ISSN 2347-4289

Brightness Preserved Resolution Enhancement Using DWT-SWT Technique

Vismi V, Suvi V
Department of Computer Science And Engineering, University of Kerala, Sree Buddha College of Engineering, Kollam
Department of Computer Science And Engineering, University of Cochin, TKMIT, Kollam
vismiviswanath@gmail.com, suvivs56@gmail.com

***Abstract*:** The paper "Brightness Preserved Resolution Enhancement Using DWT-SWT Technique" makes use of both wavelet and brightness preserving technique.The proposed technique focussing on increasing the resolution as well as preserving the brightness in the images. First DWT SWT [1]decomposes the input image separately. Thus it generates a pair of LL, LH, HL, HH. The bands from DWT undergo interpolation namely bicubic inorder to attain the size of SWT bands. The LL, LH, HL, HH from SWT need not interpolate as it has the same size as that of the input image. Then combine each of the high frequency subbands and generate estimated LH, HL, HH. Then interpolate the input image for getting the LL band. These all have to combine by using IDWT. Then perform Brightness Preserving Bi Histogram Equalisation (BBHE)[2].

Key words: Discrete wavelet transform (DWT), Stationary wavelet transforms (SWT),bicubic interpolation, Brightness Preserving Bi Histogram Equalisation(BBHE)

I. INTRODUCTION

In recent years there is an increase in the demand for better quality images in the various applications such as medical, astronomy, object recognition etc.Today,satellite images are used in many applications. But the main problem of satellite image is low resolution. So while enhancing the resolution of these images, it will directly affect the performance of the system. Hence,in order to increase the quality of the enhanced images, preserving the edges is essential.So perform interpolation technique.But by applying interpolation directly to the images,many artifacts like blurring,blocking etc are occured. The main loss of an image after applying interpolation is the loss of high frequency components which is due to the smoothening caused by interpolation. Hence,in order to increase the quality of the enhanced images, preserving the edges is essential. This problem can be solved by interpolating the images in wavelet domain. This paper makes use of the bicubic interpolation technique applied in wavelet domain. There are mainly two domains.out of which,wavelet domain includes in transform domain. The major advantage of wavelet transform is that,it can perform multi-resolution analysis of a signal with localization in both time and frequency. Image Resolution has been frequently referred as an important aspect of an image. Images are being processed in order to obtain more enhanced resolution. One of the commonly used techniques for image resolution enhancement is Interpolation. Interpolation [6] has been widely used in many image processing applications such as facial reconstruction, multiple description coding, and super resolution. There are three well known interpolation techniques, namely nearest neighbor interpolation, bilinear interpolation, and bi cubic interpolation. Image resolution enhancement in the wavelet domain is a relatively new research topic and recently many new algorithms have been proposed. Discrete wavelet transform (DWT) is one of the recent wavelet transforms used in image processing. DWT decomposes an image into different sub band images, namely low-low (LL), low high (LH), high-low (HL), and high-high(HH). Another recent wavelet transform which has been used in several image processing applications is stationary wavelet transform (SWT). In short, SWT is similar to DWT but it does not use down-sampling, hence the sub bands will have the same size as that of the input image. Image resolution enhancement technique which generates sharper high resolution image. The proposed technique uses DWT to decompose a low resolution image into different sub bands. Then the three high frequency sub band images have been interpolated using bi cubic interpolation. The high frequency sub bands obtained by SWT of the input image are being incremented into the interpolated high frequency sub bands in order to correct the estimated coefficients. In parallel, the input image is also interpolated separately. Finally, corrected interpolated high frequency sub ands and interpolated input image are combined by using inverse DWT (IDWT) to achieve a high resolution output image. The proposed technique has been compared with conventional and state-of-art image resolution enhancement techniques. The remaining section of this paper is organised as follows Section II gives an idea of literature survey. Section III describes the details about proposed technique and finally section IV concludes the paper.

II.LITERATURE SURVEY

Gholamreza Anbarjafari and Hasan Demirel[3]proposed a technique by using DWT.DWT decomposes an image into different sub-band images which includes Low-Low, Low-High, High-Low, and High-High. The high frequency sub-bands contain edge information and LL contains the low resolution of the input image. Therefore, instead of using low-frequency sub-band images, which contain less information than the original input image, we are using the input image for the interpolation of low-frequency sub-band images. The high frequency components obtained by DWT are interpolated using bicubic interpolation. In parallel, the input is interpolated using bicubic separately. As LL is the low resolution of the original image, so that it is better to use interpolation of input image for obtaining the LL band rather than using LL from DWT. This increases the quality of the image. The high frequency components are interpolated with interpolation factor .The input image is interpolated with half of the interpolation factor needed for high frequency components. So the output has sharper images. Then these are combined using IDWT. The advantage of the proposed system is that the interpolation of isolated high-frequency components in HH, HL, and LH will preserve more edge information. The drawback is that it uses the original image only for obtaining LL band from it and it does not consider the high frequency component present in the original image. So there is a loss of some of the high frequency components. In this paper [4], DWT has been employed in order to preserve the high-frequency components of the image. DWT separates the image into different sub

ISSN 2347-4289

band images, namely LL, LH, HL, and HH. High-frequency sub-bands contain the high-frequency component of the image and low frequency images are the low resolution of the original image. The interpolation cans be applied to these four sub band images. Thus four interpolated sub bands are obtained .In order to preserve more edge information i.e. obtaining sharper enhanced image an intermediate stage is proposed. This intermediate stage is obtained by taking the difference between interpolated LL sub-bands with a factor 2 and input low resolution image. Thus a difference image is obtained and this image contains only high frequency components. Hence, this difference image can be used in the intermediate process to correct the estimated high-frequency components. This estimation is performed by adding the interpolated high frequency components with the difference images. Thus an estimated high frequency components is obtained and this estimated high frequency sub-bands is again interpolated with bicubic interpolation with factor α/2 in order to reach the required size for IDWT process. Thus using inverse DWT combine the interpolated input image with these estimated high frequency components and obtained a high resolution images. In this paper[5], dual-tree CWT (DT-CWT) to decompose a low-resolution image into two complex value low frequency sub-band images and six complex valued high frequency images. These high frequency bands are obtained using direction selective filter as it gives peak magnitude responses for the image features when it orients at +75,+45,+15,-15,-45,-75 degrees. The low frequency sub-band images are the low resolution of the original image. Therefore, instead of using low-frequency sub band images, which contain less information than the original input image, we are using the input image for the interpolation of two low-frequency sub-band images. The next step is to apply interpolation using bicubic interpolation to the six complex-valued high-frequency sub-bands in parallel the input image is also interpolated using bicubic interpolation. While interpolating the input images two up-scaled images are generated and these up-scaled images are the shifted version of the input image in horizontal and vertical directions. These two real-valued images are used as the real and imaginary components of the interpolated complex LL image. This interpolated LL image is combined with interpolated high frequency sub-bands using inverse DT-CWT. The advantage of the paper is that it is shift invariant, limited redundancy and good directional selectivity. The problem with it is that there is a loss of high frequency components and computational power is higher

III.PROPOSED METHOD

The proposed enhancement method basically involves two steps .In the first step, perform resolution enhancement and in the second step brightness preserving is done.. Resolution enhancement is done using DWT-SWT technique and brightness preserving is performed by Brightness Preserving Bi Histogram Equalisation (BBHE).

A. DWT –SWT Technique

Here resolution enhancement is performed by make use of interpolation technique applied in wavelet domain. Interpolation is applied on high frequency components and that of the input image. But what it differs from the other similar paper is that it makes use two of the most popular technique namely DWT (Discrete Wavelet Transforms) and SWT (Stationary Wavelet Transforms). Both SWT and DWT are similar but SWT does not use down sampling. So there occurs the problem that, the sub-bands will have the same size as the input image. In this work, DWT has been employed in order to preserve the high frequency components of the image. But down sampling in each of the DWT sub-bands causes information loss in the respective sub-bands. That is why SWT is employed to minimize this loss. First, the low resolution input image under goes both SWT and DWT separately. Thus decompose the input low resolution input image into different sub-bands namely low-low (LL), low high (LH), high-low (HL), and high-high (HH). Three high frequency sub-bands (LH, HL, and HH) contain the high frequency components (edge details) of the input image. The interpolated high frequency sub-bands from DWT and that of the SWT have the same size which means they can be added with each other. The new corrected high frequency sub-bands can be interpolated further for higher enlargement. Among them the high frequency components are interpolated using bicubic with a interpolation factor of 2. Ignore the LL bands from both of it, as the low frequency sub-bands is the low resolution of the input image, it is better to interpolate the input image independently for obtaining the LL Sub-bands. Then take a summation of these interpolated high frequency components obtained from both DWT and SWT. Thus obtained the estimated high frequency components. Then, the input image is interpolated with half of the interpolation factor required for interpolating the high frequency components and in parallel applies interpolation to the estimated high frequency sub-bands with half of the interpolation factor. After interpolating they are combined using IDWT. The main advantage is that, the interpolation of isolated high frequency components in high frequency sub bands and using the corrections obtained by adding high frequency sub bands of SWT of the input image, will preserve more high frequency components than interpolating directly the input image.

B. Brightness Preserving Bi Histogram Equalisation

The output image obtained from the above technique is a high resolution image but to preserve the brightness of the image Brightness Preserving Bi Histogram Equalisation (BBHE) technique is used. The BBHE technique decomposes the output image obtained from the DWT-SWT technique into two sub images based on the mean of the input images. Here the processing starts with finding the mean of the input image, then based on this mean it divides the image into two different sub images. So one of the sub image contains set of samples less than or equal to the mean of the input image. While the other one contain image greater than the mean. Then using BBHE it equalises the sub images independently based on the respective histograms. This equalisation process work with the constraint that the samples in the formal set are mapped into the range from the minimum gray level value to the input mean and the samples in the latter set are mapped into the range from the mean value to the maximum gray level value. Then equalises the sub images based on the above mentioned range. Thus the equalises sub images are bounded by each other around the input mean. This image has an effect of preserving mean brightness of the image. Thus the output obtained is a brightness preserved high resolution image.

ISSN 2347-4289

IV.CONCLUSION

This proposed paper focussing on resolution enhancement of satellite images by preserving the brightness too. Here an emerging technique namely DWT-SWT is employed for better handling of resolution. By using these two techniques at the same time, the output image can preserve more high frequency bands, there by preserving the edges too as they are contained in these high frequency components. It is performed by dividing the input image into different band, the enhanced image is of better quality. Moreover the enhanced image has to undergo brightness preserving technique.

REFERENCES

[1] Hasan Demirel and Gholamreza Anbarjafari, ”Image resolution enhancement by using discrete and stationary wavelet decomposition” ,IEEE image processing, vol.20, no. 5, May 2011

[2] Komal Vij and Yaduvir Singh,”Enhancement of image using histogram processing techniques”, Int. J. Comp. Tech. Appl., Vol 2(2), 309-313

[3] Gholamreza Anbarjafari and Hasan Demeril,” Image super resolution based on interpolation of wavelet domain high frequency subbands and spatial domain input image ”, ETRI J., vol. 32, no. 3,pp.390-394, jun.2010

[4] Hasan Demirel and Gholamreza Anbarjafari, ”Discrete Wavelet Transform Based Satellite Image Resolution” ,IEEE image processing, vol.20, no. 5, May 2011

[5] H. Demirel and G. Anbarjafari,“ Satellite image resolution enhancement using complex wavelet transform ”, IEEE Geosci. Remote Sens. Lett., vol. 7, no. 1, pp. 123–126, Jan. 2010

[6] Tinku Acharya and Ping-Sing Tsai**,** “Computational Foundations of Image Interpolation Algorithms”, ACM Ubiquity, Vol. 8, 2007