



Image quality improvement using dddtdwt

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Abstract

The enhancement of degraded images using different wavelet transform techniques are presented in this paper. The performance of the wavelet techniques is analysed in terms of Peak Signal to Noise Ratio values and Root Means Square error. The Double Density Dual Tree Discrete Wavelet Transform technique is mainly focused for analysis and the results are compared with discrete wavelet transform and the Double Density DWT.

Keywords: Image Quality; DDDWT; Dual Tree DWT.

1. Introduction

Image degradation is one of the main issues in the research field. The images are degraded during transmission. The reason for degradation are noises from the channel, instruments and surrounding issues [1-2]. The researchers have used different method to enhance the degraded images. But still the research is going to improve the image quality. One of the main technique is to apply wavelet transform (WT) in the noisy image. Which is overcome the Fourier transform and short time Fourier transform [3]. The WT able to analyze both time domain and frequency domain simultaneously. Applying continuous WT for image denoising will give, more difficult because it is continuous in nature. Discrete WT is used for improving the image quality [4]. In discrete WT has one scaling function and one wavelet function. The scaling and wavelet functions are derived from mother wavelet. Choose the right mother wavelet will give the best results. For image denoising purpose the suitable wavelet selection also plays the vital role. There are different mother wavelets families are available like Harr, Coiflet, Daubechies. One of the preferable wavelet family of noise reduction method is Daubechies [5-6]. Further development of discrete WT is a double density discrete wavelet transform (DDDWT) which overcomes the some limitations of the directionality [7]. The main focus of the paper is to enhance the degraded image quality based on their image quality measurement parameters like peak signal to noise ratio (PSNR). The paper organized as follows; the section two will give the improved type of WT which is used for denoising like discrete wavelet transform (DWT) and DDDWT. The proposed algorithm and simulation results are discussed in section three and four. The fifth section gives the conclusion of this paper.

2. Image quality analysis using DWT and DDDWT

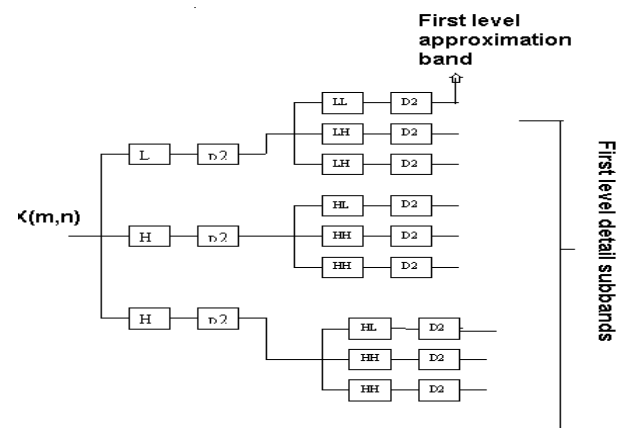


Fig. 1: One Level Decomposition Filter Structure for DDDWT.

The noisy images are applied column wise and row wise through the filter bank structure. The noisy image first split into two sub sampled images one is through a low pass filter and the other one passed through a high pass filter. After applying row wise obtained four sub bands, which are a combination of both high (H) and low (L) pass filter coefficients like LL, LH, HL, HH. Only the LL components are taken to the next level of decomposition [8-9]. After one level of decomposition it has four sub bands. The improved DWT is called DDDWT which is having one scaling and two wavelet which are derived from mother wavelet. This method has more detailed coefficients because two wavelet function. The degraded images are applied through column and then processed through row wise the resulting coefficients of one level decomposition are nine sub bands, one is low pass and remaining eight are high pass filters components it is shown in figure 1. The low pass value gives the detailed coefficients which are used to next level decomposition [10]. At the end of the second level decomposition the techniques will give the sixteen sub-bands, one low pass and

fifteen -high pass. The next step is to apply threshold for shrinkage and then applied inverse transform for reconstruction of the image at the end of the process image quality measurement calculated.

3. Image enhancement through double density dual tree DWT

The proposed method is followed by dual tree DWT and DDDWT .In this method there are two trees are used each tree follow the DDDWT filter bank structure. The flow chart for the proposed work is shown in figure 2.

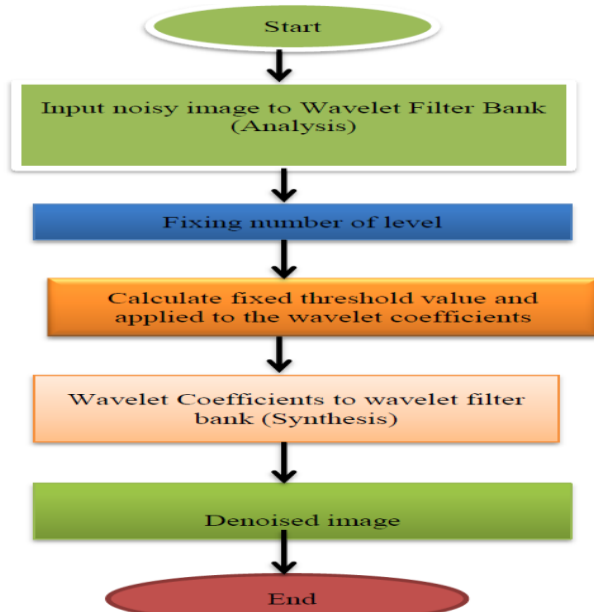


Fig. 2: The Work Flow Chart for the Proposed Technique.

The noisy image $x(m, n)$ is applied through the desired filter bank. The two similar trees are involved one is in upper and another one is in lower. Both the trees are having equal number of filters and coefficients at the end of one level decomposition process the noisy images are represented by two low pass and twelve high pass coefficients. The approximation coefficients are stored in low pass and the detailed coefficient are combination of both the high and low pass filters. In the proposed system has more detailed coefficients so it provides more information about the image. The desired level decomposition process is over, then its necessary to apply threshold for each all the sub-bands. There are two shrinkage function are familiar and well known method for wavelet denoising namely hard and soft threshold. In real time, especially when the noise is more the hard-threshold gives artifacts in the reconstructed image. Because the above mentioned limitation of hard threshold, in denoising applications soft-thresholding function preferred compared to hard thresholding.

The performance measure can be taken. One of the parameter is Root Mean Square Error (RMSE). The high RMSE value represents the poor quality of the image. In the proposed method gives the less RMSE value which proves the image quality is good.

4. Results and discussion

The degraded test images are taken for the simulation purpose. The noise variance of the images is 15dB. The number of decomposition level for simulation is 3. The gray scale image size is 512x512. The same size, variance and image are used for all methods. The performance measure of RMSE values are tabulated in table 1, which is compared with other wavelet technique like DWT and DDDWT.

Table1: Performance Analysis

RMSE Noisy	Denoised Method	RMSE
378.56	DDDTDWT	63.43
378.56	DDDWT	81.04
378.56	DWT	187

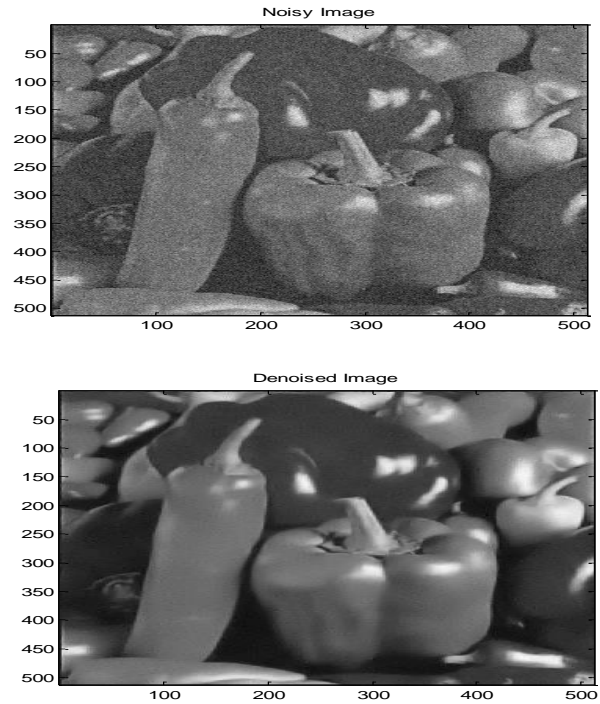


Fig. 3: Pictorial Representation of Proposed Denoising Method.

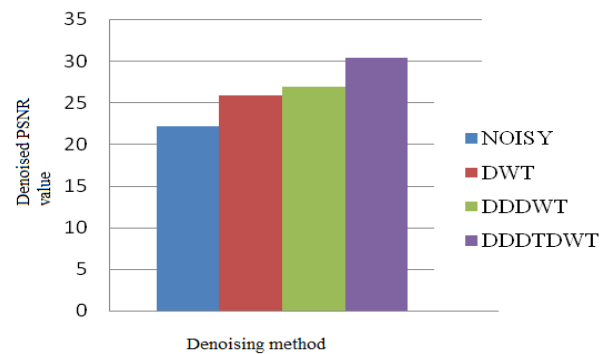


Fig. 4: PSNR Result for Different Denoising Methods.

The noisy and denoised images of proposed method are shown in figure 3. The another quality measure of image Peak Signal to Noise Ratio (PSNR) is calculated for the noisy and denoised images and the values are given in the graphical representation it is shown in figure 4.

5. Conclusion

The DDDTDWT technique has been performed for image denoising in this paper. Two more existing WT method also performed for comparison. The enhancement of degraded images using different wavelet transform techniques are presented in this paper. The performance of the wavelet techniques is analysed in terms of Peak Signal to Noise Ratio values and Root Means Square error. The performance result shows that, the DDDTDWT gives better PSNR value and RMS value for image enhancement.

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