that computes the weights of IMFs so as to optimize the sum of the entropy and average gradient of the reconstructed image**.**

Keywords **-** Image Enhancement, Contrast Stretching, Histogram Equalizations, IMF, Sharpening image. Empirical Mode Decomposition**.**

I. INTRODUCTION

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. For example, you can remove noise, sharpen, or brighten an image, making it easier to identify key features.

Image enhancements techniques are used to make images lighter or darker, or to increase or decrease contrast, or to remove undesired characteristics of an image such as color cast. The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques.

Low contrast is reduces the visual quality of digital images. This affects the clarity of resulting printouts, and further processing of these images. Presently, several software tools used in research and scientific laboratories as well as in industry are used to filter out the undesired characteristics. Most existing software tools used for image enhancement are semi automated; however, these tools are applied to normal images, and are not suitable for underwater images. They do not always work as expected with underwater images and videos. Learning to manipulate the color in underwater images and videos through computer editing software requires patience and expertise.

Physics based approaches are not suitable for color correction. In order to address issues, it is important to develop an image enhancement technique that can improve the quality of the underwater images by reducing color cast and improving the contrast.

Earlier enhancement algorithm has restricted visibility, it gives clear image upto 20 meters from viewer, in order to overcome this drawback proposed algorithm is used.It is used to improve image quality, compensate attenuation effects, enhance contrast, adjust colors, suppress noise and blur from the images.

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II. LITERATURE SURVEY

EMD has been proposed by Huang as a non-linear and non-stationary time frequency data analysis method. In EMD main process is to perform shift operation on the original data series until the final series are stationary, and thereby decompose the entire signal into several intrinsic mode function and residue.

EMD is a signal decomposition technique in which spectral component of an blur image is decomposed into IMFs. Then enhanced image is constructed by combining the IMFs [1]. The weight estimation process is carried out automatically using a genetic algorithm that computes the weight of IMFs so as to optimize entropy and average gradient of the reconstructed image [1].

Histogram Equalizations methods preserve the input brightness on the output image with a significant contrast enhancement, they may produce images with do not look as natural as the input ones. The basic idea of Histogram Equalizations method is to re-map the gray levels of an image [2].

Contrast stretching often called normalization is a simple image enhancement technique that attempts to improve the contrast in an image by 'stretching' the range of intensity values [3].

III. PROBLEM DEFINITION

The aim is to analyze the performance of three different enhancement algorithms. This project proposes different enhancement algorithms for blur images. It is useful to apply image enhancement methods to increase visual quality of the images as well as enhance interpretability and visibility. An Empirical Mode Decomposition (EMD) based blur image enhancement algorithm is presented for this purpose.

There are three algorithm for this proposed system.

1. Contrast Stretching
2. Histogram Equalization
3. EMD

- **Contrast stretching** algorithm enhances the image by adding contrast to that image and improving that intensity value of pixel.
- **Histogram Equalization** algorithm enhance that by using gray level image enhancement and it makes dark image portion as darken more and light portion of that image as light.
- **Genetic algorithm** enhances the image by optimizing the intensity value and entropy value of the image.

IV. PROPOSED SOLUTION

The objective of proposed work is to improve image quality of degraded image or blurred images. In this proposed system different image enhancement algorithms is combined to implement performance and analysis of different image enhancement algorithms. Existing image enhancement system was unable to perform different algorithms individually in the same application but in this proposed system different image enhancement algorithms is performed individually. Performance of all the algorithms is performed in single GUI window and also analyzed the result of image enhancement using graph.

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Algorithm

Proposed system having different algorithms to make enhancement of the image. Different enhancement algorithm is applied to improve the image quality of degraded or blurred images.

1. **Contrast Stretching:** Contrast stretching is one of the image enhancement technique that attempts to improve the contrast in an image by stretching the range of the intensity values. It contains to span a desired range of values. The full range of pixel values that the image type concerned allows Contrast Stretching changes the distribution and range of digital numbers assigned to each pixel in an image.

- **Global Contrast Stretching**: Meanwhile, global contrast stretching will consider all color palate range at once to determine the maximum and minimum for all RGB color image. The combination of RGB color will give only one value for maximum and minimum for RGB color. This maximum and minimum value will be used for contrast stretching process.
- **Partial Contrast Stretching**: Partial contrast is a linear mapping function that is used to increase the contrast level and brightness level of the image. The technique is based on the original brightness and contrast level of the images to be adjusted. First the system will find the range of where the majority input pixels converge for each color space. Since the input image is in RGB color space, so it is necessary to find the pixels range between the red, blue and green intensities. Then, the average of these three color space will be calculated to obtain the upper and lower color values by using the following formula

$$maxTH = (maxRed + maxBlue + maxGreen)/3$$

$$minTH = (minRed + minBlue + minGreen)/3$$

maxRed, maxBlue and maxGreen are the maximum color level while minRed, minBlue and minGreen are the minimum color level for each color palette respectively. maxTH and minTH are the average number of maximum and minimum RGB color space. maxTH and minTH will be used as the desired color ranges for all the three color palettes. Next is to start with the mapping process. The mapping function is as follows

$$P_k = \frac{(max - min)}{(fmax - fmin)}(q_k - fmin) + min$$

Where,

P_K : Color level of the output pixel

qk : Color level of the input pixel

fmin: Maximum color level values in the input image

fmax : Minimum color level values in the input image

min : Desired minimum color levels in the output image

max : Desired maximum color levels in the output image

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2. **Histogram Equalization:** Histogram function is defined overall possible intensity level, for each intensity level its value is equal to the number of pixel with that intensity.

The histogram of digital image with gray levels from 0 to L-1 is a discrete function $h(r_k) = n_k$.

Where:

rk is the kth gray level

nk is the number of pixels in the image with that gray level

n is the total number of pixels in the image

k = 0, 1, 2, …, L-1

- **Normalised Histogram Function**

  The normalised histogram function is the histogram function divided by the total number of the pixels of the image:

  $$p(r_k) = h(r_k)/n$$

  It gives a measure of how likely is for a pixel to have a certain Intensity. That is, it gives the probability of occurrence the intensity.

- **Histogram Equalisation**

  Histogram Equalization Algorithm: Let be the intensities of the image, and let be its normalised histogram function.

  The intensity transformation function for histogram equalisation is

  $$T(i_k) = \sum_{J=1}^{K} p(r_k)$$

  That is, we add the values of the normalised histogram function from 1 to k to find where the intensity will be mapped. The range of the equalised image is the interval [0,1].

3. **Empirical Mode Decomposition (EMD)**: Image will be enhancing with the help of decomposition and genetic algorithm.

A. **Decomposition:**-The decomposition procedure of 2D-EMD is as follows:

1. Find all points of 2D local maxima and all points of 2D local minima of $\mathbf{input_{IK}(i, j)}$.
2. Produce the upper envelope $\mathbf{(e_{max}(i, j))}$ by 2D spline interpolation of local maxima and the lower envelope $\mathbf{(e_{min}(i, j))}$ by 2D spline interpolation of local minima.
3. Compute the mean of the upper and lower envelopes:

   $\mathbf{e\_mean_{IK}(i,j) = (e_{max}(i, j)+ e_{min}(i, j))/2.}$

4. Subtract the envelope mean from the input signal:

$h_{IK}(i,j) = input_{IK}(i, j)- e\_mean_{IK}(i,j)$

5. Compute the stopping criterion as $\mathbf{Eps}=\frac{\sum_{i=0}^{H}\sum_{j=0}^{W}|e\_meanIK(i,j)|}{H*W}$

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Where, H and W show the dimensions of the image.

Check if the envelope mean satisfies the iteration stop criterion for the current IMF. If the stop criterion for the current IMF falls below a small threshold such that eps< τ, where τ is a small threshold, the sifting process is stopped for the current IMF (assume at step k = K), and the current IMF is obtained as $IMF_l(i, j) = h_{lK}(i,j)$ .If the stop criterion is not met, the next iteration is started with $input_{l(k+1)}(i, j) = h_{lk}(i, j)$ and this process is repeated from step 1 to find the current IMF.

6. If the current IMF is obtained successfully, the residue signal $R_l(i, j)$ is computed as **$R_l(i, j) = input_{l1}(i, j) - IMF_l(i, j)$.** If the residue does not contain any more extreme points the EMD decomposition process is terminated.Otherwise the next IMF is computed from step 1 using the residue as input i.e. $Input_{(i+1),1}(i, j) = R_l(i, j)$

V. RESULT ANALYSIS

1. After performing enhancement algorithms on image resulted image will be generated.

2. Experimental result will be calculate by considering entropy and average gradient values together.

3.For deciding better result the visual performance of all three algorithms will be consider which is calculated by average gradient and entropy.

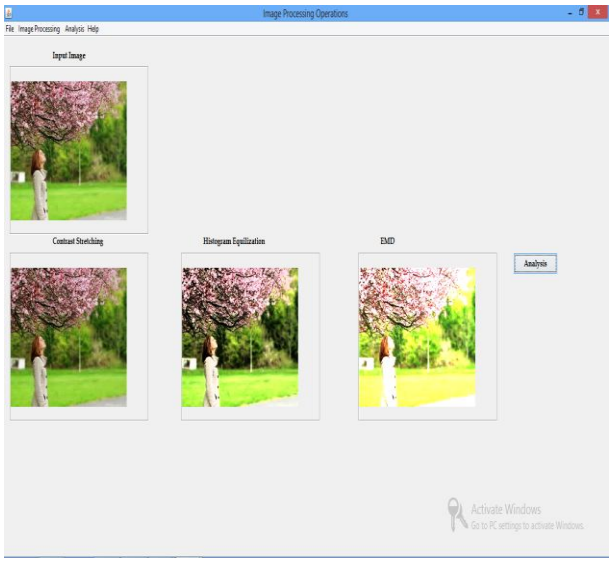

Fig. (a). Analysis Of Algorithm

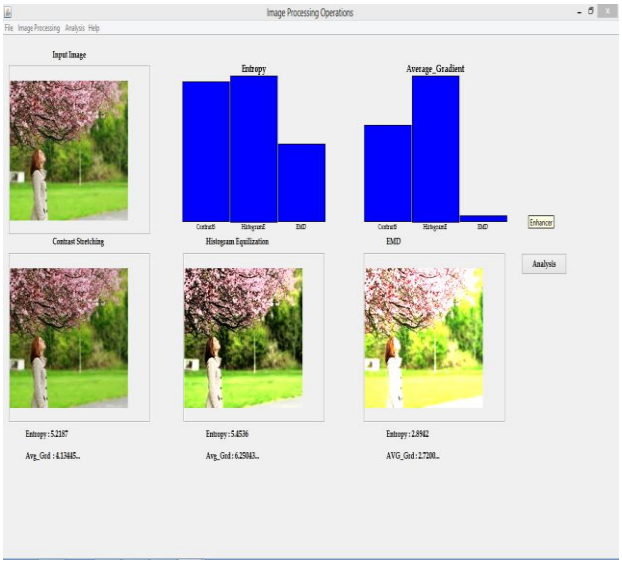

Fig. (b). Representation of Entropy & Average Gradient.

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VI. CONCLUSION

In this paper, we have discussed Blur images can be of poor quality due to limited range of light, low contrast. We have proposed an Empirical Mode Decomposition (EMD) based enhancement method for blur images. The proposed approach efficiently removes the bluish colour cast and improves the contrast. It also improves the visual quality of an image.. In order to evaluate the performance of the proposed method, we compared our results with the existing methods, Histogram Equalization and Contrast Stretching. This algorithm is used to enhance the low quality image using the different image enhancement algorithm. There is constraint in this application that image should be blur, less pixel or degraded quality image. Image must be inserted before processing the image. Proper option of image processing is to be selected. Assumption is that consider image as input then do processing on that image. Application will give some approximate result for the input image as enhancement image using different algorithms.

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