DISCRETE WAVELET TRANSFORM-BASED DIFFERENT SATELLITE IMAGE RESOLUTION ENHANCEMENT

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***Abstract*- In many research field satellite Images are used. Resolution of these satellite images are major issue .Interpolution technique is used for satellite image resolution enhancemet. Discrete Wavelet Transform produce four different frequency subbands. This technique uses DWT to decompose input image into four different frequency subbands. Input low resoluted image and high frequency subband are interpolated to generate a new resolute image by using DWT .This technique is tested on different satellite images and resolution is obtained by Peak Signal to Noise ratio**

***Keywords*- Discrete Wavetet Transform(DWT), Cycle Spinning(CS)**

I. INTRODUCTION

In many video and image processing resolution of an image is important issue. Interpolution technique simply increases the number of pixels in a digital image.this technique is widely used in many image processing application[1]. Interpolution have been developed to increase the quality of an image.Nearest neighbor, Bilinear and Bicubic are three well known interpolation technique.Wavelet are playing important role in many image processing application[9]. DWT produce four decomposed subband images low-low(LL), low-high(LH), high-low(HL), high-high(HH). These four frequency subbnds cover the full frequency spectrum of original image.To generate different frequency subband a filter bank is used.

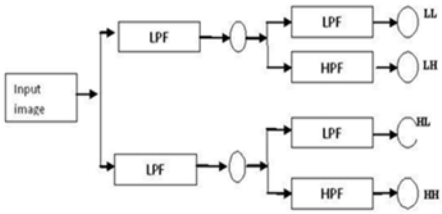

Fig 1: Block Diagram of DWT Filter Bank

Fig 2: LL, LH, HL ,HH subbands of satellite image by using DWT

This paper propose a resolution enhancement technique using input low resolute image and interpolated DWT high frequency subband images. IDWT(Inverse DWT) has been applied to combine all these images to generate final resolution enhanced image.This purpose technique is compared with WZP(Wavelet Zero Padding),CS(Cycle Spinning) method.

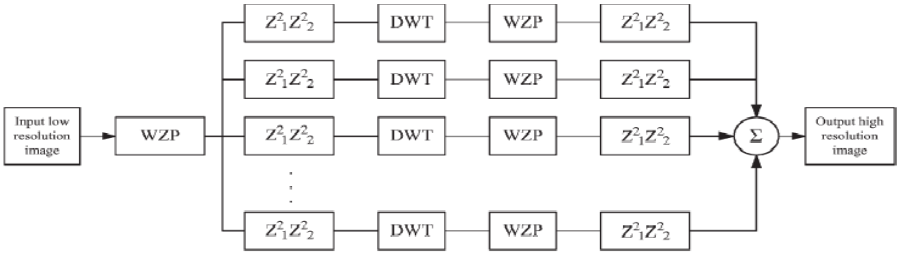

Fig 3. Block diagram of WZP and CS base image resolution enhancement

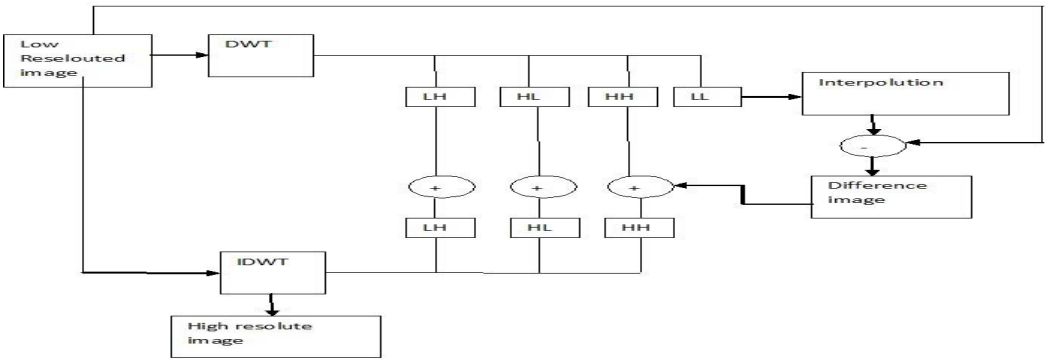

Fig.4 Block diagram of proposed resolution technique

II. WAVELET-BASED IMAGE RESOLUTION ENHANCEMENT

For satellite image resolution enhancement there are several methods in which we are used two methods for comparison purpose.One is WZP and CS and other is CWT based image resolution enhancement[3].

1] CS-BASED IMAGE RESOLUTION ENHANCEMENT

The algorithm consists of following steps

a] An initial approximation to the unknown high resolution image is generated using wavelet domain Zero Padding(WZP)[3]

b] cycle spinning method provide number of low resolution images are generated from the obtained high resolution by spatial shifting, wavelet transforming and discarding the high frequency subband

(a) (b)

III. DWT –BASED RESOLUTION ENHANCEMENT

Resolution is important feature in satellite imaging which will directly affect on the performance of the system, using these images as input image. Here DWT is used to preserve the high frequency component of the image[9].DWT separate the images into different subband images as LL ,LH, HL and HH. High frequency subband contains the high frequency components of the image. Interpolution can be applied to these four subband images[1].In wavelet domain,yhe low resolution image is obtained by low pass filtering of the high resolution image.This low resolute image is used as input image.The high frequency subband and low resoluted input image are interpolated,by taking inverse DWT(IDWT) we get new resolute image.

(c)

Fig 5 (a) Low Resoluted Input image,(b) Enhanced Image (c)LL,LH,HL,HH subbands of satellite image by using DWT

(a) (b)

(c)

Fig 6 (a) Low Resoluted Input image,(b) Enhanced Image (c)LL,LH,HL,HH subbands of satellite image by using DWT

(a) (b)

(c)

Fig 7 (a) Low Resoluted Input image,(b) Enhanced Image (c)LL,LH,HL,HH subbands of satellite image by using DWT

(a) (b)

(c)

Fig8 (a) Low Resoluted Input image,(b) Enhanced Image (c)LL,LH,HL,HH subbands of satellite image by using DWT

TABLE I: PSNR (DECIBELS) RESULTS FOR RESOLUTION ENHANCEMENT FOR DWT BASED SATELLITE IMAGES

	Fig5	Fig6	Fig7	Fig8
Input Image	24.176	24.0654	24.100	24.0654
Enhance Image	24.192	24.0655	24.157	24.0658
Elapsed Time (Seconds)	1026.571	581472	741.675	454.443

TABLE II: PSNR (DECIBELS) RESULTS FOR RESOLUTION ENHANCEMENT FOR DWT BASED SATELLITE IMAGES COMPARED WITH CONVENTIONAL TECHNIQUES

Method/Image	Fig5	Fig6	Fig7	Fig8
Bicubic	19.89	17.23	24.37	23.69
WZP	17.30	18.07	20.05	22.03
WZP and CS	21.08	18.85	24.09	28.10
Proposed Technique	24.19	24.06	24.15	24.06

IV .RESULT

The proposed technique have been tested on several different satellite images.So above figure 5, 6 and 7 shows the superior resolution of satellite images.The resolution of satellite image is obtained by PSNR(Peak Signal to Noise Ratio). Not only visual comparison but also PSNR gives supper resolution of satellite images .This PSNR is calculated by,

$$PSNR = 10 \log_{10} (R^2 / MSE)$$

Where R is maximum fluction in the input image and MSE is mean squere error.

V. CONCLUSION

This technique will propose a new resolution enhancement technique based on the interpolation of the high-frequency subband images obtained by DWT and the input image. The resolution of satellite imges are obtained by PSNR(Peak Signal to Noise Ratio).

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