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A Modified MSRCR Technique for Hyper Spectral Images on Various Levels of Resolution Enhancement

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ABSTRACT*:* Resolution plays a vital role in hyper spectral images. For example satellite images; Satellite Images obtained by satellite is influenced by impulse noise. This impulse noise deforms the edge pixels in the satellite image, which demeans the segmentation method. Hence, this impulse noise should be eliminated before enhancing satellite images. Resolution enhancement based on oriented local histogram equalization (OLHE) is existing in hyper spectral images for resolution improvement. Further to achieve high resolution, the improved Retinex algorithm is used in the proposed scheme with hyper spectral colour images. Multiscale retinex with colour restoration (MSRCR) is a type of retinex algorithm which is used in the proposed technique with hyper spectral colour images to achieve high resolution than the conventional OLHE technique. The main aim of this paper is to improve the resolution of hyper spectral colour image by using optimized MSRCR technique based on contrast limited adaptive histogram equalization (CLAHE). The MSRCR algorithm consequences in graying out and halo at the edges of the images. Hence here the focus is on enhancing the MSRCR algorithm by incorporating it with contrast limited adaptive histogram equalization CLAHE using hyper spectral colour image. Performance analysis is completed by scheming PSNR and MSE values which exposes superiority of the proposed method over the conventional method and modern Retinex (MRE) techniques.

KEYWORDS*:* Multiscale retinex with colour restoration (MSRCR), Retinex algorithm, resolution enhancement, hyper spectral colour image and. contrast limited adaptive histogram equalization (CLAHE)

I.INTRODUCTION

Colour images offer huge information for human visual perception, when compared to gray scale images. Enhance the visual data to increase the clarity of the colour image by using colour image enhancement methods. It enlarges human perception of information. Unlike colour image resolution enhancement methods are used to increase the contrast of the colour images. Resolution of an image has been always a vital issue in several image-and video-processing applications like feature extraction, satellite image resolution enhancement, and video resolution enhancement. The recital of the proposed methods over executes all available state-of-art techniques for image resolution enhancement. The ocular and quantitative results are given in the results and discussions section Interpolation in image processing is a technique to enlarge the number of pixels in a digital image.

Interpolation has been extensively used in several applications like image resolution enhancement, multiple descriptions coding, and facial reconstruction. The interpolation-based image resolution improvement has been used for a long time and several interpolation techniques have been urbanized to raise the worth of this assignment. There are three famous interpolation techniques, specifically, bicubic, bilinear, and nearest neighbour. Bicubic interpolation is more stylish than the other two techniques and makes smoother edges.

The necessary idea after the Histogram of Oriented Gradient descriptors is that local object look and shape surrounded by an image can be described by the sharing of edge directions or intensity gradients. The implementation of these descriptors can be attained by isolating the image into small attached regions, called cells, and for each cell compiling a histogram of gradient directions or edge orientations for the pixels inside the cell. The grouping of these histograms

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then represents the descriptor. In the existing technique accuracy is enhanced by using the local histograms can be contrast-normalized by scheming a measure of the intensity across a larger region of the image, called a block, and then using this value to normalize all cells within the block. This normalization results in greater invariance to alter in shadowing or illumination.

II.LITERATURE SURVEY

Resolution (temporal, spectral, and spatial) is the limiting factor for the utilization of remote sensing data (satellite Imaging etc.). Spatial and spectral resolutions of satellite images (unprocessed) are related (a high spatial resolution is associated with a low spectral resolution and vice versa) with each other [1]. Therefore, spectral, as well as spatial, resolution enhancement (RE) is desirable. Interpolation has been widely used for RE [2], [3]. Commonly used interpolation techniques are based on nearest neighbors (include nearest neighbor, bilinear, bicubic, and Lanczos). The Lanczos interpolation (windowed form of a sinc filter) is superior to its counterparts (including nearest neighbor, bilinear, and bicubic) due to increased ability to detect edges and linear features. It also offers the best compromise in terms of reduction of aliasing, sharpness, and ringing [4].

Methods based on vector-valued image regularization with partial differential equations (VVIR-PDE) [12] and in painting and zooming using sparse representations [6] are now state of the art in the field (mostly applied for image in painting but can be also seen as interpolation). RE schemes (which are not based on wavelets) suffer from the drawback of losing high frequency contents (which results in blurring). RE in the wavelet domain is a new research area, and recently, many algorithms [discrete wavelet transform [6], stationary wavelet transform (SWT) [9], and dual-tree complex wavelet transform (DT-CWT) [5] have been proposed [7]–[12]. An RE scheme was proposed in [10] using DT-CWT and Bicubic interpolations, and results were compared (shown superior) with the conventional schemes (i.e., nearest neighbor, bilinear, and bicubic interpolations and wavelet zero padding). More recently, in [6], a scheme based on DWT and Bicubic interpolation was proposed, and results were compared with the conventional schemes and the state-of-art schemes (wavelet zero padding and cyclic spinning [13] and DT-CWT [10]). Note that, DWT is shift variant, which causes artifacts in the RE image, and has a lack of directionality; however, DT-CWT is almost shift and rotation invariant [14]. DWT-based RE schemes generate artifacts (due to DWT shift-variant property).

In [14] DT-CWT-based nonlocal-means-based RE (DT-CWT-NLM-RE) technique, using the DT-CWT, Lanczos interpolation, and NLM. Note that DT-CWT is nearly shifted invariant and directional selective. Moreover, DT-CWT preserved the usual properties of perfect reconstruction with well-balanced frequency responses [14], [15]. Consequentially, DT-CWT gives promising results after the modification of the wavelet coefficients and provides fewer artifacts, as compared with traditional DWT. Since the Lanczos filter offer less aliasing, sharpness, and minimal ringing, therefore, it a good choice for RE. NLM filtering [14] is used to further enhance the performance of DT-CWT-NLM-RE by reducing the artifacts. This technique produces high latency. In this paper, high image resolutions have been achieved based on Multiscale retinex with colour restoration (MSRCR) by using high spectral colour image.

III. EXISTING ORIENTED LOCAL HISTOGRAM EQUALIZATION (OLHE) TECHNIQUE

In the Algorithm explanation technique, the filtering window is divided into four directions. Equal number of pixels should be placed in every path. These pixels may be placed on an edge or in a smooth area. The key point is to discover the optimal path to be used as a reference, or a scale to find out whether the tested pixel is noisy or noise-free pixel. The optimal direction is the direction that has the most similar pixels. So, for each pixel to be judged as an unique, it should have small variations with the pixels in the optimal path. The proposed algorithm may be explained as follows [8].

If the primary pixel in a window of size KXK is indicated by $x_{i,j}$ then the total pixels in the window, except the central pixel $x_{i+(k+1)/2,j+(k+1)/2}$ are divided into four directions.

1) The $D_{di,js,}$d=1:4 used for a window of 9X9 size, and a first pixel $x_{0,0}$. The pixels in each direction are scheduled in terms of their directed as follows:

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$$D_1^{0,0} = \{[0,0],[1,1],[2,2],[3,3],[5,5],[6,6],[7,7],[8,8]\}$$

$$D_2^{0,0} = \{[0,8],[1,7],[2,6],[3,5],[5,3],[6,2],[7,1],[8,0]\}$$

$$D_3^{0,0} = \{[0,4],[1,4],[2,4],[3,4],[5,4],[6,4],[7,4],[8,4]\}$$

$$D_4^{0,0} = \{[4,0],[4,1],[4,2],[4,3],[4,5],[4,6],[4,7],[4,8]\}$$

2) Then, the pixels in each direction $D_{a,j}$ are sorted in rising manner, hence that the outlier pixels can be précised. The new vector $r_{d\ ij}$ that obtained from the consequent sorted path. This algorithm is followed by the paper [8].

The image resolution is enhanced by using the above algorithm. In this technique, vertical or horizontal or crosswise direction is taken for resolution enhancement. Also some pixel resolutions are improved more than one time. Hence the dark pixel may be dark again. To overcome this problem, contrast limited adaptive histogram equalization will be applied in the proposed technique based on multiscale retinex with colour restoration (MSRCR).

IV.PROPOSED MSRCR TECHNIQUE BASED ON CONTRAST LIMITED ADAPTIVE HISTOGRAM EQUALIZATION

4.1 Multi Scale Retinex Algorithms (MSR)

Single-scale Retinex cannot give both the tonal rendition and dynamic series compression. Multi Scale Retinex (MSR) [10] is developed to join the strength of different enclose spaces. The Gaussian filters of different sizes are used to process input image several times. The out-coming images are massed and summed to obtain output of MSR. It is given by

$$R_i(x,y) = W_n \log I_i(x,y) - \log[F_n(x,y) * I_i(x,y)] \qquad (4.1.1)$$

Where i=1.

Here, N indicate the number of scales, W_n is weight for the net scale. MSR give colon improvement. It also gives tonal rendition and dynamic range density. The halos are trim down by using MSR. But MSR result images violate gray world assumptions. Hence it affects from greying out of the image, whichever globally or locally. This provides a wash out look. This is the major disadvantage of MSR algorithm.

4.2 Multi Scale Retinex with Colour Restoration Algorithm (MSRCR)

To restore colour, MSR is customized by adding a colour restoration task [4]. The colour restoration factor is specified by:

$$\alpha_i(x,y) = f\left[I_i(x,y) / \sum_{n=1}^{N} I_n(x,y)\right] \qquad (4.2.1)$$

It is the colour restoration coefficient in the i_{th} spectral band. The number of spectral bands is specified by K.MSRCR algorithm is specified by,

$$R_i(x,y) = \alpha_i(x,y) \sum_{k=1}^{K} W_k \log I_i(x,y) - \log[F_k(x,y) * I_i(x,y)] \qquad (4.2.2)$$

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The block diagram of MSRCR algorithm is shown in figure.1. MSR algorithm be unsuccessful to meet Grey World Assumption. This difficulty can be removed by using colour restoration method. Thus a colour restoration factor (CRF) part is attached with the MSR part to get the MSRCR algorithm.

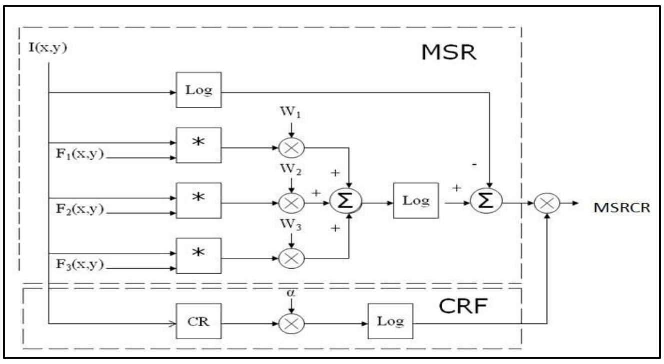

Figure 4.1 Circuit diagram of MSRCR Algorithm

Most important trouble of MSRCR algorithm are the occurrence of halo artifacts at edges, bad colour rendition and graying out of low contrast areas. The MSRCR has halo artifacts in high contrast edges. The greying out effect of MSRCR is shrinking via adaptive filtering on luminance canal. At high contrast edges, these adaptive filters become accustomed the nature of the filter. In this method they decrease the halo artifacts and greying out. But still then a halo artifact waits in images improved by using adaptive image enhancement techniques. Halo artifacts in colour images with a fast edge preserving filter. However it shrinks the contrast. The Gaussian surround procedure is customized to decrease halo artifacts. But still it output in de-saturation of colour.

The proposed technique is alterations of multiscale scale retinex with colour restoration algorithm. It shrinks the graying out of images of multiscale retinex with colour restoration algorithm and halo artifacts. Also shrinks the clarity of images. The enhanced MSRCR technique employs contrast limited adaptive histogram equalization and multi scale retinex with colour restoration algorithm. The multiscale retinex with colour restoration and the contrast limited adaptive histogram equalization schemes are applied to the low contrast image independently. The image fusion is applied to merge their outputs. The output image achieved has more brightness than the result of conventional multiscale retinex with colour restoration schemes.

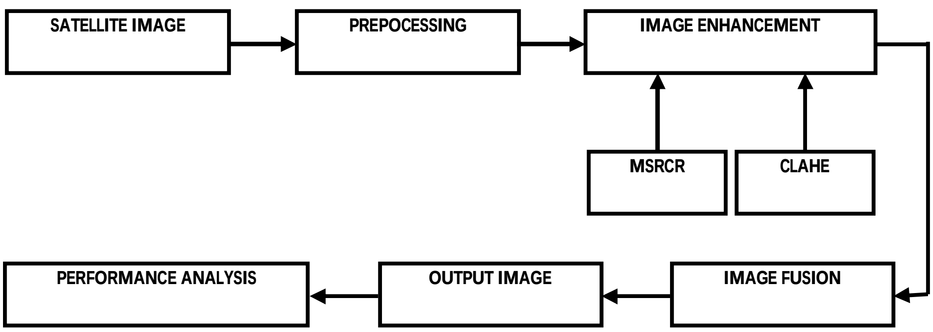

Figure 4.2 Block diagram of modified MSRCR algorithm

The block diagram of modified MSRCR algorithm is shown in figure 4.2. From the figure 4.2, A low contrast image is provide as input image. In low contrast image, the MSRCR algorithm is applied to achieve high intensity or clarity. But the result image has halo artifacts at the edges and graying out. CLAHE is nothing but Contrast Limited Adaptive Histogram equalization. It works on tiny regions of the image. These tiny regions are called as tiles. Mingle these small

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regions of the image by using bilinear interpolation. By limiting the contrast in homogeneous areas, it decreased the noise in the images. It improves the contrast of these small regions of the image. The edge based colour constancy can be achieved by using CLAHE. It develops the local contrast of images. Hence halo artifacts at the edges and graying out of the images can be reduced using CLAHE. CLAHE cannot be applied directly to the colour channels in a colour image as it modifies the colour balance of the image. Hence the image is initially converted to the LAB colon space. Then the algorithm is applied. After that the output image is converted back to the RGB colour space. The image fusion is used to merge the data in the two images into a one image which has lot of information when compared to any of the two input images. Here image fusion block come together the output image of CLAHE and output image of MSRCR to create single improved output image. It connects the two images by wavelet decompositions. Hence the output image contrasts to the old MSRCR result image thus enhancing the intensity of the MSRCR output image.

V.RESULTS AND DISCUSSION

Simulation is performed by using MATLAB R2012a. Hyper spectral colour images are used as input images. Since these images have low contrast, they appear darker. The Oriented Local Histogram Equalization (OLHE), Improved MSRCR algorithms is applied on this hyper spectral colour images. These algorithms enhance the contrast of the input image.

ORIGINAL IMAGE **IMPULSE FILTERING** **ENHANCEMENT IMAGE**

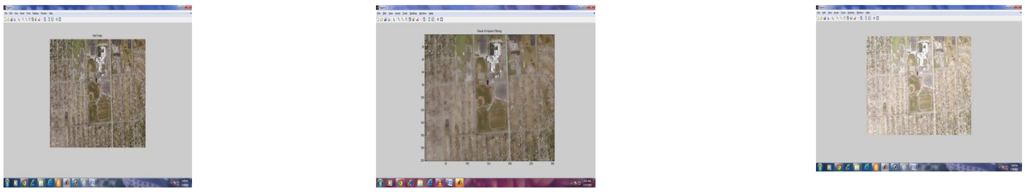

Figure 4.3 Output of improved MSRCR algorithm

The simulation results obviously show that the enhanced MSRCR output images have more intensity than the oriented local histogram equalization image. The value parameters used for comparison are Peak Signal to Noise Ratio (PSNR) and Mean Square Error (MSE). Comparison between enhanced Multi Scale Retinex with Colour Restoration Algorithm (MSRCR) and oriented local histogram equalization (OLHE) is performed as shown in table.1.

Table 1 Comparison of the Existing and Proposed for the 'Washington DC' image

TEST IMAGES	ALGORITHM	MSE	PSNR
1	Existing OLHE -RE	0.0121	66.61
	Improved MSRSCR with CLAHE	0.0101	72.00
2	Existing OLHE –RE	0.0110	64.01
	Improved MSRSCR with CLAHE	0.0100	71.00
3	Existing OLHE -RE	0.0121	66.61
	Improved MSRSCR with CLAHE	0.0101	72.00

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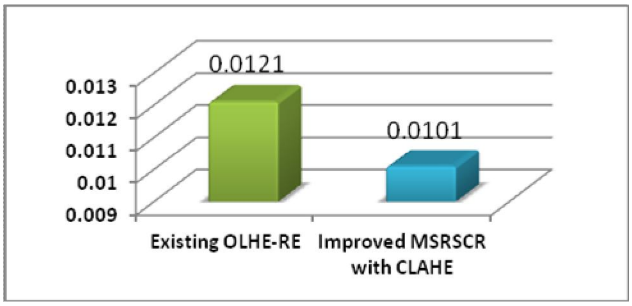

Figure.4 Performance analysis of improved MSRCR and OLHE algorithms for MSE values

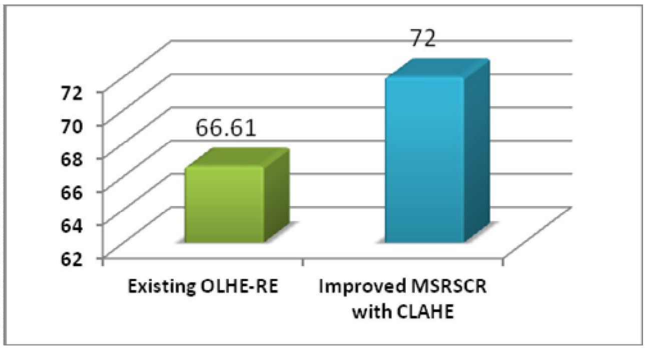

Figure5 Performance analysis of improved MSRCR and OLHE algorithms for PSNR values

From the figure.4 and figure.5, the proposed Multi Scale Retinex with Colour Restoration Algorithm (MSRCR) technique provide improved results in terms of MSE and PSNR as compared with oriented local histogram equalization (OLHE) technique. It is clear that the proposed MSRCR, schemes outperform OLHE techniques qualitatively and quantitatively.

VI.CONCLUSION

In this paper, the design of oriented local histogram equalization (OLHE) and Improved Multi Scale Retinex with Colour Restoration Algorithm (IMSRCR) is performed by using hyper spectral colour image in order to achieve the high resolution of image with low impulse noise. Performance analysis between these two algorithms is carried out. From the results, the Improved Multi Scale Retinex with Colour Restoration Algorithm (IMSRCR) offers 16.5% MSE and 7.5% PSNR improved values than the oriented local histogram equalization (OLHE). In future, the some other new Retinex algorithm will be used for high spectral colour images to achieve high resolution than the Improved Multi Scale Retinex with Colour Restoration Algorithm.

REFERENCES

[1] [Online].Available:http://www.satimagingcorp.com/
[2] Chen. T, Ma.K. K., and Chen. H.,(2000), "Tri-state median filter for image denoising", IEEE transaction image processing , vol. 8, pp 1834-1839.
[3] Chen. T and Wu. R. H., (1999), "Adaptive impulse detection using center weighted median filters", IEEE transaction image processing , vol. 6, pp146-153.
[4] Chen. T., and Wu. H. R.,(1999), "Space variant median filters for the restoration of Impulse noise corrupted images", IEEE transaction image processing , vol. 7, pp 1634- 1639.
[5] Demirel.H and Anbarjafari.G,(2011), "image resolution enhancement by using discrete and stationary wavelet decomposition," ieee trans. Image process., vol. 20, no. 5, pp. 1458– 1460.

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(An ISO 3297: 2007 Certified Organization)

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[6] Demirel.H and Anbarjafari.G.,(2011), “discrete wavelet transform-based satellite image resolution enhancement,” ieee trans. Geosci. Remote sens.,vol. 49, no. 6, pp. 1997–2004.
[7] Demirel.H and Anbarjafari.G.,(2010), “Satellite image resolution enhancement using complex wavelet transform,” IEEE Geosci. Remote Sens. Lett., vol. 7, no. 1, pp. 123–126.
[8] Dhivya. R and Agustin Vijay. S, (2014), “Hyperspectral Image Resolution Enhancement Using Object Tagging OLHE Technique”, International Journal of Innovative Research in Computer and Communication Engineering, Vol.2, Special Issue 1, pp. 907-914.
[9] Jane cullum and Ralp.A Willoughby,(2010), “ A survey of Lanczos procedures for very large real ‘symmetric’ eigenvalue problems”, Watson research center, yorktown heights, new york, 10598.
[10] Karakos and Trahanias.P,(2003), “combining vector median and vector directional filters:the directional distance filters”, IEEE signal prcess. Mag.,vol. 22, no. 6, pp. 123–151.
[11] Selesnick. W., Baraniuk. R. G and Kingsbur. N.G.(2005), “The Dual-Tree Complex Wavelet Transform”, IEEE signal prcess. Mag., vol. 22, no. 6,pp. 123–151.
[12] Trahanias. P, anda. N and Venetsanopoulos,(2003), “vector directional filters—a new class of multichannel image process filters”, IEEE signal prcess. Mag., vol. 22, no. 6, pp. 123– 151.
[13] Tschumperle.D and Deriche.R,(2005) “vector-valued image regularization with pde’s: a common framework for different applications,” ieee trans.Pattern anal. Mach. Intell., vol. 27, no. 4, pp. 506–517.
[14] Muhammad zafar iqbal, abdul ghafoor, and adil masood siddiqui,(2013), “Satellite image resolution enhancement using Dual-tree complex wavelet transform And nonlocal means”,Ieee geoscience and remote sensing letters, vol. 10, no. 3.
[15] Wang. Z and Zhang. D, (1998), “progressive switching median filter for the removal of impulse noise from highly corrupted images”, IEEE Geosci.Remote Sens. Lett., vol. 7, no.1, pp. 123–126.

BIOGRAPHY

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