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 resolved image for a low resolved 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 resolved image. Highly resolved 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 resolved 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 resolved 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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III. PROPOSED METHOD

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 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.

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.
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).

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

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

\[
PSNR = 10 \times \log_{10} (MSE)
\]
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