International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 4, April 2014)

Image Superresolution using Discrete and Stationary Wavelet Transform

Firdous.M. Ghante
Dept of E & TC,
Sinhgad Academy of Engg, Pune, India.
firdousghante@gmail.com

Atul.B.Ingole
Asst Prof, Dept of E & TC,
Sinhgad Academy of Engg, Pune, India.
ingoleatulb@gmail.com

***Abstract*— This paper reviews the techniques available for image resolution enhancement. Nowadays images are widely used over the internet and also in medical and security areas. This paper, also propose a image resolution enhancement technique based on Bicubic interpolation of high frequency subband obtained from DWT and the input image.DWT is applied in order to decompose an input image into different subbands. The estimated high frequency subbands are being modified by using high frequency subbands obtained from SWT. All these images are combined to generate new resolution enhanced image by using IDWT.**

Keywords—Discrete wavelet transform, Bicubic interpolation, Stationary wavelet transform.

I. INTRODUCTION

Resolution is the important parameter of image. Many techniques are available to enhance the resolution of image, more generally interpolation is used. Interpolation has been widely used in multiple description coding [2], facial reconstruction [3] and super resolution [4]-[7], There are many techniques available for interpolation such as nearest neighbor interpolation, bilinear interpolation and bicubic interpolation.

Wavelet is also new and very efficient way to use for image resolution enhancement. Many new algorithms have been proposed using wavelets [5]-[8]. Discrete wavelet transform (DWT) [9] is one of the recent wavelet transforms used in image processing... Another recent wavelet transform which has been used in several image processing applications is stationary wavelet transform (SWT). In this approach a resolution enhanced image obtained this is done by first decomposing an input image into different subbands using DWT. Then high frequency subbands of images have been interpolated by using bicubic interpolation. The high frequency subbands obtained by SWT of the input image are being incremented into the interpolated high frequency subband in order to correct estimated coefficient. At the same time input image is interpolated using bicubic interpolation. Finally, corrected high frequency subband and interpolated image are combined by using IDWT to achieve high resolution image.

II. LITERATURE REVIEW

As it was mentioned before, resolution is an important feature in imaging, which makes resolution enhancement of images to be more important as it directly affect the performance of system using these images as input. In image resolution enhancement using interpolation the main loss is on its high frequency component (i.e. edges in the image), which is due to smoothing caused by interpolation. as to increase the quality of super resolved images, preserving the edges is essential. DWT has been used in order to preserve the high frequency component of the image [6]. The redundancy and shift invariance of the DWT mean that DWT coefficients are inherently interpolable [10].DWT employ down sampling in each of the subband image which causes information loss in the respective subbands. That is why SWT is employed to minimize this loss.

III. PROPOSED SUPERRESOLUTION

Fig. 1 illustrates the block diagram of the proposed image resolution enhancement technique. In this work one level DWT is used to decompose an input image into four different subband images.fig.2 shows decomposition of DWT. Fig. 3 shows four subbands obtained from dwt decomposition. Three high frequency subband (LH, HL and HH) contain the high frequency components of the input image. In this technique bicubic interpolation with enlargement factor 2 is applied to high frequency subbands of the input images which gives better result for

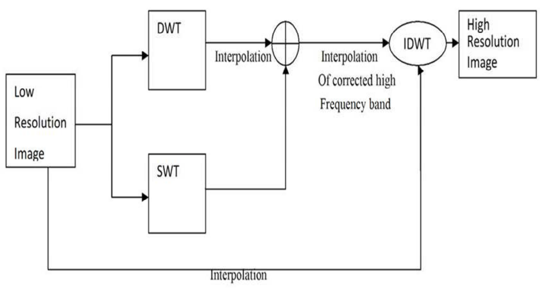

Fig. 1 Block diagram of proposed system

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 4, April 2014)

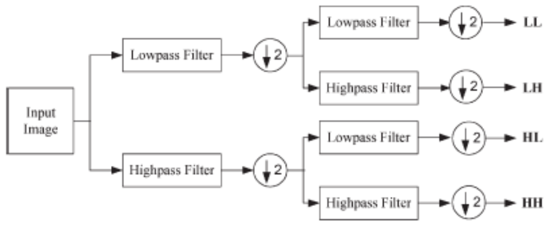

Fig. 2 Block diagram of DWT filter banks of level 1.

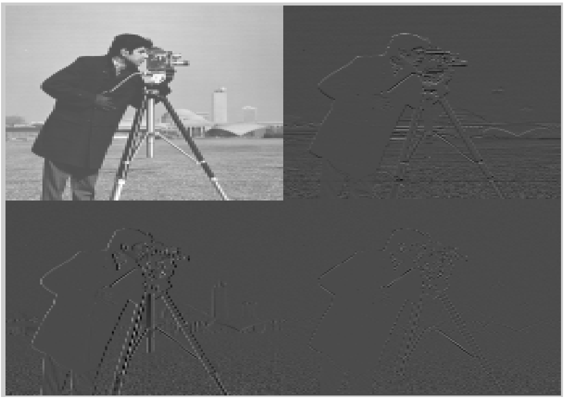

Fig.3. LL, LH, HL and HH subbands of image obtained by DWT.

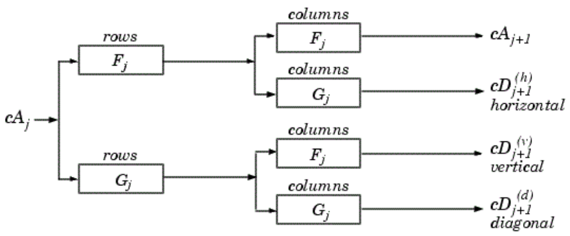

Fig. 4 Block diagram of SWT decomposition of level 1

interpolation than other mentioned techniques as the block uses the weighted average of four translated pixel values for each output pixel value. The interpolated high frequency subband and the SWT high frequency subbands have the same size which means they can be added with each other. Fig. 3 shows decomposition of SWT the new corrected high frequency subbands can be interpolated further for higher enlargement. Also it is known that in wavelet domain the low resolution image is obtained by low pass filtering of the high resolution image. Therefore, instead of using low frequency subband image we are using input image for interpolation. This increases the quality of super resolved image. By interpolating input image and corrected high frequency subbands and then applying IDWT, illustrated in fig. 1, the output image will contain sharper edges than interpolated image obtained by interpolation of the input image directly.

IV. RESULT AND DISCUSSION

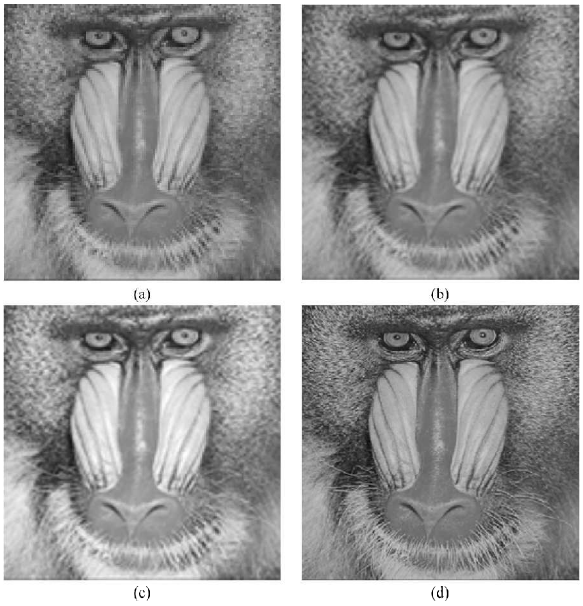

Fig 5.(a)Original low resolution Baboon's image.(b) Bicubic interpolated image.(c) Super resolved image using WZP.(d)Proposed technique.

Fig 5. Shows that super resolved image of Baboon's picture using proposed technique in (d) are much better than low resolution image in (a), superresolved image by using the interpolation(b).and WZP (c). Note that input low resolution images have been obtained by down sampling the original high resolution images.

V. CONCLUSION

This work proposed an resolution enhancement technique for low resolution image based on high frequency subbands obtained from DWT, this subbands are corrected using SWT high frequency subband, also high frequency subbands have been interpolated the interpolated high frequency subband coefficient have been corrected by using high frequency subbands achieved by SWT of the input image .afterwards all these images are combined using IDWT to generate a super resolved image.

REFERENCES

[1] H. Demirel, G. Anbarjafari, "Image Resolution Enhancement Using Discrete and Stationary Wavelet Decomposition," in IEEE Transaction Image Processing, VOL.20, NO. 5, MAY 2011

[2] Y. Rener, J. Wei, and C. Ken, "Downsample-based multiple description coding and post-processing of decoding," in *Proc. 27th Chinese Control Conf.*, Jul. 16–18, 2008, pp. 253–256.

[3] 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.

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 4, April 2014)

[4] H. Demirel, G. Anbarjafari, and S. Izadpanahi, "Improved motionbased 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.
[5] 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.
[6] 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.
[7] 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.
[8] 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.
[9] S. Mallat, A Wavelet Tour of Signal Processing, 2nd ed. New York: Academic, 1999.
[10] 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.
[11] 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.