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Discrete and Stationary Adaptive Sub-Band Threshold Method for Improving Image Resolution

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***Abstract*—**Image Processing is a structure of Signal Processing for which the input is the image and the output is also an image or parameter of the image. Image Resolution has been frequently referred as an important aspect of an image. In Image Resolution Enhancement, images are being processed in order to obtain more enhanced resolution. To generate highly resoluted image for a low resoluted input image with high PSNR value. Stationary Wavelet Transform is used for Edge Detection and minimize the loss occurs during Downsampling. Inverse Discrete Wavelet Transform is to get highly resoluted image. Highly resoluted output is generated from the Low resolution input with high quality. Noisy input will generate output with low PSNR value. So Noisy resolution enhancement technique has been used for adaptive sub-band thresholding is used. Downsampling in each of the DWT subbands causes information loss in the respective subbands. SWT is employed to minimize this loss. Inverse Discrete wavelet transform (IDWT) is to convert the object which is downsampled using DWT into a highly resoluted object. Used Image denoising and resolution enhancement techniques will generate image with high PSNR value. Our Proposed method will improve Image Resolution and reached the optimized threshold.

***Keywords*—**Image Processing, Inverse Discrete wavelet transform, PSNR.

I. Introduction

ADAPTIVE Wavelet Filter can be used to denoise the noisy image that is it can be used to remove the unwanted noise present in the image [1]. The image output from the Inverse Discrete Wavelet Transform have noise if the original input image has noise, this noise can be removed by using Adaptive Wavelet Filter [3]. Input image can be read from the image source file. Input image may be the low resoluted noisy image. SWT is used to overcome data loss in the image during downsampling process while applying DWT [2]. Image can be decomposed into various subbands and the higher level subbands can be added with the higher level subbands of the DWT. SWT can also be used for the purpose of Edge detection [4]. Discrete Wavelet Transform (DWT) is used to downsample the image and decompose the image into various subbands and add the higher subbands with the higher subbands of the SWT to prevent the data loss. Estimated Higher subbands are generated and Inverse Discrete Wavelet Transform (IDWT) [5] can be used to upsample the image that generate the high resolution output image [6].

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II. Review of Literature

Compression is individual of the main image processing technique. Image compression is the symbol of an image in digital form in the midst of as little bits as probable whereas maintain a satisfactory level of image feature [8]. Progressively more images are acquired and developed digitally or a variety of film digitizers are performed to convert conventional unprocessed images into digital design. Data compression is the technique to decrease the redundancies in data illustration in order to reduce data storage space needs and therefore communication expenses. Dropping the storage requirement is comparable to growing the capability of the storage standard enlarge the speed of communication and therefore communication bandwidth [7]. The well-organized behaviour of storing huge quantity of data and owing to the storage limitations and bandwidth, the specified images can be compressed before storage and communication. At a number of presently time, the compressed image is to reconstruct as a decompressed the unique image or estimate of it. Redundancy is that piece of data so as to remove at what time it is not essential or be capable of be reinserted to understand the data when essential. Mainly, the redundancy is to be reinserted in direct to produce the unique data in its novel form. An image must be consideration of as a matrix of pixel standards. In direct to compress the image, repeated must be demoralized, for example, areas anywhere readily available are little or no modify among pixel values. Consequently, images having huge areas of identical colour will have huge redundancies, and on the other hand images that have regular and large changes in colour will be a smaller amount redundant and it is very hard to compress [9]. The purpose of image density is to decrease redundancy of the image data in direct to be capable to store or transmit data in an efficient form. Data compression is achieved as soon as one or more of these redundancies are reduced or eliminated. There are several methods of image compression available today that is lossy and lossless image compression. In lossless compression, each solitary bit of data with the intention of file remains behind the file is uncompressed. The JPEG image file, usually used for photographs, is an image to facilitate lossy compression [10]. Wavelet analysis is a mathematical method that can be used to represent data and functions [11]. The wavelet transform is an up-and-coming signal processing method that able to be used to correspond to modern non- stationary signals with high effectiveness. A wavelet is a waveform of efficiently limited period that has a regular value of zero.

III. Proposed Method

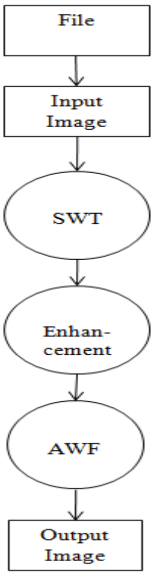

Fig. 1 Architecture of the Proposed System

Data Compression Steps:

Step1. Load the particular image to be compressed.

Step2. Performing the transform – The wavelet compression algorithm begins by the image transformation from data space to wavelet space. This can be done using several levels.

Step3. Identifying the threshold, that neglects all the coefficients of wavelet coefficients which will below an assured threshold. We choose our own threshold to protect a certain percent of the whole coefficients.

Step4. Perform compression at all the possible transform.

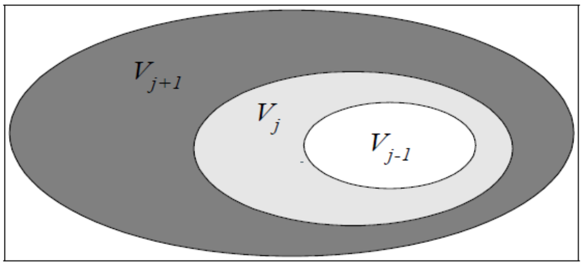

Fig. 2 Nested Subspaces

Fig. 2 demonstrates the Nested Subspaces that can be used to calculate the Discrete Transformation using Wavelet Transformation Method that can be achieved the assured threshold by using coefficients.

Wavelet transformation can be calculated using space Decomposition. Fig. 3 demonstrates the space decomposition technique.

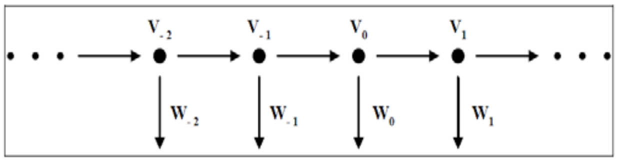

Fig. 3 Space Decomposition

$$\text{Space Decomposition}=V_j \oplus W_j \oplus W_{j+1} \oplus W_{j+2} \oplus \dots \oplus W_0 \quad (1)$$

V_j is spanned by W_{j+1} and V_{j+1}

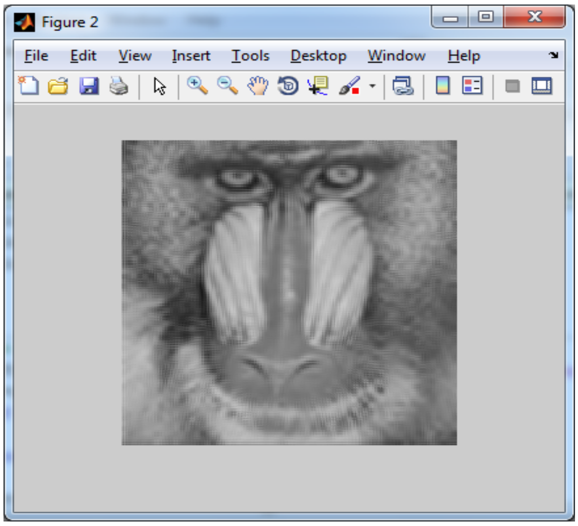

Fig. 4 Original Image

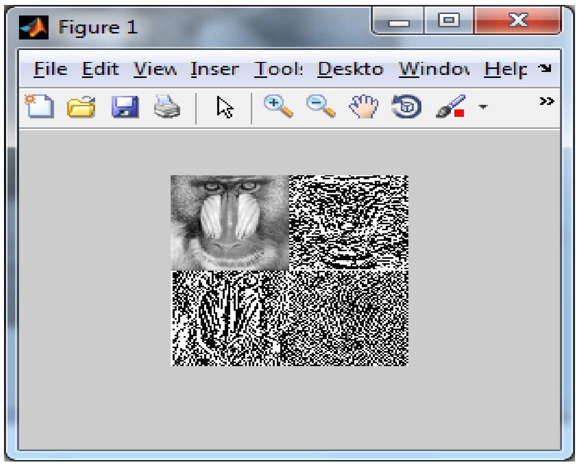

Fig. 5 After DWT

The Daubechies wavelet transforms can be calculated using Haar wavelet transform by calculating the current averages and differences via scalar products with scale signals and wavelets the only differentiation between them consists in how these scaling signals and wavelets are defined [13]. Figs. 4 and 5 illustrate that the Image can be classified using Daubechies Wavelet Transformation.

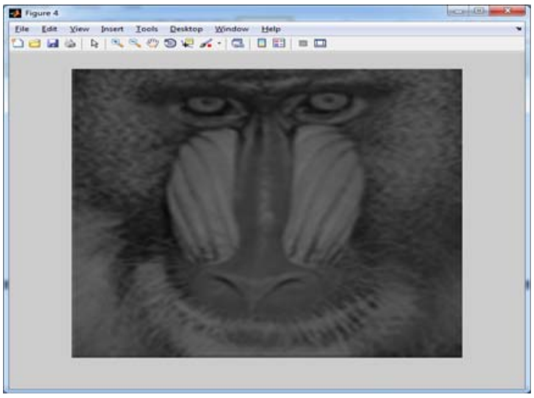

Fig. 6 After IDWT

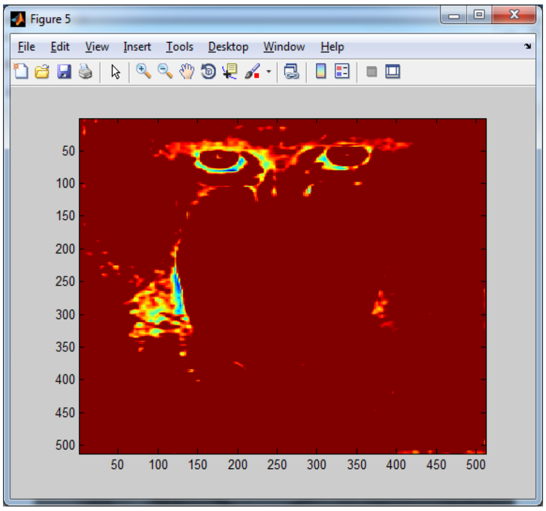

Fig. 7 Interpolated Input

DWT have been modified as an extremely proficient and executable method decomposition of signals for sub band. The 2 Dimension DWT is recognized as a main operation in an image processing. It is multiple dimension of resolution analysis and it further decomposes all the images into coefficients of wavelet and scaling function. In Discrete Wavelet Transform, every energy signal understands to specified wavelet coefficients. This feature is helpful for all the compressing images [12]. Wavelets translate the image into a sequence of wavelets which can be stored more powerfully than blocks of pixel values. Wavelets have uneven edges. In DWT, a time-scale illustration of the digital signal is calculated using digital filtering methods [14].

IV. Performance Evaluation

In this paper, we compared wavelet of Discrete wavelet transform (DWT). The value of a compression technique might be calculated by the conventional curve measures such as Mean square error (MSE) and energy retained(ER). We compared the performance of these transforms on image.

Mean Squared Error (MSE) is used to calculate the Peak signal-to-Noise Ration (PSNR).

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{i=0}^{n-1}[I(i,j) - K(i,j)]^{2} \quad (2)$$

The Peak signal-to-Noise Ratio (PSNR) can be calculated as:

$$PSNR = 10 \text{ x } \log_{10}(MSE) \quad (3)$$

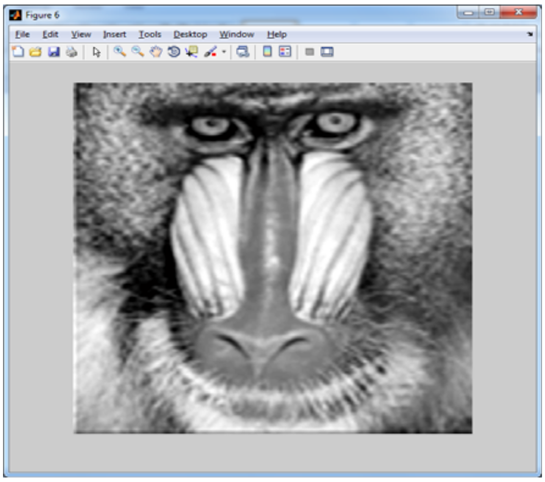

Fig. 8 Output Image with PSNR value

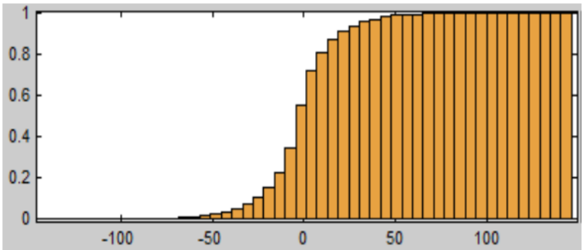

Fig. 9 Cumulated Histogram

Using Matlab Simulator, the Cumulated Histogram can be identified using the Peak Signal-to-Noise Ratio.

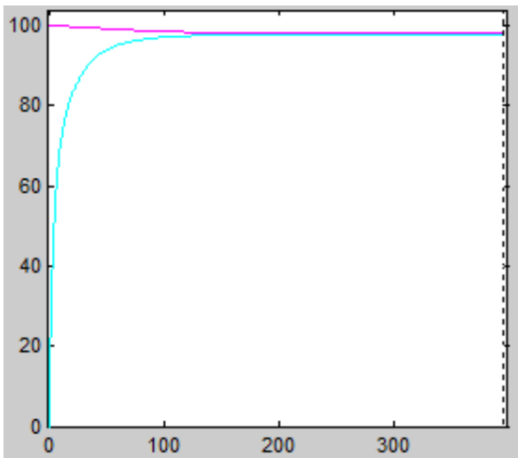

Fig. 10 Wavelet Transform

V. CONCLUSION

DWT to decay an image into dissimilar subbands, and after that the elevated frequency subband images have been interpolated. SWT can be used for edge recognition and to remove the loss of data during downsampling. IDWT to generate a super resolved imaged. Then the proposed denoising method has been used to remove the noise in the image thus the image will generate high PSNR value. Low resolution video can be taken as input, then that video can be processed by various wavelet transform to get high resolution output video for the low resolution input video and it efficiently generate high resolution color image for the low resolution image input. Noise in the input image or video object can be removed to get higher PSNR value in the output image or video object.

REFERENCES

[1] Hasan Demirel, Gholamreza Anbarjafari, “Image Resolution Enhancement by using Discrete and Stationary Wavelet Decomposition”, IEEE Transaction on Image Processing, Vol.20, No.5, May 2011.
[2] L. Yi- bo, X. Hong, and Z. Sen-yue, “The wrinkle generation method for facial reconstruction based on extraction of partition wrinkle line features and fractal interpolation,” in *Proc. 4th Int. Conf. Image Graph.*, Aug. 22–24, 2007, pp. 933–937.
[3] H. Demirel, G. Anbarjafari, and S. Izadpanahi, “Improved motion based localized super resolution technique using discrete wavelet transform for low resolution video enhancement,” in *Proc. 17th Eur. Signal Process. Conf.*, Glasgow, Scotland, Aug. 2009, pp.1097–1101.
[4] Y. Piao, I. Shin, and H. W. Park, “Image resolution enhancement using inter- subband correlation in wavelet domain,” in *Proc. Int. Conf. Image Process.*, 2007, vol. 1, pp. I-445–448.
[5] H. Demirel and G. Anbarjafari, “Satellite image resolution enhancement using complex wavelet transform,” *IEEE Geoscience and Remote Sensing Letter*, vol. 7, no. 1, pp. 123–126, Jan. 2010.
[6] C. B. Atkins, C. A. Bouman, and J. P. Allebach, “Optimal image scaling using pixel classification,” in *Proc. Int. Conf. Image Process.*, Oct. 7–10, 2001, vol. 3, pp. 864–867.
[7] W. K. Carey, D. B. Chuang, and S. S. Hemami, “Regularity-preserving image interpolation,” *IEEE Trans. Image Process.*, vol. 8, no. 9, pp. 1295–1297, Sep. 1999.
[8] J. E. Fowler, “The redundant discrete wavelet transform and additive noise,” Mississippi State ERC, Mississippi State University, Tech. Rep. MSSU-COE-ERC-04-04, Mar. 2004.
[9] X. Li and M. T. Orchard, “New edge-directed interpolation,” *IEEE Trans. Image Process.*, vol. 10, no. 10, pp. 1521–1527, Oct. 2001.
[10] S. Zhao, H. Han, and S. Peng, “Wavelet domain HMT-based image super resolution,” in *Proc. IEEE Int. Conf. Image Process.*, Sep. 2003, vol. 2, pp. 933–936.
[11] A. Temizel and T. Vlachos, “Wavelet domain image resolution enhancement using cycle-spinning,” *Electron. Lett.*, vol. 41, no. 3, pp. 119–121, Feb. 3, 2005.
[12] A. Temizel and T. Vlachos, “Image resolution upscaling in the wavelet domain using directional cycle spinning,” *J. Electron. Imag.*, vol. 14, no. 4, 2005.
[13] G. Anbarjafari and H. Demirel, “Image super resolution based on interpolation of wavelet domain high frequency subbands and the spatial domain input image,” *ETRI J.*, vol. 32, no. 3, pp. 390–394, Jun. 2010.
[14] A. Temizel, “Image resolution enhancement using wavelet domain hidden Markov tree and coefficient sign estimation,” in *Proc. Int.Conf. Image Process.*, 2007, vol. 5, pp. V-381–384.

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