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Image Enhancement Using Local Window Histogram Equalization Using Gaussian Filter

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Abstract: **— in this paper we propose a methodology in image enhancement that is based on local window histogram equalization using Gaussian filter that enhances the image in much better way as compared to other techniques that were previously used. Here we are using a local window that allows us to change the window size as suitable to make the image much better in contrast as well as to retain its naturalness, here we use a Gaussian filter that removes the noise from the image and makes it quality much better. We compare this method with various other techniques that were previously used.**

***Keywords*— image enhancement, Gaussian filter, histogram equalization, local window HE**

I. INTRODUCTION

Image processing is a technique to enhance the images that are captured through cameras, sensors that are placed on satellites, day to day taken pictures etc. The purpose of image processing is to produce an improved version of the input image by performing various operations on it. Now days, image processing has become an important technique in various fields related to Remote Sensing, military applications, graphic industry, medical science, forensics etc. Basically in terms of computer graphics, image enhancement is the process of improving the quality of an image that is stored digitally by altering the image with some software tool. For example, making an image lighter or darker, or increasing or decreasing its contrast etc.

The main aim of image enhancement is to improve the information present in the images, or to provide a better quality of image that was given as an input. Various other histogram equalization methods suggested earlier does not enhance the image with proper contrast as well as noise ratio is greater. Image processing have become a very important concept in various applications related to medical industry, military, forensics etc. So to enhance an image with better contrast and lower noise has become an objective [1].

The method we want to suggest is based on histogram equalization that uses Gaussian model to enhance an image with lower noise and better quality as compared to other algorithms that were previously used.

II. RELATED WORK

As discussed in the previous sections Histogram Equalization is the common method to enhance the image. Histogram Equalization can be performed in two ways Local Histogram Equalization (LHE) and Global Histogram Equalization (GHE) [2].

In the Global Histogram Equalization the histogram function enhances the contrast of the whole image and gives the image an unnatural view and the high frequency components are stretched and low frequency components are compressed.

This makes the view of the image sometimes unnatural. This HE cannot enhance the image locally so to overcome this problem Local Histogram Equalization was proposed. Local Histogram Equalization enhances the image locally so that the image is contrasted in a proportionate way. Further generalizations of these techniques have been proposed that we will discuss here.

Adaptive histogram equalization (AHE) is an image processing technique used to improve contrast in images. Adaptive histogram equalization works by taking small regions and based on their local cumulative density

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function performs contrast enhancement of those small regions.

Quadrant Dynamic Histogram Equalization (QDHE) is a contrast enhancement method in image processing using traditional Histogram Equalization (HE) but it performs image contrast enhancement using mean filtering technique [5].

In Exposure based Sub image Histogram Equalization (ESIHE) the images are partitioned into sub-images.

If the AHE contains small intensity values then the noise can get enhanced in those regions so to prevent such situations Contrast limited Adaptive Histogram Equalization (CLAHE) is used.

Which technique is best?

We have discussed so many techniques related to image enhancement but every method has some advantages as well as some disadvantages. Here we are proposing a method that enhances the image in such a way that it proportionally enhances the image and removes the noise as well. We have combined local window histogram equalization as well as Gaussian filter to enhance the image.

Figure 1. Various Histogram Equalizations

Various histogram equalizations are shown in the figure. These are used to enhance the image. Here in the images we can observe that HE produces an enhanced image as it produced in the which gives a natural look to the image in this image as comparing with the original image whereas AHE is increasing the brightness as well as making the image contrasted at one point and less contrasted at other points of the image, CLAHE is not enhancing the the image in an appropriate way and other algorithms like BPDFHE are giving better results but clarity is being compromised in these images ESIHE is increasing brightness in the image.
LWHE-G is providing a balanced image but it is not showing much better as compared to the previous images but it is contrasting with balance at various points and giving the image a natural look as well as it is making the image look clearer.

III. PROPOSED METHOD

Image enhancement is a technique by which a given image can be made better in quality than the original image. To enhance the given image we use various image enhancement methods like enhancement by point processing, spatial filtering, pseudo color image processing etc Our objective is to increase the contrast in the image and reduce the amount of noise in the image and improve the quality of the image more than that was being done by previous traditional methods and to enhance the image using local information and to show that image is enhanced with greater detail and lower noise compared to the several existing methods that were previously used.

So here we are using local window histogram equalization (LWHE) method for image enhancement using Gaussian model. LWHE is a method that is based on histogram equalization method that is used to enhance the image. Here we have used a parametric model, Gaussian filter that enhances the image with lower noise and better quality as compared to various existing methods. Here we are using a technique local window histogram equalization that is based on traditional histogram equalization with varying window size and a parametric model, noise is an unwanted element that destroys the quality of an image so we use Gaussian filter that improves the quality of image by removing noise to a great extent.

The image is given as input to the LWHE algorithm and we can see the difference in its histogram. Simple image contains various peaks in its histogram whereas the image that was enhanced using LWHE contains uniform distribution.

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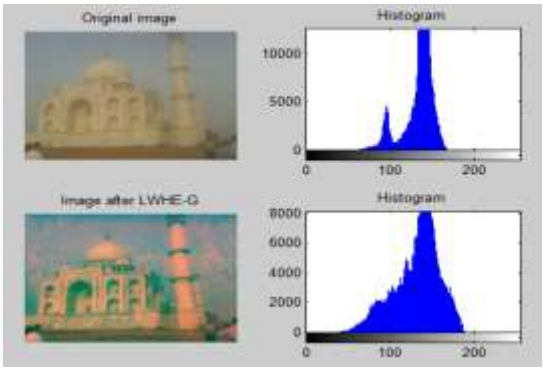

Figure-2 Image and LWHE-G

Here in the local window histogram equalization using Gaussian filter we can see that noise is reduced as the peaks are not shown much in the second histogram whereas the peaks are so much shown in the origina image as well the image has become much clearer.

IV EXPERIMENTAL RESULTS

When the simulation results were performed using various evaluation parameters it was found that the noise is reduced to a great extent and the entropy is increased of the image. So we can say that LWHE-G is a comparatively better method that was used before.

Technique	Entropy	psnr	GradMag
HE	6.94	13.86	11.90
AHE	7.74	16.43	10.03
LWHE-G	**7.67**	**19.21**	**5.60**
ESIHE	7.67	32.29	6.92
BPDFHE	7.57	46.33	6.68
CLAHE	7.58	15.03	10.32
QDHE	7.71	29.64	7.28

Table-1 comparative analysis of various methods

Here in the table-1 we can see that entropy of LWHE-G is better than various other methods and psnr is also comparatively good and Gradient Magnitude is less

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