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RESEARCH PAPER

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A NEW APPROACH ON DENOISING FOR 1D, 2D AND 3D IMAGES BASED ON DISCRETE WAVELET TRANSFORMATION AND THRESHOLDING

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ABSTRACT: Image processing is used to improve the quality of the image for better human understanding. Quality of the image is not maintained because of noise. Noise can be removed by various algorithms and it is considered as one of the pre processing step in image processing. In this paper we have proposed a new method for denoising one dimensional, two dimensional and three dimensional images based on discrete wavelet transform. Wavelet transform is the simplest method to decompose the image signals into sub-bands and to analyse each sub-bands[1]. The key advantage of using discrete wavelet transform is it gives both information such as number of times noise occurred and place where noise is occurred. We have introduced a predictor variable based on discrete wavelet transform which will be efficient in finding the peak signal nose ratio (PSNR). The proposed new algorithm is applied for one dimensional, two dimensional and three dimensional signals, and then the results are compared by using different types of filters. In this paper, different thresholding techniques are used and compared in terms of PSNR in db.

Keywords: PSNR, db, DWT

I. INTRODUCTION

An image can be represented in terms of signals and output may be an image or characteristics associated with the image [2]. Meaningful information can be obtained from an image. We can process the image and can produce better image by applying this new algorithm.

In order to remove noise and to improve the quality of image noise has to be reduced. Fourier transform is not as effective as discrete wavelet transform. We are going to reconstruct filter banks in discrete wavelet transform like analysis and synthesis filter bank. Application of wavelet transform is image enhancement and noise attenuation.

In this paper, we are going to take an image without any noise and then introduce noise into that image. Then remove the noise by preserving edges based on discrete wavelet transform. In one dimensional wavelet transform, we are going to decompose the signals into sub-signals. In two dimensional discrete wavelet transform, we are going to apply analysis filter to each row of both of the two sub band images. We are going to use three dimensional discrete wavelet transform, for voluminous signals and video processing.

II. RELATED WORK

In the past S.Grace chang, Bin Yu,Martin vetterli[3] proposed an adaptive data driven threshold for image denoising using wavelet thresholding. Gabriela ghimpeteanu[4] proposed a decomposition framework for image denoising algorithms. Anju T S Nelwin raj N R[5] have been proposed for image denoising using shearlet transformation. Various algorithms and techniques have been proposed for image denoising. Still image denoising is an challenging task for the researchers.

III. ONE DIMENSIONAL WAVWLET TRANSFORM

In mathematics, a wavelet series is a representation of a square-integrable (real-or complex-valued) function by a certain orthonormal series generated by a wavelet. In one dimension DWT, analysis filter filters the original image using low pass filter and high pass filter. The output of each filter is then down sampled by two to obtain the two sub-signals. Output signal is represented by o(n) and given as input i(n). Multi resolution analysis is also an important benefit of wavelet transform [6].

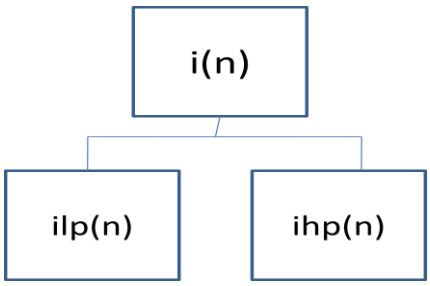
Algorithm

1. read a noisy image
2. decompose the signals into two sub bands using
   i. analysis filter
   ii. synthesis filter
3. perform thresholding
4. remove noise by inverse method
5. display the image

In one dimensional wavelet transform, input filters are represented by i(n) and two filters are used. One is analysis filter and other is synthesis filter. The role of analysis filter is used to divide the signals into two sub signals that are one frequency of the signal is low represented by l(n) and other is high represented by h(n).

First of all analysis filter decomposes the input signal i(n) using low pass(represented by ilp(n)) and high pass

filters(represented by ihp(n)). The output of each filter are represented by olp(n) and ohp(n) are then down sampled by two to get the two sub band signals. If we are going to apply synthesis filter recursively then we will get inverse discrete transform.



One dimensional discrete wavelet transform values of output signals are displayed in form of mesh graph.

IV. TWO DIMENSIONAL WAVELET TRANSFORM

In two dimensional DWT, analysis filter filters the original image using low pass filter and high pass filter. Output signal is represented by o(n) and given as input i(n).

In two dimensional wavelet transform, input filters are represented by i(n) and two filters are used. One is analysis filter and other is synthesis filter. The role of analysis filter is used to divide the signals into four sub signals that are one frequency of the signal is low represented by l(n) and other is high represented by h(n). Bilateral filtering combines gray levels or colors based on their similarity and it is non-iterative, simple[7]. still tere are several filtering methods are available. LL refers low-low filter, LH refers low-high filter, HL refers high-low filter and HH refers high-high filter respectively.

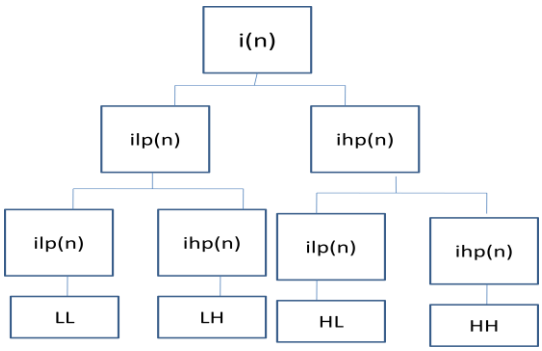
Steps in denoising algorithm

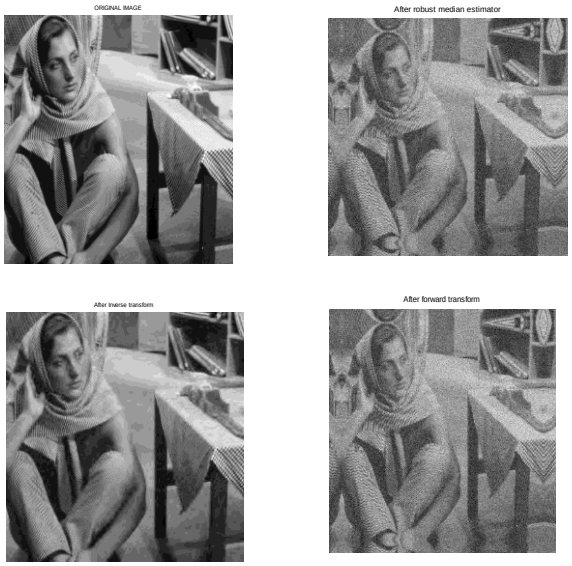
1. read a noisy image by introducing noise (sigma(n)*randomvalue(n))
2.
   a. analysis filter
   b. synthesis filter
4. Calculate Peak Signal Noise Ratio value between denoised and original image.
4. remove noise by inverse method
5. display the image

The PSNR value of Barbara image is listed below

PSNR = 27.0785

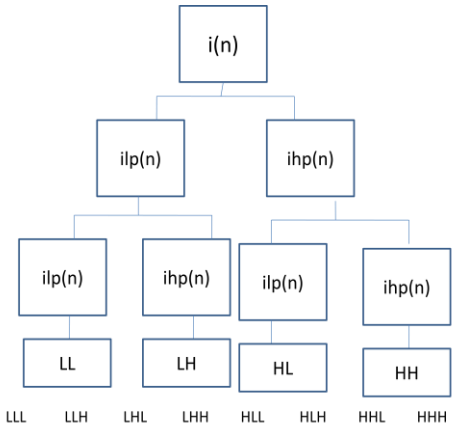
3. decompose the signals into four sub bands using





(a)original image (b) noisy image (c) after forward transform (d) after discrete wavelet transform

V. THREE DIMENSIONAL WAVELET TRANSFORM



Filter bank is applied to each of the dimension in three dimensional wavelet transformation. So the input signal will

be divided into eight sub signals. Below table shows the comparison value between barbara image and lena image.

In this paper, after introducing predictor varible the performace is improved. Once image was captured then the first step is to do was forward transform. Then quantization step will be performed with entropy encoding.

Entropy decoding is performed with inverse transformation. Image will be compressed and reconstructed using this technology with better performnace. After image quantization the image will be rconstructed.

V. EXPERIMENTAL RESULTS AND DISCUSSIONS

In this paper, a new predictor variable is introduced and gives better results than the previous method for denoising 1D,2D and 3D images. This method represents the image in splitted form into sub-bands, then denoising and calculate the PSNR value. It is observed that discrete wavelet transform gives best result for denoising.

	Image denoising methods			
	Previous method		New Method	
	One analysis	Two analysis	One analysis	Two analysis
MSE	94.260	93.954	92.222	92.021
PSNR	28.388	28.40	27.0785	27.105
MSE	82.67	82.60	80.45	80.50
PSNR	28.961	28.961	27.52	27.55
MSE	82.099	82.397	80.400	80.325
PSNR	28.987	28.972	27.345	27.122
MSE	93.946	93.774	92.233	91.995
PSNR	28.402	28.410	26.320	26.328

VI. FUTURE SCOPE

Even though discrete wavelet transformation is easy to implement methods has to be proposed to remove all types of noise.

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