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Enhanced Wavelets Transform Edge Detection Technique for X-Ray Images.

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Abstract: ***Target edge detection is one of the crucial and indispensable process used to detect the size of the fracture by using multi resolution discrete wavelet transforms in image processing field. It is a foremost step of image enhancement and is prior to segmentation procedure.Computerised imaging techniques such as X-ray, CT, Ultrasound and MRI are used by the radiologist helps in diagnosing diseases. Digital x-rays are economically agile helps in detecting microscopic bone fracture which are not detectable by human eye. The paper involve the use of daubechies wavelet transform (db1) undergoes multi resolution three level wavelet decomposition that isolate into higher and lower frequencies readily, results in finding edges in horizontal and vertical function which is the necessary aspect of edge detection for x ray images.Matlab code have been implemented for testing the boundaries of the image objects in authentic digital x ray images as well as for the standard dataset images. Computer-aided diagnosis system (CADD) is becoming a popular research area in diagnosing x-ray bone fractures,bone cancerdiseases.***

Keywords: Daubechies, edge detection, wavelet transform, X-ray.

I. INTRODUCTION

Computer-aided diagnosis system (CADD) is becoming a popular research area in diagnosing x-ray bone fractures. Target edge detection is a frequently assigned job that is to be done preceding to any perception to the scene which includes objects, contour, diameter, colour and location but objects are biased from their background. Edge is the key feature of an image.

The objective of target edge detection is to find the points where intensity level changes abruptly in an image. Edge gives the information about the perimeters between distinct regions to identify objects for segmentation and matching outcome [1].The boundaries of the objects in the regions are the prime step in many image processing algorithms.

This paper deals with a method to recognize edges from real x-ray images of human being based on median filter and multiresolution discrete wavelet transform, as wavelets are the mathematical means for ordered decomposing function.

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II. RELATED WORK

The two categories of operators are

In 1st order derivative [2]

In 1st order derivative, the convolution mask of the input image is modified to produce gradient image that undergoes thresholding which results in edges. The traditional operators like sobel, prewitt, Robert [5] are 1st order derivative operators giving the information about the gradient of the image by perceiving the maximum and minimum intensity values through which the edges can be detected. The allocated intensity values of neighborhood pixel gives the classified edge. These edges are more sensitive to noise, require more performance time and may not be suitable to real time application.

A. In 2nd order derivative [2],

Marr and Hildreth[6], proposed Laplacian of a Gaussian (LOG) operator which are also called as 2nd derivative operator filtered by gaussian filters and is very important as they wise to noise.these operators have variance of the Gaussian filter and threshold parameters that compute automatically[7],usually these are fixed values.a compelling obstacle of LoG is during zero crossing points with asymmetric figure leads to tilt edges causing increment in smooth filtering[8].later Canny overcome this problem by introducing an operator for detecting single and localized edge,but as the number of images increases, the operator becomes noise sensitive leading to false edges.It can be used as local adaptive method for searching edges compared to global thresholding technique.

B. In Wavelet Transforms, [10]

Wavelets are a mathematical means for ordered decomposing functions. Compressed digital image data by Haar wavelets have less memory compared to the original image. These are having high PSNR values, low MSE values and high compression ratios mostly preferred by researchers when using multiresolution wavelet transforms. They takes less memory and time as compared to digital images extracted from the world wide web.

The Haar wavelet transforms divides the original image into 8×8 sub blocks and restoring the compressed good quality image [11].

Modified Moore neighbor algorithm with filtering range for the detection of edges results in longer duration to find the true edges.

III. METHODOLOGY

To reach the goal of edge detection, the methodology has divided into two sub portions.

A. Wavelet decomposition by using Daubechies wavelet transforms.

In 2D image of discrete wavelet transform, considering the discrete sequence s(n), forn-0,1,2……., undergoes sub band decomposition resulting in series of coefficients called DWT coefficients as shown by given equation

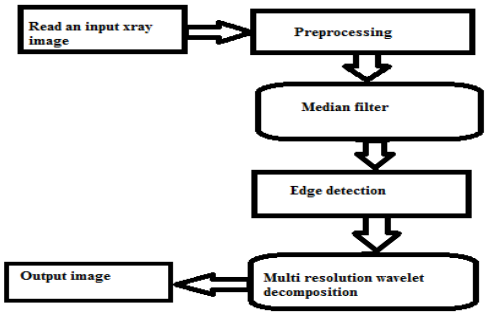
$$w\emptyset(j0,k) = \frac{1}{\sqrt{M}}\sum_n s(n)\emptyset j0,k(n) \text{---------- (1)}$$

$$w\varphi(j,k) = \frac{1}{\sqrt{M}}\sum_n s(n)\varphi j,k(n) \text{---------- (2)}$$

Wavelet coefficient for Inverse Discrete Wavelet Transform (IDWT) of 2D image considering discrete signal can be expressed as

$$s(n) = \frac{1}{\sqrt{M}}\sum_K w\emptyset(j0,k)\emptyset j0,k(n) + \sum_k w\emptyset(j,k)\varphi j,k(n) \quad (3)$$

B. Block diagram of the proposed system.



IV. ALGORITHM FOR TWO-DIMENSIONAL DISCRETE WAVELET TRANSFORMS

Implementation of subband coding for 2D digital images can be continued by using one dimensional discrete wavelet transform, results in detection of horizontal and vertical edges separately and details in both directions that is the diagonal edges. For interpretation of 2D signals, multiplying the scaling and wavelet function separately in n1 and n2 for horizontal and vertical direction given as

$$\emptyset(n1,n2) = \emptyset(n1)\emptyset(n2)$$
$$\varphi H(n1,n2) = \varphi(n1)\emptyset(n2)$$
$$\varphi V(n1,n2) = \emptyset(n1)\varphi(n2)$$
$$\varphi D(n1,n2) = \varphi(n1)\varphi(n2)$$

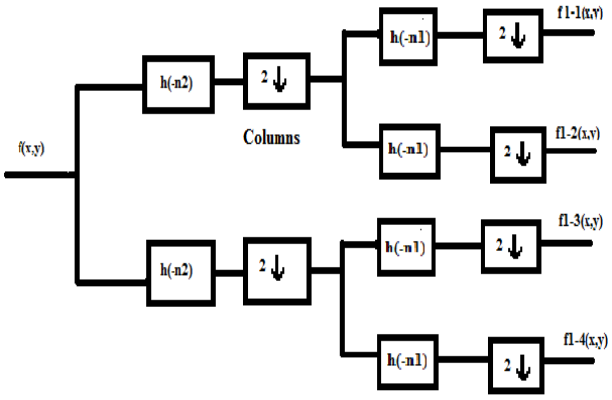


Fig: .1. Filtering of scaling and wavelet function separately.

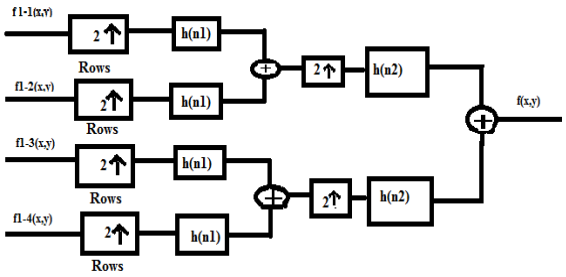


Fig.2. Filtering for image reconstruction.

To achieve the original resolution from the reconstructed image, the IDWT is performed, through which the connected rows and columns of filter are up sampled by two.

V. RESULT AND DISCUSSION

A database of 2 real x-ray images and a standard image from benchmark dataset . The implementation of algorithm is done by using MATLAB 2018a tool with system configuration core i3, windows7 (64bit) followed by 16GB RAM. The final decomposition level 3 images is shown below

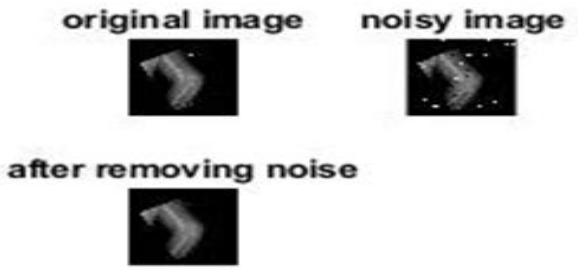
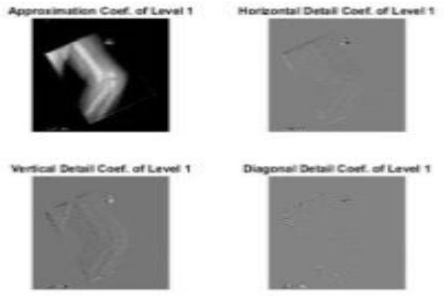
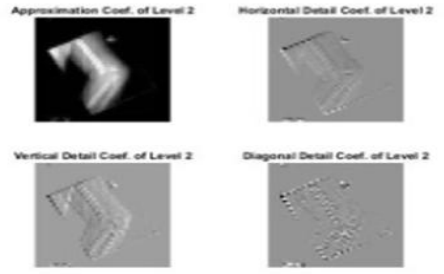


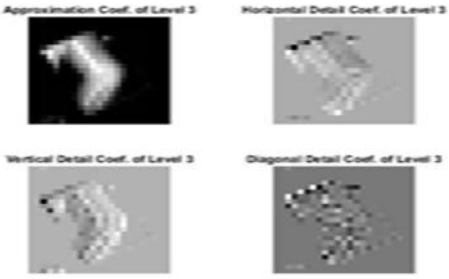
Fig.3.filtered input image



Level 1 decomposition



Level 2 decomposition



Level 3 decomposition

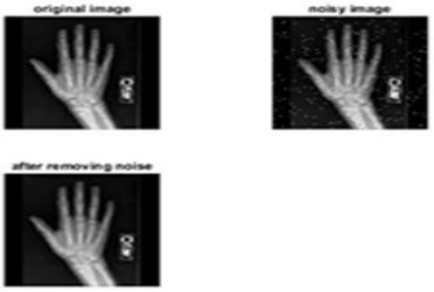
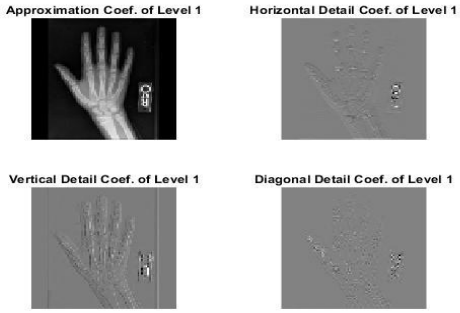
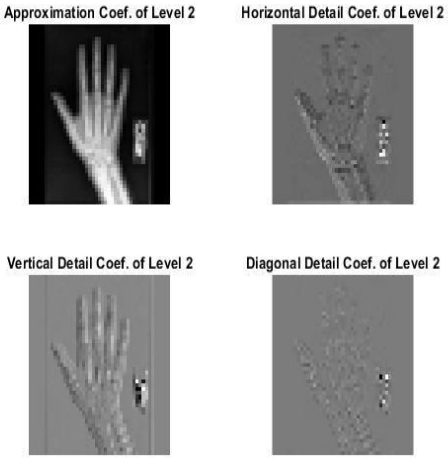


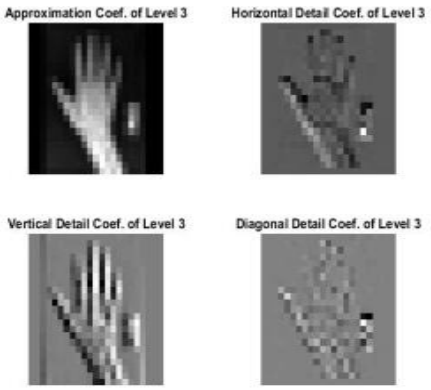
Fig.4.filtered input image



Level 1 decomposition



Level 2 decomposition



Level 3 decomposition

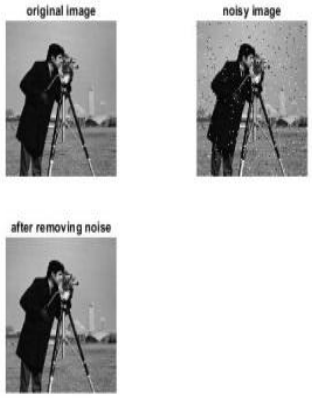
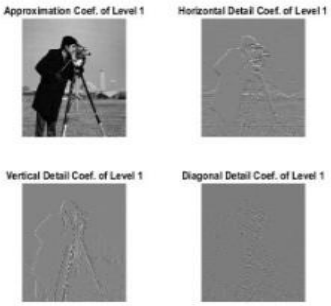
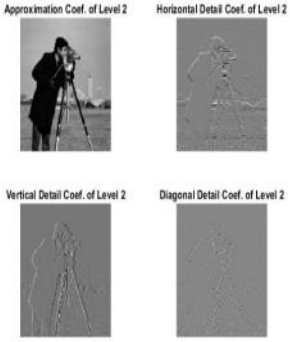


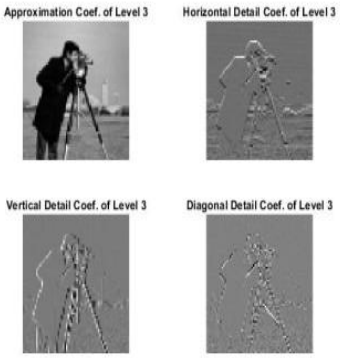
Fig.5.filtered input image



Level 1 decomposition



Level 2 decomposition



Level 3 decomposition

Fig 6. Reconstructed output images

It has been investigated, as x-ray images are rich in salt and pepper noise, it can be filtered by using median filtering, the results of decomposition of image levels gives horizontal, vertical and diagonaledgesLL,LH,HL,HH finer multiresolution levels as shown in fig 3, fig4, fig5 respectively. The higher the frequencies the edges can detected, the one with lower frequencies have to restrict it.Finally the compressed image can be restored comprising high compression ratio and good quality image as shown in fig 6.

VI. CONCLUSION

Finally the proposed scheme achieves an effective edge detection method that can be implemented from real human x-ray images and some standard images based on median filter and daubiecies (db1) wavelet transform. Any level of decomposition of image can be suitable, noise free, having good optical quality and take less performance time, as these images step through median filtering for improving the quality of the image and finding out the true edges in all direction. The use of wavelets helps in saving the memory and computational time in future.

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Tabassum Nahid Sultana is working as an assistant professor and currently a third year part time PhD student at Visvesvaraya Technological University Belagavi. She holds her Bachelor of engineering and master degree from Visvesvaraya Technological University Belagavi.

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