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Survey on Content Image Detail Enhancement on Wavelet Analysis Using Satellite and Medical Images.

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ABSTRACT

To Improve Image Quality on Contrast and Sharpness using Wavelet based smoothness and gradient operator on Image Enhancement. Detail enhancement is required by lot of problems in the fields of image processing and computational photography. In Existing Method on Smoothing and gradient operator algorithm reduces color distortion in the detail-enhanced image, especially around sharp edges. In our proposed method we implement on Wavelet using with smoothness for contrast enhancement and gradient operator on color image sharpness enhancement. Then visibility restoration module utilizes average color difference values and enhanced sharpen and contrast on image with better quality.

Keywords: Smoothing, Edge preserving, contrast enhancement, Resolution, Noise reduction.

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INTRODUCTION

The images taken by the satellites are used in applications like Geo-studies, Climatic conditions and selenology. The resolution plays a main role in all these applications for affective factor of all images. Interpolation is the method used to increase the resolution of digital image. In image processing technique, Interpolation plays a predominant role for its applications like multiple description coding, Resolution enhancement, Facial reproduction of images. Interpolation is basically divided into three types:-Bi-cubic interpolation, bilinear interpolation, nearest neighbor interpolation. In all these three interpolations, Bi-cubic interpolation is highly developed comparing from other two techniques because of its sharper images. It is an extension of cubic interpolation for interpolating data points on a 2D regular grid. Bi-cubic interpolation can be consummate using cubic splines or cubic convolution algorithm, Lagrange polynomials. In many image processing applications wavelets are playing a crucial role. The decomposition of two dimensional wavelet of an image is performed by taking one dimensional discrete wavelet transform (DWT) along in image the rows are taken first and in columns, the results are decomposed. In result four decomposed sub bands are formed. They are Low-Low (contrast), Low-High (horizontal), High-Low (vertical), and High-High (diagonal). The frequencies spectrum of original image is fully covered by those sub bands of frequency components.

Image resolution enhancement using wavelets is mainly new subject and also many new algorithms have arrived. For this content image detail enhancement we are using nonlocal means (NLM) algorithm and dual tree complex wavelet transform. So by using these algorithms sharpness of the reconstructed images. In dual tree complex wavelet transform, input images are divided into four sub bands. There is an interpolation between low resolution images and input images because to regenerate a high resolution image by using inverse dual tree complex wavelet transform. Each sub bands are uniquely divided into another four sub bands equally which makes a total of sixteen sub bands. Cubic interpolation is used for six complex-valued high frequency sub band images to be interpolated. There is separate interpolation parallel to the input low resolution image. Lastly, Interpolated input low resolution image and Interpolated high sub band images are joined by using inverse dual tree complex wavelet transform (IDT-CWT). This inverse dual tree complex wavelet transform technique is compared with state-of-the-art image resolution enhancement techniques and conventional. By using this technique, the image has better edge preservation rather than previous methods. There is no information loss. In this proposed method we have a better resolution accuracy and Compatibility.

METHODS OF SMOOTHING, EDGE PRESERVING AND RESOLUTION

Guided Filter [6]

In General linear translation-variant filtering process, an output image q, guidance image I, and filtering input image p are involved. According to the application p and I are taken earlier which are exactly same. At pixel i, the filtering output is shown as average weight.

$$q_i = \sum_j W_{ij}(I) p_j,$$

Here pixel indexes are I and j. The functions of independent of P and guidance image I is filter kernel Wij. With respect to p this filter is linear.

Interpolation [7]

Interpolation is the method used to increase the resolution of digital image. In image processing technique, Interpolation plays a predominant role for its applications like multiple description coding, Resolution enhancement, Facial reproduction of images

Bi-cubic interpolation [7]

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In Two dimensional regular grids, data points are interpolated by elongating of cubic interpolation is known as Bi- cubic interpolation. This can be accomplished by using any three ways Splines, Cubic algorithms, Lagrange polynomials.

Dual-tree Complex Wavelet Transform [2]

The input image is divided into four different divisions of sub band images by dual-tree Complex Wavelet Transform (DT-CWT). There is interpolation between the input image and high-frequency sub band images. By using inverse DT-CWT, a high resolution image is generated by merging all interpolated images. Complex Wavelet Transform provides directional selectivity to achieve the resolution enhancement. High-frequency details, sharpness is contributed by the high- frequency sub bands in six different directions

EXISTING METHOD OF IMAGE ENHANCEMENT [6]

For Satellite and medical imaging resolution plays a key role, which gives the resolution enhancement for image will be far better than previous image. Satellite images are used by many applications, as mentioned before. For better quality of applications, resolution enhancement is carried out for images. Gradient operator is an operator which operates vector for N-dimensional scalar function. As we know about the gradient operator there are limitations at only some particular edges. It can't be done for all the edges at once. Contrast and Edges through put rate is low.

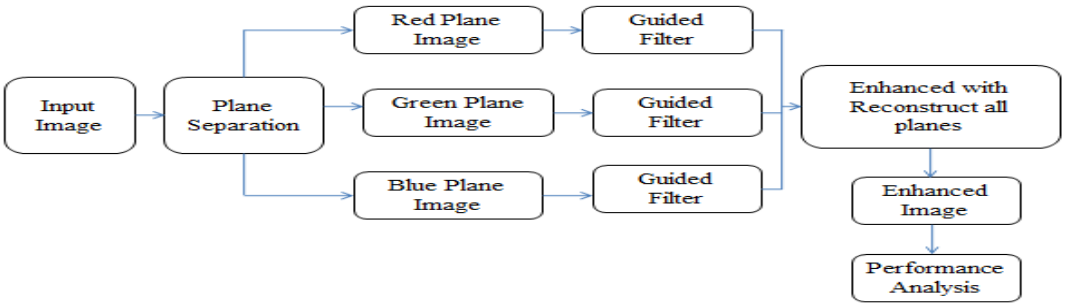
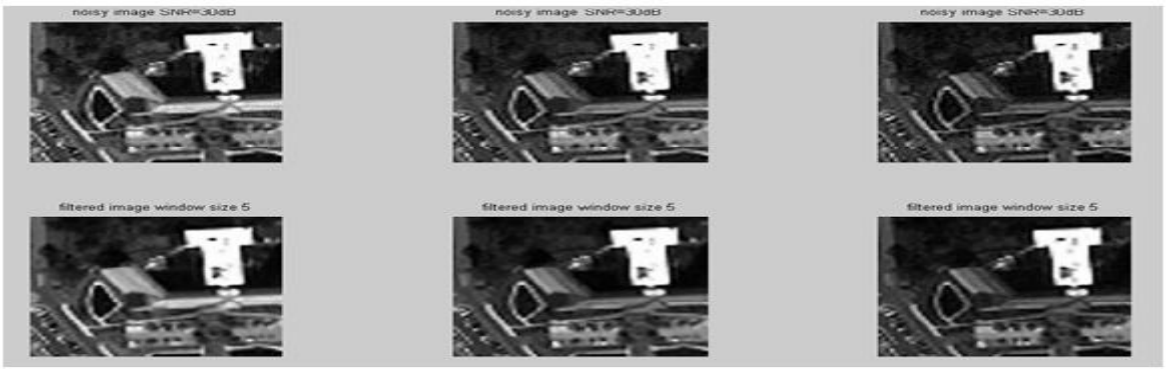


Figure 1: Edge-preserving smoothing by Guided Filter [6]

Satellite and medical images which we want to have a clear smoothing and edge preservation are usually chosen as input (1) images. Plane separation (2) of red, green, and blue is processed for input image. The different colored plane images are added to Guide filter**.** In different colored plane images the noise is reduced separately by using Guided filter. Enhancement of all three planes is done and combined to form an output image. At result, the input and output images are compared by graphical representation as performance analysis. The output image is nothing but Enhanced image



(a) (b) (c)

Figure 2: Reduction of signal noise ratio (SNR) = 30db for all three different planes (a), (b), (c) from input low resolution image [6]

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PROPOSED METHOD OF IMAGE ENHANCEMENT

For better results we are combining the guided filter and dual-tree complex wavelet transform. Guided filter makes the image to be edge-preserving smoothing. In consideration of the total content of a guidance image, the guided filter figure out the filtering, this can be the different image or input image itself. For edge preserving smoothing operator, the guided filter can be used as popular bilateral filter but near edges it has better behavior. For smoothing process the guided filter is also a more generic concept. Beyond smoothing, it will transfer the structures and shapes of the complete guidance image to the filtering output, it enable new filtering applications like guided feathering and de-hazing .However, the guided filter generally has a quick and non-approximate linear time algorithm, regardless of the intensity range and resize. It is one of the fastest edge-preserving filters currently.

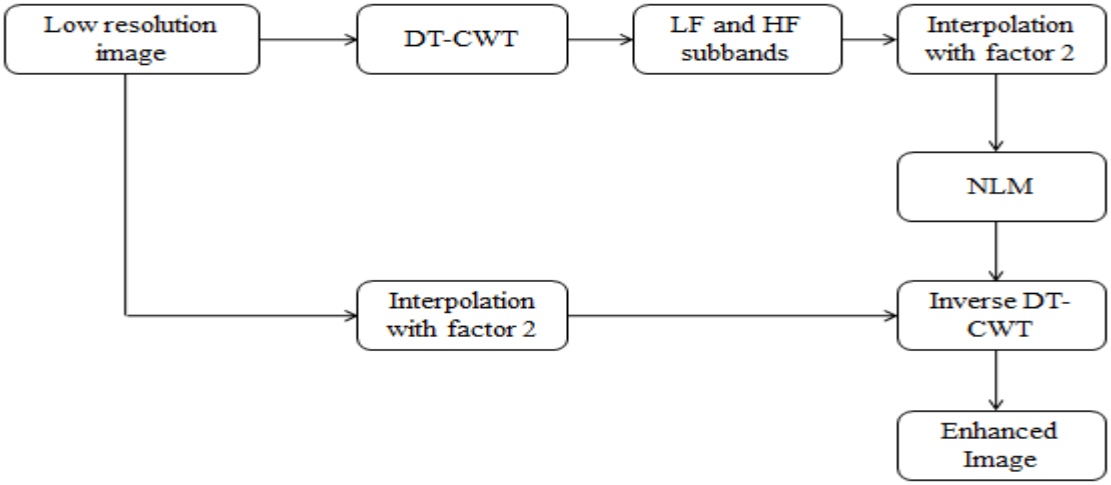

Figure 3: Edge-preserving smoothing by GUIDED FILTER AND DT-CWT

Dual tree complex wavelet transform is applied to a satellite low resolution input image. Wavelet is separation of four different sub bands namely Contrast, Vertical, Horizontal and Diagonal but in Dual tree complex wavelet transform there is a division of each sub band into four different individual sub bands as mentioned above. The divided sub bands have High and low frequencies. Fractor2 makes interpolation for each sub band. For image de-noising an Algorithm called Non-Local Means algorithm is used.

For given noisy image, the NL-means de noised value f (i) at pixel I is obtained by average of all pixels in neighborhood

$$\hat{f}(i) = \frac{1}{C(i)} \sum_{j \in \Omega_s} w(i,j) f(j)$$

W (i, j) is determined by the similarity of Gaussian neighborhood between pixels i and j

$$w(i,j) = \exp\left(-\frac{\left\| N_i - N_j \right\|_{2,a}^2}{h^2}\right)$$

An Inverse Dual tree complex wavelet transform is used to integrate all the sub bands. Other interpolation with factor2 is combined with IDT-CWT.

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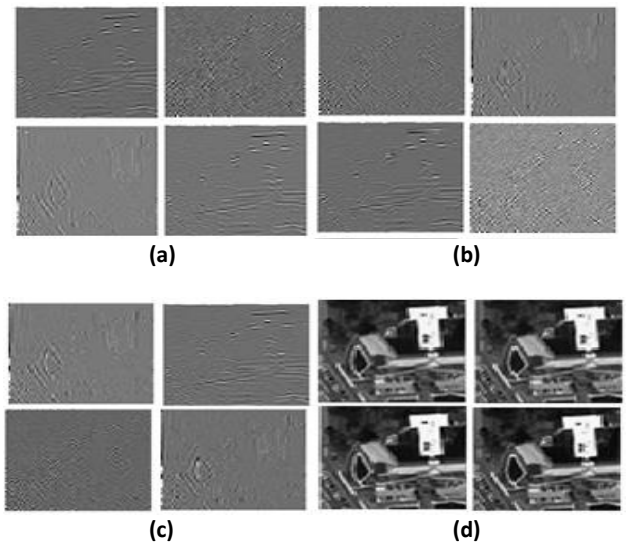

Figure 4: LL(a), LH(b), HL(c), and HH(d) sub bands of a satellite image obtained by using DT-CWT

Table 1: Comparing between existing and proposed image enhancement level

parameters	Guided filter (existing method)	DT-CWT with guided filter (proposed method)
Smoothing	low	High
Edge preserving	medium	High
Resolution	medium	High

From this tabulation Smoothing is low for Guided filter when compared with DT-CWT with guided filter. Coming to other parameters Edge preserving and Resolution exists in guided filter but when compared to DT-CWT with guided filter it is less.

CONCLUSION

By this project we compare between GUIDED filter and DT-CWT with GUIDED filter. This proposed system will be Better edge preservation rather than previous existing methods. In this project no information loss. Better resolution accuracy and compatibility with reduction in noise.

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