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Optimized Edge Detection of Medical Images Using Bacterial Foraging Optimization Method

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Abstract - Edge detection is very important field of image processing as well as in medical field. It helps in detecting various cracks in the body. So in proposed work utilization of various methods has been done e.g. DWT for image partition into HH, HL, LL and LH sub levels. Then utilization of BFO will be done to get reduced feature set and in the histogram equalization is done to show the frequency level of extracted image. The whole simulation is being done in MATALB 2010 environment. The whole simulation is tested using various parameters like MSE, PSNR and Entropy and the obtained results is satisfactory.

Keywords - Histogram Equalization, Edge Detection, DWT, BFO.

I. INTRODUCTION

These days computerized cameras are positively the most utilized gadgets to take the pictures. They are all over the place, including cell telephones, pocket PCs or palmtop PCs), robots and home security frameworks [1, 2, 3]. There is most likely the nature of the pictures got by advanced cameras, paying little heed to the setting in which they are utilized, has enhanced altogether since early days. Various problems that exist in pictures while capturing are as shown below;

1. Contrast deformities,
2. Chromatic deviations,
3. Vignetting (i.e., a decrease of a picture shine or immersion at the fringe contrasted with the picture focus)
   Geometrical contortions,
4. Shading demosaicing and
5. Centre imperfections [4, 5].

In day to day life many such cases occurs in which minute hair line fracture may get un-noticed in the X-ray by the Doctors in such cases Bone fracture detection using image processing will help the doctor to avoid such errors. Digital image processing is an expanding area with application regarding to our daily lives, especially in progressive transmission of images video coding, digital libraries image database, remote sensing, and other image database, remote sensing, and other and analysis techniques have been developed to aid the interpretation of remote sensing images and to extract as much information as possible from the image [6, 7]. The huge collection of digital images are collected due to the improvement in the digital storage media, image capturing devices like scanners, web cameras, digital cameras and rapid development in internet. This leads to rapid and efficient retrieval of these images for visual information in different fields of life like medical, medicine, art, architecture, education, crime preventions, etc [8, 9].

II. EDGE DETECTION

Edge detection is one of the most frequently used techniques in digital image processing. Edge detection process has three steps: filtering, enhancement and detection. Images may be affected by different types if noise. The most widely studied two types are the white noise, impulse noise and ”salt and pepper” noise. To reduce the influence of noise a filtering step (for example Gaussian filtering) is necessary before edge detection. Enhancement techniques have the role of improving the quality of a digital image. Enhancement is usually performed by computing the gradient magnitude. Detection methods are used to determine which points are edge points or not. Usually, thresholding provides the criterion used for detection. The most frequently used edge detection methods are: Sobel edge detection, Prewitt edge detection, Roberts edge detection, Laplacian of Gaussian (LoG) edge detection and Canny edge detection [10, 11].

III. PROPOSED METHODOLOGY

X-ray medical imaging plays a vital role in diagnosis of bone fracture in human body. The X-ray image helps the medical practitioners in decision making and effective management of injuries. In order to improve diagnosis results, the stored digital images are further analyzed using medical image processing. The most common ailment of the human bone is fracture. Bone fractures are nothing but the cracks which occur due to accidents. There are many types of bone fractures such as normal, transverse, comminuted, oblique, spiral, segmented, avulsed, impacted, torus and greenstick. Generally for X-ray image segmentation of bone fractures, a number of edge detection algorithms like sobel, prewitt, roberts and canny were used.

So, this work mainly proposed the computer aided diagnosis of bone fracture detection in X-ray images using edge detection operators in addition with DWT and BFO

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optimization algorithm and the proposed model's performance is evaluated using various metrics like PSN and Histogram.

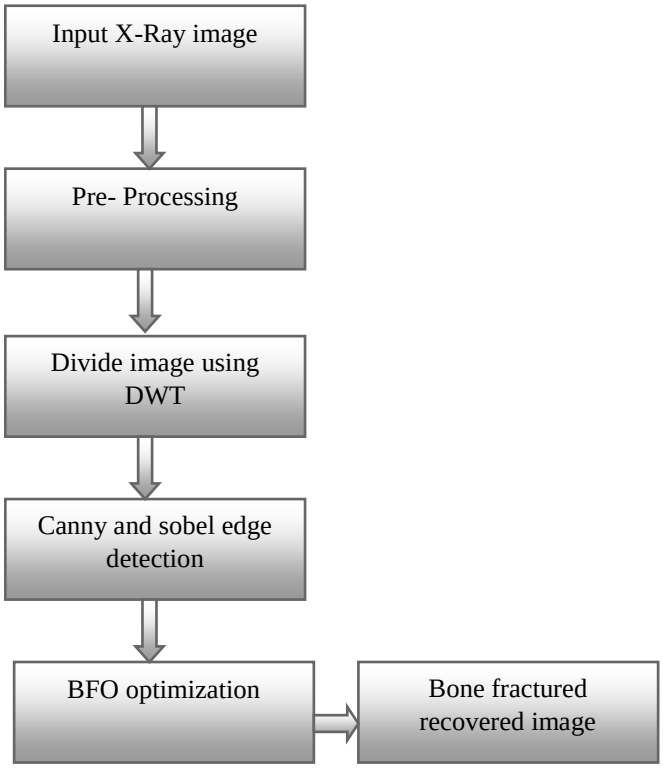

Fig. 1 Proposed Flowchart

Step: 1 Upload X-ray image.

Step: 2 2D DWT decomposition separates an image into the four parts (HL, LL, LH, HL), each of them contains different information of the original image. Detail coefficients represent edges in the image, approximation coefficients are supposed to be a noise. A proper modification of approximation coefficients is the easiest way for edge detection.

Step: 3 Then the principle of the simplest method of edge detection is based on replacing of all approximation coefficients by zeros using canny and sobel. This modification removes low frequencies from the image. The image is reconstructed using only the remaining wavelet coefficients. By means of this method the most expressive edges are found.

Step: 4 The image is reconstructed from remaining coefficients and from modified approximation coefficients using BFO. This method provides sufficient results.

Step: 5 Find PSNR and histogram.

IV. PROPOSED EDGE DETECTION ALGORITHM

$global\ Fimg\ Rimg\ Eimg$

$set(handles.dip,'string','Please\ wait...');$

$soi\ =\ size(Fimg);$

$thresh\ =\ 0.1;$

$Bimg = im2bw(Fimg, thresh);$

$[LL, LH, HL, HH]\ =\ dwt2(Bimg,'haar');$

$pbst = bfo(Fimg);$

$[rh\ ch] = size(HH);$

$for\ i = 1{:}rh$

$for\ j = 1{:}ch$

$HH(i,j) = min(min(pbst)).* zeros(1);$

end

end

$Rimg\ =\ uint8(idwt2(LL, LH, HL, HH,'haar', soi));$

$usr = input('Select\ 1\ for\ Sobel\ 2\ for\ Log\ \&\ 3\ for\ Canny\ :\ ');$

$if\ usr == 1$

$type\ =\ 'sobel';$

$elseif\ usr == 2$

$type\ =\ 'log';$

$elseif\ usr == 3$

$type\ =\ 'canny';$

end

V. RESULTS AND DISCUSSION

Parameters

A. PSNR: Peak signal-to-noise ratio, often abbreviated PSNR, is an engineering term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. PSNR: The Peak Signal-to-Noise Ratio (PSNR) is defined as:

PSNR=10*log (255*255/MSE)

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B. MSE: In statistics, the mean squared error of an estimator is one of many ways to quantify the difference between values implied by an estimator and the true values of the quantity being estimated.

MSE: The mean-squared error (MSE) between two images I1 (m,n) and I2(m,n) is

$$MSE = \frac{1}{mn} \sum \sum [(I,j) - K(I,j)]^2$$

Where M and N are the number of rows and columns in the input images, respectively.

C. Entropy;The entropy is a valuable tool to measure the richness of the details in the output image.

Entropy= PSNR (img,RS_ESIHE)

Database

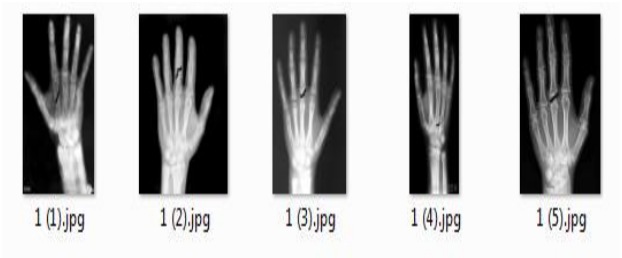

Fig. 2 Database

Above images has been utilised for running and implementation of the algorithm.

Results

Below Table shows the values of 4 different parameters for obtained enhanced output image.

Table.1 Proposed Parameters

Image no.	Entropy for original image	Entropy for enhanced image	PSNR	MSE
1.	6.758	.320	57.65	.1022
2.	4.64	2.81	57.56	.2023
3.	6.96	.124	57.53	.1024
4.	5.38	.105	57.34	.2021
5.	6.26	.302	57.23	.1024

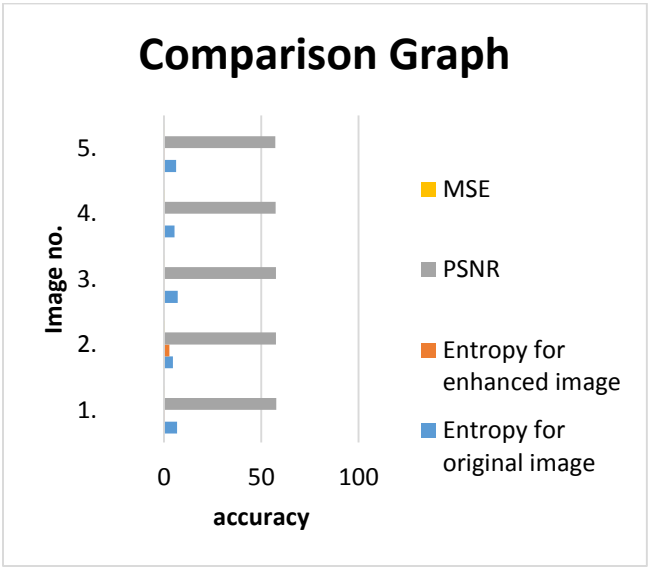

Fig. 3 Comparison Graph

VI. CONCLUSION AND FUTURE SCOPE

A combination of Histogram Equaliation and Bacteria Foraging optimization algorithm based edge detector has been developed and implemented to produce better edge detection results than traditional detectors. Such that BFO algorithm is used to choose the optimal value for canny edge detector, Sobel and log edge detector to produce more accurate and satisfactory edge detection results.

Results of the proposed edge detector and the edge detectors based on Entropy, MSE and PSNR method were presented both qualitatively and quantitatively. From the qualitative and quantitative results of edge detectors on medical images, It is concluded that the proposed edge detector clearly outperform all the other methods in study. It has been observed that proposed method obtain optimal results but with high computational effort. So the BFO based technique produced more accurate results than other studied techniques. Finally obtained results indicate that the proposed method have a high effectiveness on a large category of image applications. The effectiveness of method is checked by simulating the test images on MATLAB. The proposed method provides the superior edge detection results to existing edge detection techniques based on the Entropy, MSE and entropy. In addition, the proposed method provides better quality in visualization by obtaining maximum PSNR value. Future work lies in the utilization of other wavelet methods.

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