SATELLITE IMAGE ENHANCEMENT USING BLOCK BASED SCALAR SHARPNESS INDEX

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ABSTRACT: Satellite images are regularly affected by noise in their procurement and transmission process. Expulsion of noise from the picture by weakening the high frequency segments evacuates some vital points of interest too. In this paper, a basic and element wavelet-based methodology is exhibited for improvement of the satellite image sharpness or blurriness of an Image. Four arrangements of strategies are taken after here (Denoising, Decomposition, Sharpness Estimation, and Filtering). A Scalar Index comparing to the information picture's sharpness is registered through the weighted normal of the processed log-energies. The Block Based Scalar Sharpness Index is computed by taking the RMS of 0.01 of biggest estimation of the sifting parameter which takes the no. of Block Size. This proposed technique is the least complex, quickest and exact contrasting with the presently best-performing methods for the sharpness estimation.
Keyword: DWT, Decomposition filter, Blurring, Denoising, Decomposition, Image sharpness.

I. INTRODUCTION

To detect the sharpness we have some certain algorithm which can consequently anticipate sharpness or blurriness well known as sharpness estimators. Main objective of such algorithm have been demonstrated to be helpful for undertakings, for example, location or detection of main subject, enhancement of image, quality enhancement, and rebuilding of image i.e. image restoration. Many of researchers worked for the sharpness/blurriness estimation with various algorithms or methodologies [1], [2], [3]. First consideration of Blurriness estimation techniques is that, the image are affected at the edge i.e. edge information is not clear and appropriately edge appearance models are used to estimate the amount of blurriness [2], [4]. Some different techniques utilized to gauge the sharpness i.e. spectral information. Later some algorithm was proposed, which deals with sharpness as well as blurriness and it is named as hybrid algorithm. The only disadvantage of this method is computational complexity. This paper concentrates in the sharpness and blurriness calculation in a simple and dynamic wavelet based algorithm and then based on the calculated value try to reduce the blurriness and enhance the sharpness. Input image should be denoised first to remove the unwanted component, if it is available. Now this denoised input will be decomposed by four level discreet wavelet transform [1,4]. This multi level DWT divides the input image into four sub components i.e. LL, LH, HL, HH, calculate the log energy of all the individual component except LL component.

$$LE_{LH_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} LH_n(i,j)\right)$$

$$LE_{HL_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} HL_n(i,j)\right)$$

$$LE_{HH_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} HH_n(i,j)\right)$$

A Scalar Index comparing to the data image's sharpness is processed through the weighted average of the registered log-energies. A few Satellite pictures are taken for implementation and testing. This Image's general sharpness List SSI is utilized as a separating segment and the picture is sifted through to give the Sharpened Image. Here along with the Scalar Sharpness Index speaking to the image's general sharpness.

A Block based calculation is exhibited to focus the local perceive sharpness. Root mean square method is used to calculate the Block Based Scalar Sharpness Index. RMS of 0.01 of biggest estimation of SSI which takes the no. of Block Size is representing SSI [9]. It is the most aggressive and basic with the right now best performing strategies for the sharpness estimation. Alongside its effortlessness this calculation is additionally the fastest calculation for all the Size of Images. So at last for image enhancement the SSI and Block Based SSI are utilized as a filter. After every certain interval the images are processed with the above said algorithm and the final sharpened resulting images are presented.

II. RELATED THEORIES

A Flow graph portraying the complete procedure is given underneath. Contingent on the way of output (Picture) the system coordinates to separate arrangement of procedures. When we are taking image as an input, then check whether it's a grayscale or not, if not then covert it and make it double type data format. Denoise the input image, because it will prevent the unnecessary enhancement of image pixel. Next image done as per the required number of level, user input is also allowed. We have some certain filters (eg. Haar, Daubechies,) for the decomposition, Haar as well as db1 filter is used with three level of decomposition [6].

The individual subband log-vitality is ascertained through comparison (5), (7) and (8). DWT Coefficients is represented by Cn in the subband at level n [5], [6]. The no. of subbands utilized can be 3 or 4 relying on the prerequisite. For this specific strategy we have set it to 3 at level 3 by ignoring LL Subband at this level. Here a weightage (W) is given to each subband as indicated by their substance. The estimation of W ought to be around 0.7 or higher for keeping up higher qualities at HH Subband. The summed log energy at every level of decomposition can be written as:

$$TLE_n = W(LE_{HH_n}) + 0.375(1-W)(LE_{HL_n} + LE_{LH_n}) + 0.25(1-W)(LE_{LL_n})$$

Image overall sharpness is represented by TLEn, Combination of all TLEn will give the Scalar Sharpness Index which is given by

$$SSI = \sum_{n=1}^{3} 2^{L-n}\ TLE_n$$

L should be equal to or greater than the level of decomposition (n). Presently this SSI is utilized as a Filtering part and is utilized to upgrade the picture.

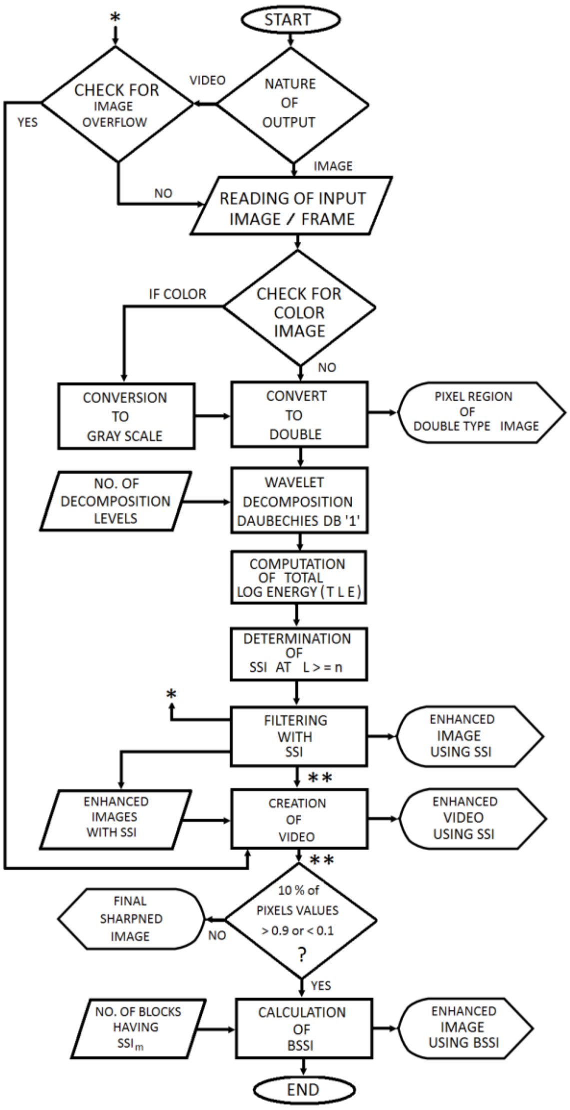


Figure 4.1 Flow Diagram of Proposed Work

The estimation of SSI is continuously more prominent or equivalent to 0. The higher estimations of SSI speak to higher sharpness in the picture. On the off chance that the yield is feature, the arrangement of pictures are consistently upgraded and later are utilized for making a feature with needed edge rate. 24 f/s is typical standard we can utilize. This same system can be utilized to improve every little squares of the picture and the method is called piece based picture upgrade and for this we have to ascertain the SSI of every square with a square size of 16 x 16 or 8 x 8. Be that as it may, at the season of the production of Block guide 0.5 of every 1 is covered both evenly and vertically with neighbor pieces. So 16 x 16 will bring about 8 x 8 and 8 x 8 will bring about 4 x 4 in the info picture. Before applying this system we ought to go for the histogram investigation of the whole picture for the reason for tone alteration. On the off chance that either under 0.1 pixels or more than 0.9 pixels quality is not more than 10%, at that point the past picture came about out after the sifting of the picture with SSI is the last upgraded picture and square based upgrade is not connected.

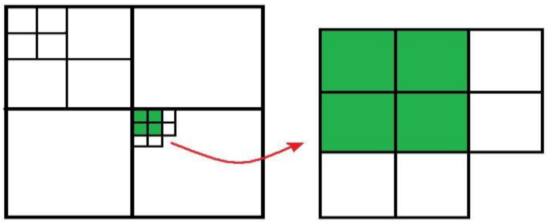


Figure 4.1 Neighbor Block Overlapping

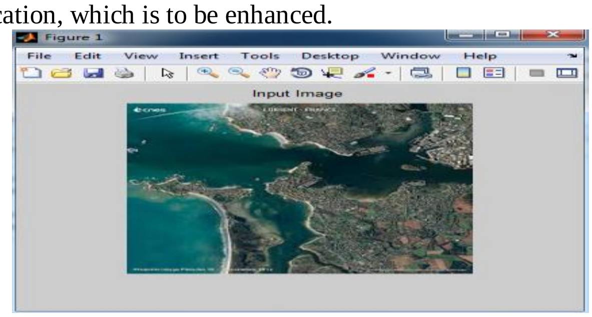
If there should be an occurrence of the block based enhancement system a component called SSIm is looked into. It is a component that characterizes 0.05 or 5% of the most extreme SSI. The total no. of blocks that fulfills the element SSIm is signified as SB and is utilized as a part of the parameter's estimation BSSI. Before heading off to the computation of BSSI, the picture ought to be considered as an arrangement of block of square size 32 x 32 and afterward the SSI of every piece ought to be computed utilizing the discrete wavelet transform coefficients of every block. As the total sharpness of the picture/casing is controlled by the picture/frames keenest districts, the variable SB is contemplated. The block based scalar sharpness index is dictated

$$S = \sum_{i=1}^{SB} SSI_i^{\,2} \quad \text{where,} \quad BSSI = \left(\frac{S}{SB}\right)^{0.5}$$

Like SSI and BSSI can be used for filtering the image to give a enhanced image output.

III. IMPLEMENTATION OF PROPOSED WORK

Step-1 In the very first step take the input image from the location, which is to be enhanced.



Step 2: Since the proposed work is using grayscale so check the size of input and find it out that whether the taken input is RGB or grayscale image. If the selected input is RGB then convert it into grayscale image. The output is then converted

into grayscale image.

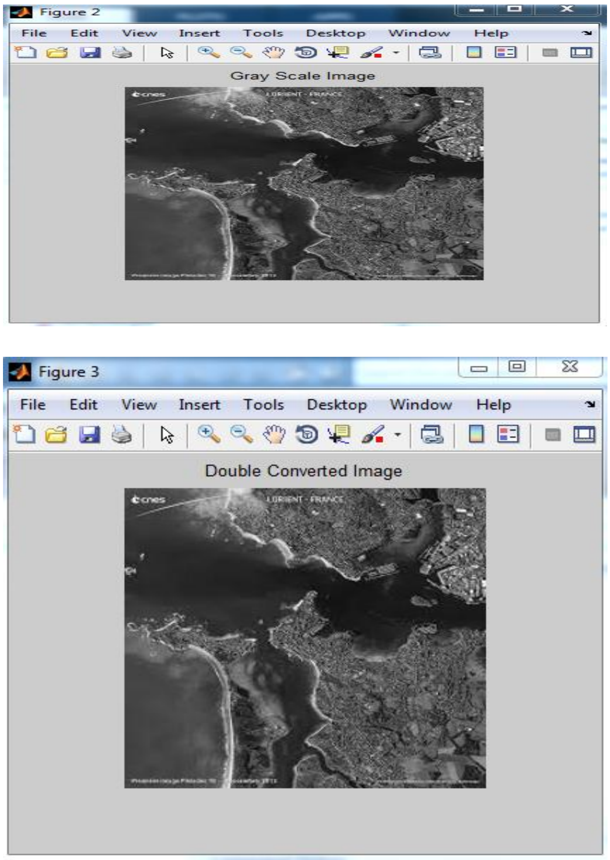


Figure 4.2: grayscale image and double converted image.

Step 3: Discreet wavelet transform decomposition is performed hereafter using Haar filter.

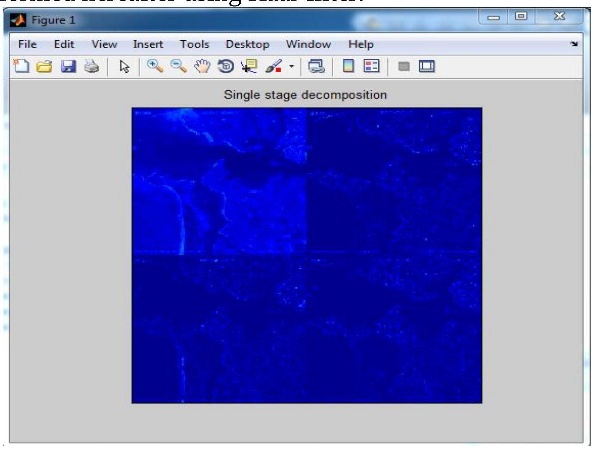


Figure 4.3 First level of DWT decomposition

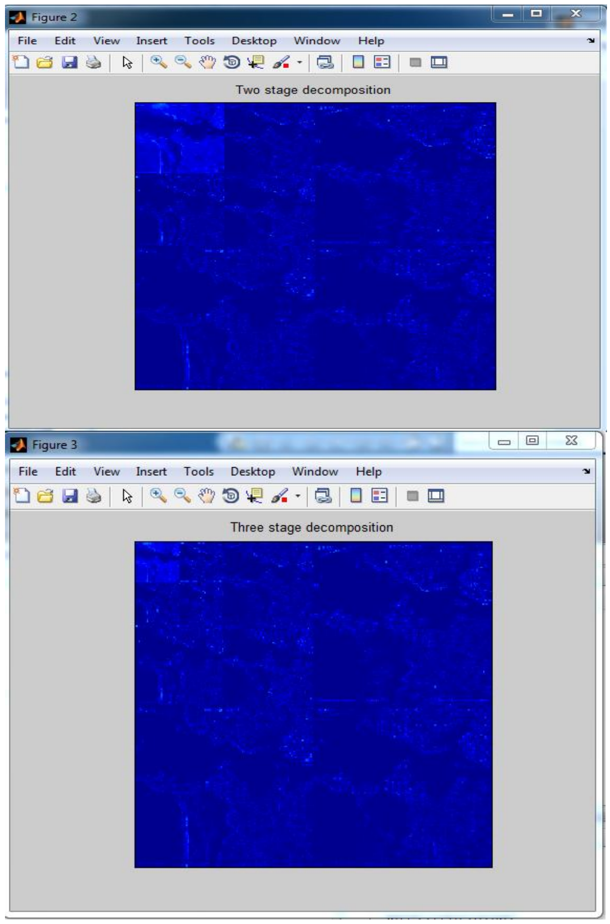


Figure 4.4 second and third level of DWT decomposition.

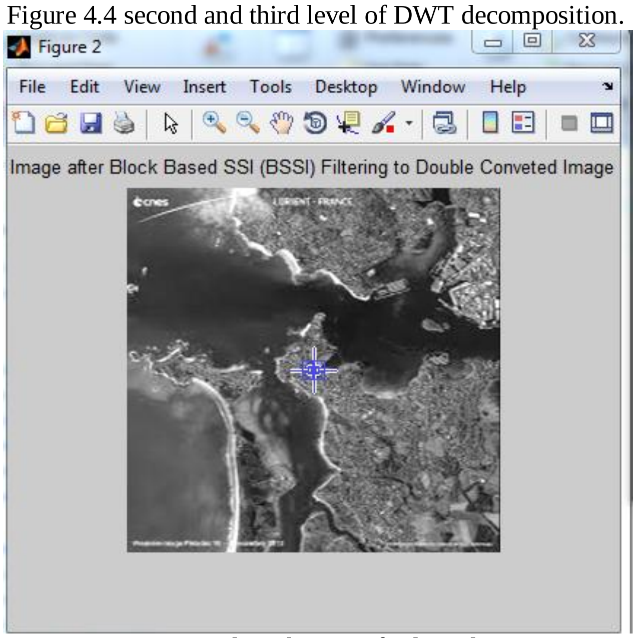


Figure 4.5 Filtered BSSI of selected input

Figure 4.6 Selected area of above figure.

IV. RESULT

The original images, enhanced images after filtering with the factor BSSI and one of the small areas of each of the enhanced images are presented above. In the Figure 4.5 the block based Scalar Sharpness Index (BSSI) of the first picture has been utilized as the separating parameter and the first picture is sifted through to give the upgraded picture. A little territory is chosen from the picture and is appeared in Figure 4.6. It is anything but difficult to distinguish the careful areas from this picture where more vapors are available. The main issue is to differentiate the outskirt range from required zone if vapors are available above it; however this happens in great climate condition.

V. CONCLUSION

Various input satellite image have been taken to test the proposed algorithm with and sharpness is calculated. Scalar Sharpness Index (SSI) is the quantity which defines the images sharpness. SSI is nothing but a filter element; using this filter we got the sharpened image. A novel technique is presented here in this work with the Scalar Sharpness Index, which is used for Block based algorithm (BSSI) to enhance the satellite image. MATLAB 13 environment is used to prove the proposed algorithm. Graphical, pictorial and statistical output is presented here in the form of graphs, image and PSNR value.

VI. FUTURE SCOPE

Researchers who have been interest in the area of image enhancement they can extend this work for color RGB image also. To improve the efficiency and accuracy one can also improve the feature extraction and classification method. This can also be designed as a standalone system for this proposed algorithm to make the system and investigation faster.

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