International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

An Effective method for Satellite Image Enhancement

Prof. Dr. M. Narayana (ph.d) , K.Durga Prasad , P.Jyothi
[1]Head of the Department (ECE) JayaPrakash Narayana College of engg Mahabubnagar,Telangana,India
[2]Associate Professor JPNCE Mahabubnagar,Telangana,India
[3]M.Tech Scholar JayaPrakash Narayana College of engg Mahabubnagar,Telangana,India

ABSTRACT:- *Satellite colour images are being used in many fields of research. One of the major issues of these types of colour images is their poor perception. In this letter a new method to enhance the satellite image which using the concept of wavelet and multi structure decomposition. The proposed enhancement technique uses DWTwith SWT to decomposed input image into different sub bands. Multi Structure decomposition is a Powerful theoretical tool, which is used in nonlinear image analysis .Detecting the positions of the edges through threshold decomposition and these edges are sharpened by using filter. This method will give better qualitative and quantitative results.*

Keywords: - Discrete wavelet Transform (DWT), ,SWT,FFT ,STFT,Satellite ImageEnhancement Validation Analysis

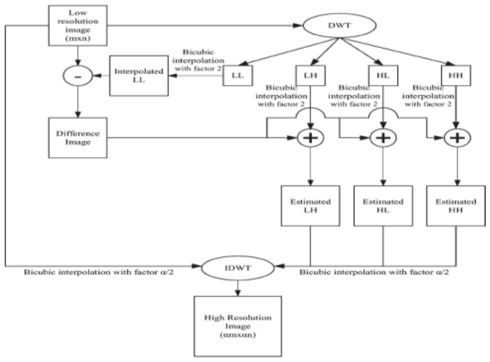
1.INTRODUCTION

Pictures are the most common and convenient means of conveying or transmitting information. A picture is worth a thousand words. Pictures concisely convey information about positions, sizes and inter-relationships between objects. They portray spatial information that we can recognize as objects Satellite Image Contrast Enhancement is the technique which is most widely required in the field of image

processing to improve quality of the feature [1]. In general, the popular edge enhancement filtering is carried out with the help of traditional filters [2, 3 and 4]. But these filters do have some problems, especially while enhancing edges sharpened for image. The effort on edge enhancement has been focused mostly on improving the visual perception of images that are not clarity because of so many sub bands. Noise removal and preservation of useful information are important aspects of image enhancement[5]. A wide variety of methods have been proposed to solve the edge preserving and noise removal problem for more improvement. Wavelets are also playing a most role in many image-processing applications. The Wavelet decomposition of an image is performed by applying their performance was very slow; hence, researchers

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

developed a new version which is easier to use and understand. In this new method, the use of the ridge let transform as a pre-processing step of wavelet was discarded, thus reducing the amount of redundancy in the transform and increasing the speed considerably The first part of the tutorial reviews the motivation of " Why Wavelet Proposed " and briefly reminds the history of tiling in time frequency space. Followed, the wavelet transform structure is shown. The wavelet transform can be decomposed with four steps: (1) Sub band Decomposition (2) Smooth Partitioning (3) Renormalization (4) Ridge let Analysis. Resolution is the major issue in these kinds of images.Resolution is one of the important characteristics of an image.Images are transformed in order to obtain high resolution. One of the most commonly image resolution enhancement[8][10] technique is interpolation. Interpolation is widely used whileenhancing the resolution of an image. Three different interpolation techniques are present. Nearest neighbourinterpolation, bilinear interpolation and bicubic interpolationare three interpolation techniques. Image resolution enhancement using wavelet domain is a new topic and on this domain there are many algorithms present. Wavelet plays an important role in image resolution enhancement. Here, two wavelet based image resolution enhancement techniques are shown. The first technique is based on discrete wavelet transform and the second technique is based on discrete wavelet and stationary wavelet transform. Both these techniques are compared using different satellite images.



Fig; 1: Block Diagram: Discrete Wavelet Transform

This has two advantages: it reduces the edge detection to a simple binary process of each and every angle; and it makes the estimation of edge direction straight and cross condition also. Edge detection and direction estimation may be carried out by identifying simple patterns, which are closely related to the Prewitt operators [6]. These detected edges were then sharpened by using some morphological filters [9].. A summation is applied over all levels in order to reconstruct the sharpened image.

1.1 Image Enhancement:-

Image enhancement techniques improve the quality of an image as perceived by a human. These techniques are most useful because many satellite images when examined on a colour display give inadequate information for image interpretation. There is no conscious effort to improve the fidelity of the image with regard to some ideal form of the image. There exists a wide variety of techniques for improving image quality. The contrast stretch, density slicing, edge enhancement, and spatial filtering are the more commonly used techniques. Image enhancement is attempted after the image is corrected for geometric and radiometric distortions. Image enhancement methods are applied separately to each band of a multispectral image. Contrast generally refers to the difference in luminance or grey level values in an image and is an important characteristic. It can be defined as the ratio of the maximum intensity to the minimum intensity over an image. Contrast ratio has a strong bearing on the resolving power and delectability of an image. Larger this ratio, more easy it is to interpret the image. Satellite images lack adequate contrast and require contrast improvement.

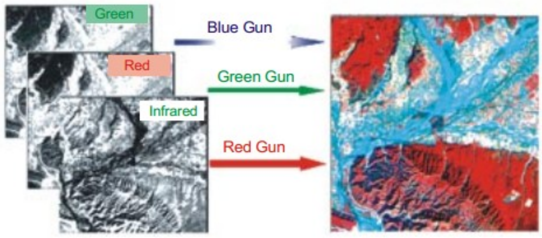


Fig: 2 Plane Separation Process on Input Image

A colour infrared composite 'standard false colour composite' is displayed by placing the infrared, red, and green in the red, green and blue frame buffer memory (Fig. 3). In this healthy vegetation shows up in shades of red because vegetation absorbs most of green and red energy but reflects approximately half of incident Infrared energy. Urban areas reflect equal portions of NIR, R & G, and therefore they appear as steel grey. While displaying the different bands of a multispectral data set, images obtained in different bands is displayed in image planes (other than their own) the colour composite is regarded as False Colour Composite (FCC). High spectral resolution is important when producing colour components. For a true colour composite an image data used in red, green and blue spectral region must be assigned bits of red, green and blue image processor frame buffer memory. Wavelets implementations are based on the original construction which uses a pre-processing step involving a special partitioning of phase-space followed by the ridge let transform which is

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

applied to blocks of data that are well localized in space and frequency. In the last two or three years, however, wavelets have actually been redesigned in an effort to make them easier to use and understand. As a result, the new construction is considerably simpler and totally transparent. Moreover, this process is very time consuming, which makes it less feasible for texture features analysis in a large database Fast discrete wavelet transform based on the wrapping of Fourier samples has less computational complexity as it uses fast Fourier transform instead of complex ridge let transform. In this approach, a tight frame has been introduced as the wavelet support to reduce the data redundancy in the frequency domain.To achieve higher level of efficiency, wavelet transform is usually implemented in the frequency domain. That is, both the wavelet and the image are transformed and are then multiplied in the Fourier frequency domain. The product is then inverse Fourier transformed to obtain the wavelet coefficients. The process can be described as

Wavelet transform = IFFT [FFT(Wavelet) × FFT(Image)] and the product from the multiplication is a wedge .The trapezoidal wedge in the spectral domain is not suitable for use with the inverse Fourier transform which is the next step in collecting the wavelet coefficients using IFFT.

The wedge data cannot be accommodated directly into a rectangle of size $2j \times 2j/2$. To overcome this problem, Candies et al. have formulated a wedge wrapping procedure [10] where a parallelogram with sides $2j$ and $2j/2$ is chosen as a support to the wedge data.The wrapping is done by periodic tiling of the spectrum inside the wedge and then collecting the rectangular coefficient area in the centre.

1.2 SHORT-TIME FOURIER ANALYSIS

In an effort to correct this deficiency, Dennis Gabor (1946) adapted the Fourier transform to analyze only a small section of the signal at a time—a technique called windowingthe signal. Gabor's adaptation, called the Short-Time Fourier Transform(STFT), maps a signal into a two-dimensional function of time and frequency.

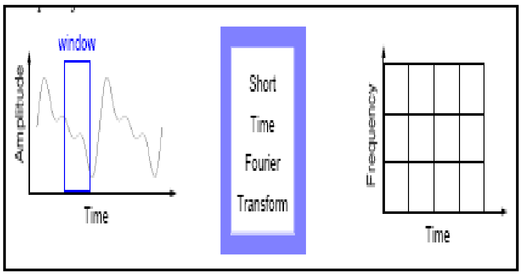


Fig3. Short Time Fourier Transform

The STFT represents a sort of compromise between the time- and frequency-based views of a signal. It provides some information about both when and at what frequencies a signal event occurs. However, you can only obtain this information with limited precision, and that precision is determined by the size of the window. While the STFT compromise between time and frequency information can be useful, the drawback is that once you choose a particular size for the time window, that window is the same for all frequencies. Many signals require a more flexible approach—one where we can vary the window size to determine more accurately either time or frequency.

2. PROPOSED ALGORITHM:

In image resolution enhancement by using interpolation the main loss is on its high frequency components (i.e., edges), which is due to the smoothing caused by interpolation. In order to increase the quality of the super resolved image, preserving the edges is essential. In this work, DWT has been employed in order to preserve the high frequency components of the image. The redundancy and shift invariance of the DWT mean that DWT coefficients are inherently interpolable.In this correspondence, one level DWT (with Daubechies 9/7 as wavelet function) is used to decompose an input image into different subband images. Three high frequency subbands (LH, HL, and HH) contain the high frequency components of the input image. In the proposed technique, bicubic interpolation with enlargement factor of 2 is applied to high frequency subband images. Downsampling in each of the DWT subbands causes information loss in the respective subbands. That is why SWT is employed to minimize this loss. The interpolated high frequency subbands and the SWT high frequency subbands have the same size which means they can be added with each other. The new corrected high frequency subbands can be interpolated further for higher enlargement. Also it is known that in the wavelet domain, the low resolution image is obtained by lowpass filtering of the high resolution image. In other words, low frequency subband is the low resolution of the original image. Therefore, instead of using low frequency subband, which contains less information than the original high resolution image, we are using the input image for the interpolation of low frequency subband image. Using input image instead of low frequency subband increases the quality of the super resolved image. Fig. 1 illustrates the block diagram of the proposed image resolution enhancement technique.

By interpolating input image by $\alpha/2$, and high frequency subbands by 2 and α in the intermediate and final interpolation stages respectively, and then by applying IDWT, as illustrated in Fig. 1, the output image will contain sharper edges than the interpolated image obtained by interpolation of the input image directly. This is due to the fact that, the interpolation of isolated high frequency

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

components in high frequency subbands and using the corrections obtained by adding high frequency subbands of SWT of the input image, will preserve more high frequency components after the interpolation than interpolating input image directly

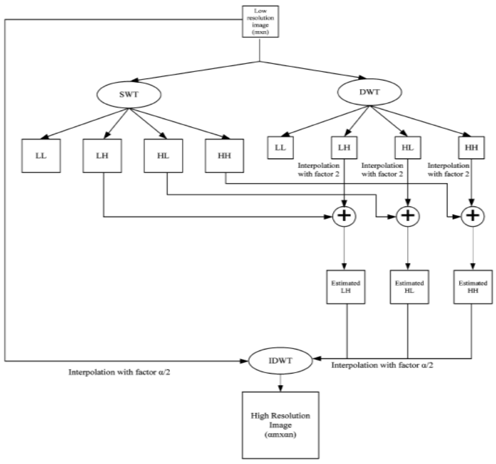


Fig4. Block diagram of the proposed super resolution algorithm

. Image enhancement techniques are used to improve an image, where "improve" is sometimes defined objectively (e.g., increase the signal-to-noise ratio), and sometimes subjectively (e.g., make certain features easier to see by modifying the colours or intensities). Peak signal to noise ratio (PSNR) and root mean square error (RMSE) have been implemented in order to obtain quality results. PSNR can be obtained by using the following formula:

PSNR = 10 log10[(255X255)/RMSE] (2)

RMSE is representing input image I1 and proposed enhanced image I2 which can be obtained by the following formula:

MSE= {∑∑ [K (i, j)-P (i, j)] ^2} / (MXN) (3)

In Root Mean Square Error

RMSE=√ ({∑∑ [K (i, j)-P (i, j)] ^2} / (MXN)) (1)

3. RESULT ANALYSIS:

The results for the enhancement of satellite images are given. The images tested in the proposed method were performed shown in figure (e) which was express in the numerical form of satellite image. The result image can be evaluated with three characteristics, edges, distortion and sharpness. According to the distortion evaluation, adjusting errors are required, by computing the Mean Square Error (MSE). Mean square error has been the performance metric in lost performance compared with Wavelet Enhancement. Peak Signal to Noise Ratio (PSNR) adjusts the quality of the image which the higher the PSNR refers to the better quality for Wavelet Enhancement image. Quantity is high in proposed image enhancement techniques

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

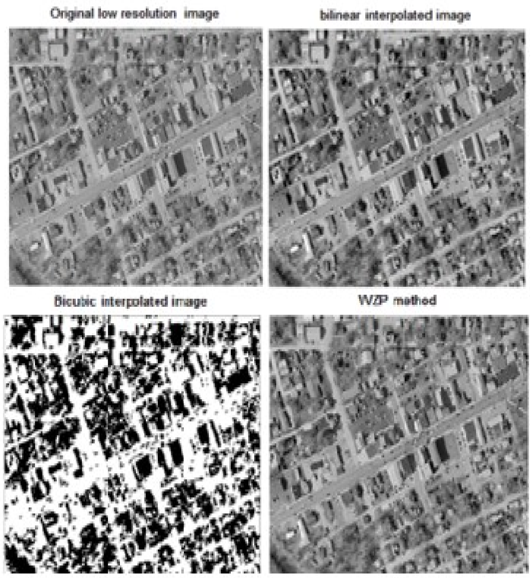


Fig. Original LR image, Bilinear, Bi-cubic and WZP method

Fig. Proposed resolution model

Table 1: PSNR and MSE values of various methods

	PSNR in dB	MSE
Bilinear	47.74	10.98
WZP	58.74	8.68
DWT-RE	58.9	8.19
Proposed	59.29	7.64

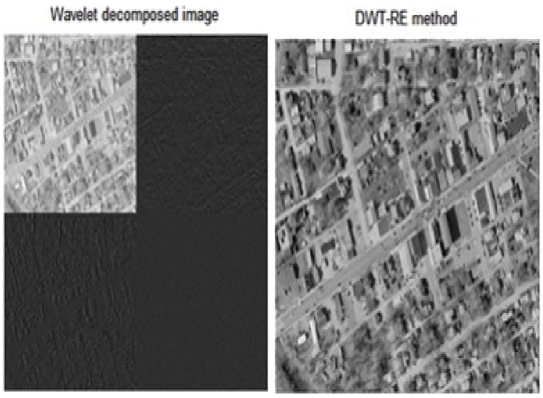


Fig. DWT-RE method

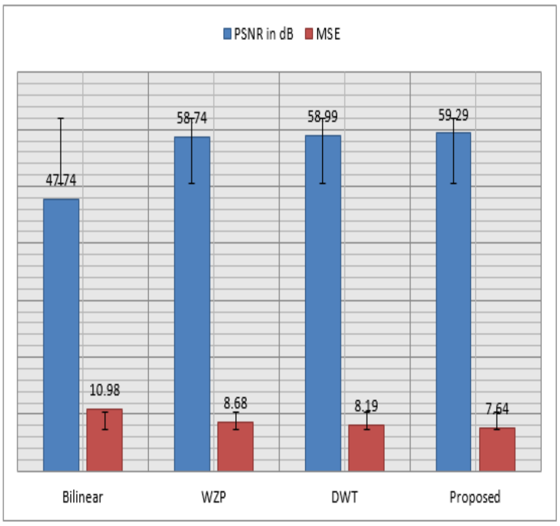


Fig. Comparison of PSNR and MSE values

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

4. Future Scope:-

This resolution enhancement can further improve with Lenclos based up-sampling and Gabor filtering for texture characterization. Up-sampling reduces the distortion of detailed information and Gabor provides detail, structure components at different orientations using Satellite Images.

5.REFERENCES:-

[1] Chao Rui;Zhang Keg Li Yan-jun. An image fusion algorithm using Wavelet Transform[J]. Chinese Journal of Electronics，2004 32(5):750 753.

[2] Li, H., Manjunath, B.S., Mitre, S.K., 1995. Multi sensor image fusion using the Wavelet Transform. Graphical Models Image, Process. 57 (5), 235–245.

[3] Li, S., Wang, Y., 2000. Multi sensor image fusion using discrete multi Wavelet Transform. In: Proc. 3rd Internat. Conf. on Visual Computing, pp. 93–103.

[4] Li, H., Manjunath, B.S., Marta, S.K., 1995. Multi sensor image fusion using the Wavelet Transform. Graphical Models Image Process. 57 (5), 235–245.

[5] E. J. Candies'. L. Donohue. Wavelets：A surprisingly effective non-adaptive representation for objects with edges [J].

[6] PU Tina, FANG Qing Zhen, NI Goutkiang, Contrast-Based Multi-resolution Image Fusion ActElectronicSonica, 2000 V.12, pp.116-118 (in Chinese).

[7] E. J. Candies and D. L. Donohue, "Wavelets—a surprisingly effective Non-adaptive representation for objects with edges," in Curve and Surface Fitting:Saint-Malo 1999, A. Cohen, C. Rabat, and L. L. Schumacher,
Eds. Nashville, TN: Vanderbilt University Press, 1999.

[8] J. L. Stark, F. Muztagh, and A. Bijaoui, Image Processing and Data Analysis: The Multi scale Approach. Cambridge, U.K.: Cambridge Univ. Press, 1998.

[9] E. J. Candies and D. L. Donohue.
Wavelets: new tools for limited-angle tomography, Manuscript, 2004.

[10] Donohue, D. L., Minimum Entropy Segmentation, in Wavelets: Theory, Algorithms and Applications, C. K. Chui, L. Montefusco and L. Pucker (eds.), Academic Press, San Diego, 1994, 233{270}.

[11]J. L. Stark, E. Candies, and D. L. Donohue, "The wavelet transform for image de-noising," IEEE Trans. Image Processing, vol. 11, pp. 131–141, June 2002.

[12] A.M. Mendon and A. Campeche, "Segmentation of retinal blood vessels by combining the detection of centre lines and morphological reconstruction," IEEE Trans. Med. Image., vol. 25, no. 9, pp. 1200– 1213, Sep. 2006.