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Image Contrast Enhancement Using Novel Histogram Equalization

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Abstract: Histogram equalization is a well-known and effective technique for improving the contrast of images. The traditional histogram equalization (HE) method usually results in extreme contrast enhancement, which causes an unnatural look and visual artifacts of the processed image. In this project, novel histogram equalization method is proposed that is composed of histogram separation module and an intensity transformation module. The proposed histogram separation module has proposed prompt multiple threshold procedure and an optimum peak signal-to-noise ratio (PSNR) calculation to separate the histogram in small-scale detail. As the final step of the proposed process, the use of the intensity transformation module can enhance the image with complete brightness preservation for each generated sub-histogram.

Keywords: Histogram equalization, contrast enhancement, multiple thresholds, peak signal-to-noise ratio.

I. INTRODUCTION

An image may be defined as the two-dimensional function, f(x, y), where x and y are spatial(plane) coordinates, f is function, and the amplitude of f at any pair of coordinates (x, y) is called intensity or gray level of the image at that point. When x, y, and intensity values of f are all finite, discrete quantities, we call the image a digital image. The field of digital image processing refers to processing digital images by means of digital computer. The digital image is composed of finite number of elements, each of which has particular location and value. These elements are called as picture elements, image elements, pells and pixels. Pixel is a term most widely used to denote the elements of the digital image. Images play an important role in human perception. Imaging machines cover almost the entire electromagnetic spectrum, ranging from gamma to radio waves. They can operate on images generated by sources that humans are not accustomed to associating with images.

II. MATERIALS AND METHODS

The HE method [1] is to re-map the gray levels of an input image using a transformation function with the cumulative distribution of the input image. HE attends to and stretches the dynamic range of the image histogram to improve the overall contrast of the original image. However, the HE method is unsuitable for consumer electronic applications. BBHE (Brightness Preserving Bi-Histogram Equalization) preserves the mean brightness while the contrast is enhanced [2],[3]. In order to overcome the existing drawback, a Novel Histogram Equalization Algorithm is formulated for uniform contrast enhancement, noise tolerance and brightness preservation.

III. PROPOSED METHOD

A Novel Histogram Equalization method, involves two important modules: a histogram separation module and an intensity transformation module. First, the proposed histogram separation module is a combination of prompt multiple threshold procedure and an optimum PSNR calculation to separate the histogram in small-scale detail. As the final step of the proposed process, the use of the intensity transformation module can enhance the image with complete brightness preservation for each generated sub-histogram. The output image of Novel Histogram Equalization (Proposed Method) is compared with the Histogram Equalization (Existing Method). In HE the brightness of the original image is not preserved.Thus the proposed method has uniform contrast and brightness and is shown in Fig. 1.From Fig. 1. The contrast enchancement is achieved and there is no feature loss. This histogram plot shows the number of occurrence. The numbers of occurrences occur between the intensity values of (10 to 200). There is no uniform distribution.

Fig. 1 Output Image

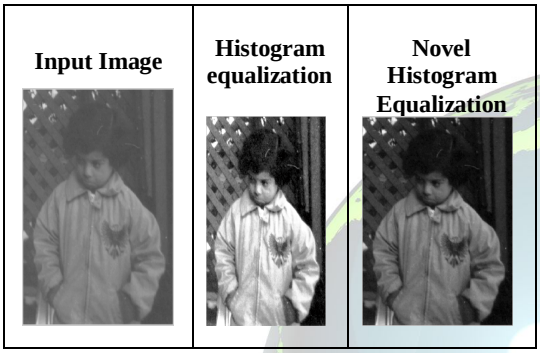

Fig. 2 Comparison of HE and NHE

From Fig.2,the output image of Novel Histogram Equalization (Proposed Method) is compared with the Histogram Equalization (Existing Method). In HE the brightness of the original image is not preserved. But in the proposed method the uniform contrast and brightness of the original image is achieved.Table I shows MEAN, STANDARD DEVIATION,RMSE,PSNR and AMBE value of various input images. This table shows the range of PSNR value which is greater than 0.1 and resultant AMBE value which is low. It indicates that the proposed method preserve brightness of the image without any feature loss**.** Histogram modification techniques can be categorized into two main types, global histogram modification and local histogram modification. Global histogram modification techniques attempt to modify the spatial histogram of an image in order to closely match a uniform distribution via the transform function. This is generated by using the histogram information of the entire input image. However, global histogram modification technique cannot adapt to local brightness features. This causes limitations in the amount of contrast enhancement in some parts of the image.

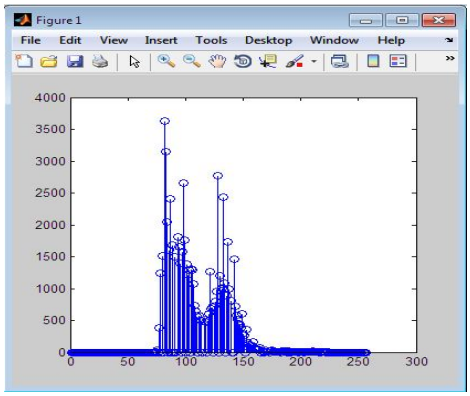

Fig. 3 Histogram Plot of Existing Method

Image shown in fig. 3 is the histogram plot of the Existing Method. This histogram plot shows number of occurrence. In this more number of occurrences occurs between the intensity values of (75 to 175). There is no uniform distribution. The Proposed technique (Novel histogram equalization) attains Noise tolerance, Uniform contrast, Brightness preservation.[4]. 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. Compression deals with techniques for reducing the storage required to save an image or the bandwidth required to transmit it. It is familiar to most user of computer in the form of image file extensions such as the jpg file extension used in the JPEG(Joint Photographic Expert Group).The Novel Histogram Equalization Algorithm is formulated for uniform contrast enhancement, noise tolerance and brightness preservation and this is formulated by a table with comparison.

TABLE I
MEAN, STANDARD DEVIATION,RMSE,PSNR and AMBE VALUE OF VARIOUS INPUT IMAGES

Input Image	Mean Value	Standard Deviation	RMSE Value	PSNR Value	AMBE Value
Pout Image	110.3	23.1810	6.7624	31.528	0.1214
Lena Image	115.9	29.9554	6.6083	31.729	0.01

The proposed histogram separation module has proposed prompt multiple thresholding procedure and an optimum peak signal-to-noise ratio (PSNR) calculation to separate the histogram in small-scale**.** Thus, the final step of the proposed process, the use of the intensity transformation module can enhance the image with complete brightness preservation for each generated sub-histogram**.** From Fig. 4,

Histogram plot shows the number of occurrences. In this the number of occurrences is distributed uniformly that is the occurrences between the intensity values of (0 to 250).

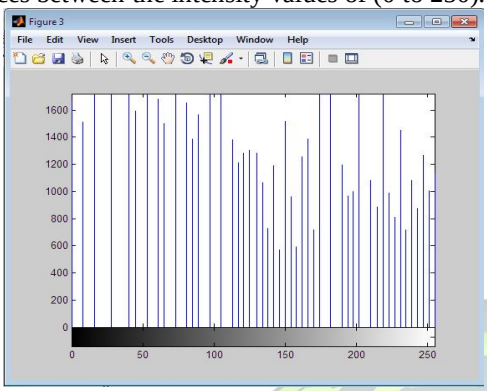

Fig. 4 Histogram Plot of Proposed Method

IV. CONCLUSION

Thus, a Novel Histogram Equalization method is to enhance the contrast of an image. By using the Histogram Separation module the sub histograms were generated. These sub histograms were equalized by the intensity transformation module to achieve an accurate contrast enhancement. The results revealed that the novel Histogram Equalization method generated very high quality enhancement images. This method has uniform contrast, noise tolerance, brightness preservation, convenient implementation. It is used in consumer electronics application such as TV to provide high contrast without any loss.

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BIOGRAPHY

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