

CONTRAST ENHANCEMENT TECHNIQUES FOR MEDICAL IMAGES

¹Ribana K, ²Pradeep S^{1,2}Assistant professors,Department of Electronics and Communication Engineering,
M.Kumarasamy College of Engineering, Karur, Tamilnadu.¹ribanak.ece@mkce.ac.in, ²pradeeps.ece@mkce.ac.in.

Abstract: Image contrast enhancement is the processes of improving the quality of an image by varying the difference between the adjacent pixel values. It performs a vital role in the area of medical imaging and its applications. Medical image processing can be obtained by various techniques like image denoising, image sharpening and image contrast enhancement. In this paper image contrast enhancement is going to be analysed for the medical images. It is very useful for identifying diseases and its diagnosis. Medical image enhancement can be obtained in various methods here DSIHE with filtering method is proposed for obtain better enhancement, low noise and high PSNR value.

Keywords: image enhancement, PSNR, DSIHE.

1. Introduction

Contrast enhancement made the image with high visual quality and lower noise. The main aim of the enhancement technique is to differentiate the background image with foreground image to obtain the clear vision. Contrast enhancement for medical images can be obtained directly by various techniques like spatial filtering, neighbourhood operation, sigma functions, and image histogram adjusting techniques. Poor contrast image having the histogram is stretched in to the smaller range because of the various reasons like lack of light intensity in the field, lowest device performance etc., to wider the range of the image histogram indirect enhancement method is used. Indirect enhancement of medical images can be obtained by histogram modification techniques like histogram equalisation method in that the original image histogram is modified by applying mathematical equations on the original image histogram and the final result obtained by the modified histogram technique will provide better contrast enhancement than the original image.

2. Previous Work

This part describes previous algorithms and methods for contrast enhancement of medical images.

Imadjust method is used to provide better enhancement when compared with an original image. Another direct method is neighbourhood operation it can be obtained directly by sliding the window on the image which performs the smoothening operation like filtering hence the image becomes noise free and it produces better enhanced noise free image. Histogram Equalization (HE) is a basic technique for obtaining the contrast enhancement. Which made the output image as highly contrast enhanced or very low enhanced by modify the various part of the input image histogram. Hence the output image produced by this technique having highest noise values, for medical image diagnosis the noise value at the output must be low. For producing better enhancement with low noise at the output can be obtain by Brightness preserving Bi Histogram Equalization (BBHE). In this method the input image histogram is divided in to equal histograms with reference to the mean value of the original image histogram. Then the two histograms are separately under goes the HE method finally that two histograms are combined to produce the out image histogram. The resultant image produces better enhancement with considerable amount of noise. For further elimination of noise performance Dualistic Sub Image Histogram Equalization (DSIHE) is used in that method the original image histogram is separated in to two different histograms with reference to the median value of an original image. The remaining steps for obtain the output is similar to the BBHE method. To improve the quality of an output image Recursive Sub-Image Histogram Equalization (RSIHE) is performed in this method the input image histogram is separated recursively with reference to the local mean values of recursive histograms the result obtain by this method is more effective compare to the existing methods. The histogram modification can also obtain by the gamma correction method. By changing the parameter gamma the input image histogram can be modified and the output histogram range is wider than the input image histogram hence the enhancement is attain with low noise.

3. Proposed Algorithm

Proposed method is done by MATLAB simulation tool. The following steps are performed

Step 1: Image Acquisition

Step 2: neighbourhood operation

It is carried by nlfilter keyword in MATLAB for removing the noise presence in an input image.

Step 3: Histogram modification

The output histogram obtain from the neighbourhood function is modified by

$$H' = 255[\sum PDF(i,j) + 0.5]$$

$$H_{modified} = \theta(\text{original histogram}) + (1 - \theta)H'$$

Here the θ value is kept as 0.5 to obtain the modified histogram is close to the original image histogram and Probability Density Function (PDF) is calculated as,

$$PDF(i) = \frac{n_i}{MN}$$

Where $i = i_{min}, i_{min}+1, i_{min}+2, \dots, i_{max}$, n_i denotes the number of pixels for luminance i , and MN denotes the total number of gray level pixels in the input image.

Step 4: Dualistic Sub-Image Image Histogram Equalisation

The modified histogram is separated by two equal histograms that two histograms are undergoes histogram equalisation separately and combined to get final output image.

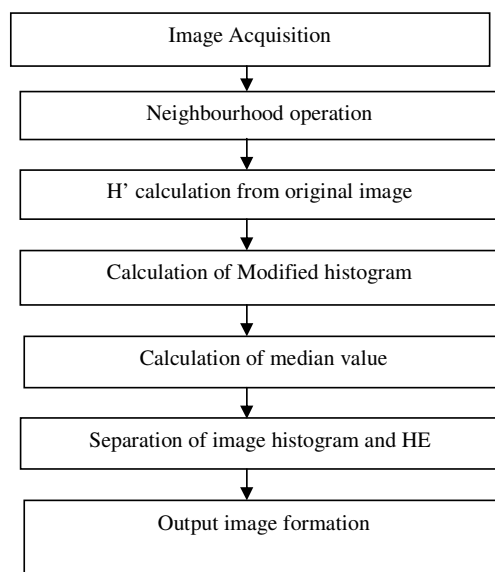
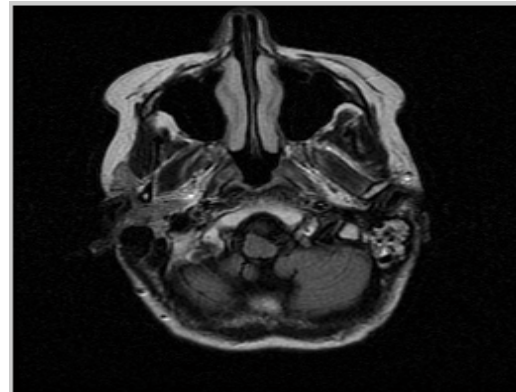


Figure 3.1 Flow Diagram of Modified Color Preserving AGC Algorithm

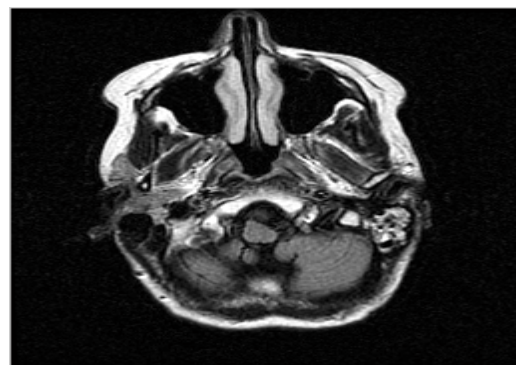
4. Results and Discussion

The proposed method is compared with direct enhancement methods imadjust, neighbourhood

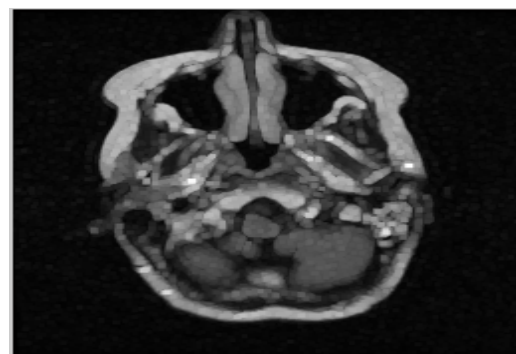
methods and indirect enhancement methods HE, BBHE, DSIHE and gamma correction method. The performance of an output image is calculated by obtaining PSNR values of all other existing methods by comparing that proposed method produce better enhancement with high PSNR values.



(a)Original image



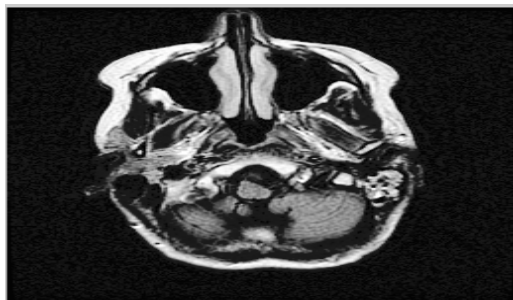
(b)Imadjust image



(c)Neighborhood operated image



(d)Histogram equalised image



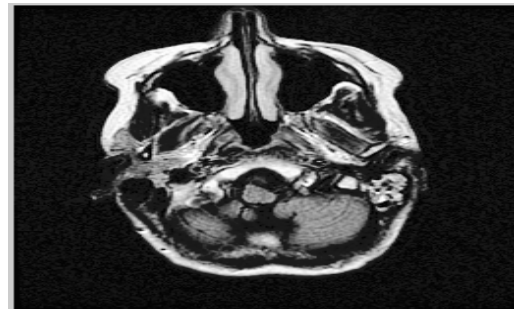
(e)BBHE



(f)DSIHE



(g)gamma corrected image



(h)Proposed method(neighborhood with modified DSIHE)

Figure 4.1. Simulation results (a)Original image (b) Imadjust image (c) Neighborhood operated image(d) Histogram equalised image (e) BBHE (f) DSIHE (g) gamma corrected image (h) Proposed method (neighborhood with modified DSIHE)

Table 1. Peak Signal to Noise Ratio (PSNR) For Imadjust image, Neighborhood operated image, Histogramequalisedimage,BBHE,DSIHE,gamma corrected image, proposed method (neighborhood with modified DSIHE)

Enhancement Methods	PSNR
imadjust	12.43
Neighborhood operation	8.25
HE	7.40
BBHE	13.75
DSIHE	10.04
GAMMA CORRECTION	15.08
Proposed method(neighborhood with modified DSIHE)	17.08

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