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A BASIC INVESTIGATION ON WAVELET BASED NON LINEAR IMAGE ENHANCEMENT TECHNIQUE FOR AERIAL IMAGING

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ABSTRACT: *A wavelet-based dynamic range compression algorithm is applied to improve the visual quality of digital images. The necessary images are captured from the high dynamic range scenes with non-uniform lighting conditions. Image enhancement algorithm with sufficient fastness offers dynamic range compression. Also, it preserves the local contrast. Tonal rendition is additional benefit of it. Hence, this finds applications that includes image interpretation . The necessary simulation work is under curtesy of brigtex biophotonics (BTBP) center of our campus*

KEYWORDS: Wavlet, range compression, digital image, image enhancement, tonal rendition, BTBP

1. Introduction

Aerial images in general will be usually captured sources such as aircrafts etc.,. These obviously suffer from lack of clarity. The atmosphere up to 1000 Km of the earth effects the images. Few of such as turbidity due to haze, fog, clouds or heavy rain. They have unacceptable and sudden visibility .Sometimes, the conditions at which the images are taken may lead to non visibility even for the human eyes. Though, human observers may not see much than smoke, there may be useful information in images taken under such poor conditions. Of course, captured images are usually not the same as that of a real scenario, and are generally a poor rendition of it.
Problems because of the limited dynamic range of the imaging devices could be soved by, a group of existing image processing algorithms .These of course, promise some contrast enhancement to some extent. Now a days, a wavelet-based dynamic range compression (WDRC) algorithm may improve the visual quality of digital images of high dynamic range scenes with non-uniform lighting conditions. The WDRC algorithm , in its revised form introduces few new features. These includes histogram adjustment and non-linear color restoration process. Image enhancement algorithm of faster rate, provides dynamic range compression. Also it preservies the local contrast and tonal rendition. This will be a right choice candidate in aerial imagery applications. Arieal image may be catering image interpretation for classified environment. Such environment may include security and other services. In this proposal, the WDRC algorithm is applied in aerial imagery. The simulation work required is with the help of BTBP center, Odalarevu. The results obtained from large variety of aerial images show strong robustness and high image quality indicating promise for aerial imagery during poor visibility flight conditions[1]. Aerial image measurement includes non-linear, 3-dimensional, and materials effects on imaging. Aerial image measurement excludes the processing effects of printing and etching on the wafer.

In this paper, We proposed a non-linear image enhancement method, which allows selective enhancement based on the contrast sensitivity function of the human visual system. We also proposed an evaluation method for measuring the

Figure 1 Areal image of the test of the building

performance of the algorithm and for comparing it with existing approaches. The selective enhancement of the proposed approach is especially suitable for digital television applications to improve the perceived visual quality of the images.[2-7]

The basic strategy of the proposed approach shares the same principle of the methods that is, assuming that the input image is denoted by I, then the enhanced image O is obtained by the following processing discussed else where[ ]

2. Proposed algorithm

Enhancement algorithm consists of three stages: the first and the third stage are applied in the spatial domain and the second one in the discrete wavelet domain. Our motivation in making an histogram adjustment for minimizing the illumination effect is based on some assumptions about image formation and human vision behavior.

$S(x,y) = L(x,y)R(x,y)$

where $R(x, y)$ is the reflectance and $L(x, y)$ is the illuminance at each point (x, y). In lightness algorithms, assuming that the sensors and filters used in artificial visual systems possess the same nonlinear property as human photoreceptors, i.e.,logarithmic responses to physical intensities incident on the their photoreceptors, Equation 1 can be decomposed into a sum of two components by using the transformation

$I(x,y) = \log(S(x,y))$ (1)

$I(x,y) = \log(L(x,y)) + \log(R(x,y))$ (2)

where $I(x,y)$ is the intensity of the image at pixel location (x,y). (2) implies that illumination has an effect on the image histogram as a linear shift. This shift, intrinsically, is not same in different spectral bands.

Another assumption of the lightness algorithms is the grayworld assumption stating that the average surface reflectance of each scene in each wavelength band is the same: gray [8].

From an image processing stance, this assumption indicates that images of natural scenes should contain pixels having almost equal average gray levels in each spectral band.

Combining (2) with the gray-world assumption, we perform histogram adjustment as follows: 1. The amount of shift corresponding to illuminance is determined from the beginning of the lower tail of the histogram such that a predefined amount (typically 0.5%) of image pixels is clipped

2. The shift is subtracted from each pixel value

3. This process is repeated separately for each color Channel

A. Wavelet Based Dynamic Range Compression And Contrast Enhancement:

Dynamic range compression and the local contrast enhancement in WDRC are performed on the luminance channel. For input color images, the intensity image $I(x,y)$ can be obtained with the following equation:

$I(x, y) = \max[Ii\,(x, y)]$

The enhancement algorithm is applied on this intensity image.

B. Local Contrast Enhancement

The local contrast enhancement which employs a center surround approach is carried out as follows The surrounding intensity information related to each coefficient is obtained by filtering the normalized approximation coefficients with a Gaussian kernel are the normalized approximation coefficients. The contrast enhanced coefficients matrix *A new* which will replace the original approximation coefficients.

C. Detail Coefficient Modification

The detail coefficients are modified using the ratio between the enhanced and original approximation coefficients. If the wavelet decomposition is carried out for more than one level, this procedure is repeated for each level.

A linear color restoration process is used to obtain the final color image in our previous work .For WDRC with color restoration a non-linear approach is employed. The RGB values of the enhanced color image along with the CR factor. Histogram clipping from the upper tail of histograms in each channel give the best results in converting the output to display domain.[9-17]

4. RESULTS AND DISCUSSION

Figure 2 The enhancement results for different types of turbidity. Left Column is of original images. Right column Enhanced images.

The processing for generation of the results is after training a personality in BTBP. Latter, using MATLAB support group of images are processed and appears in Fig.2. These are observable in pairs. Righter image is found will more resolution than the left. It is deemed that the ones with more resolution could be because of applying our proposed algorithm. More focus on this is under progress.

5.CONCLUSION

In this paper, application of the WDRC algorithm in aerial imagery is implemented. The simulation of the algorithm proposed is under collaboration of the facilities of BTBP, Odalarevu. The results obtained from large variety of aerial images show strong robustness, high image quality, and improved visibility indicating promise for aerial imagery during poor visibility flight conditions. This algorithm can further be applied to real time video streaming and the enhanced video can be projected to the pilot's heads-up display for aviation safety.

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REFERENCES

[1] Ch. Raviteja and T.Ramyasree**,** "Wavelet Based Non Linear Image Enhancement Technique For Aerial Imaginary", B.Tech project, JNTUK, Kakinada, 2013.

[2] D. J. Jobson, Z. Rahman, G. A. Woodell, G.D.Hines, "A Comparison of Visual Statistics for the Image Enhancement of FORESITE Aerial Images with Those of Major Image Classes," Visual Information Processing XV, Proc. SPIE 6246, 2006,

[3] S. M. Pizer, J. B. Zimmerman, and E. Staab, "Adaptive grey level assignment in CT scan display*,"* Journal of Computer Assistant Tomography, vol. 8, pp. 300-305 , 1984.

[4] J. B. Zimmerman, S. B. Cousins, K. M. Hartzell, M. E. Frisse, and M. G. Kahn, "A psychophysical comparison of two methods for adaptive histogram equalization," Journal of Digital Imaging, vol. 2, pp. 82-91, 1989.

[5] S. M. Pizer and E. P. Amburn, "Adaptive histogram equalization and its variations," Computer Vision, Graphics, and Image Processing, vol. 39, pp. 355-368, 1987.

[6] K. Rehm and W. J. Dallas, "Artifact suppression in digital chest radiographs enhanced with adaptive histogram equalization," SPIE: Medical Imaging III, 1989.

[7] Y. Jin, L. M. Fayad, and A. F. Laine, "Contrast enhancement by multiscale adaptive histogram equalization," *Proc. SPIE*, vol. 4478, pp. 206-213, 2001.

[8] E. Land and J. McCann, "Lightness and Retinex theory," Journal of the Optical Society of America, vol. 61, pp. 1-11, 1971.

[9] A. Hurlbert, "Formal Connections Between Lightness Algorithms" Journal of the Optical Society of America, vol. 3, No 10 pp. 1684-1693, 1986.

[10] E. H.Land, "An alternative technique for the computation of the designator in the Retinex theory of color vision," Acad. Sci. USA. Vol. 83, pp. 3078-3080, May 1986.

[11] J. McCann, "Lessons learned from mondrians applied to real images and color gamuts," Proc. IS&T/SID Seventh Color Imaging Conference, pp. 1-8, 1999.

[12] R. Sobol, "Improving the Retinex algorithm for rendering wide dynamic range photographs," Proc. SPIE 4662, pp. 341–348, 2002.

[13] A. Rizzi, C. Gatta, and D. Marini, "From Retinex to ACE: Issues in developing a new

algorithm for unsupervised color equalization," Journal of Electronic Imaging, vol. 13, pp. 75-84, 2004.

[14] D. J. Jobson, Z. Rahman and G.A. Woodell, "Properties and performance of a center/surround retinex," IEEE Transactions onImage Processing: Special Issue on Color Processing, No. 6, pp. 451-462, 1997.

[15] Z. Rahman, D. J. Jobson, and G. A. Woodell, "Multiscale retinex forcolor image enhancement," Proc. IEEE International. Conference. on I Processing, 1996.

[16] D. J. Jobson, Z. Rahman, and G. A. Woodell, "A multi-scale retinex for bridging the gap between color images and the human observation of scenes," IEEE Transactions on Image Processing, Vol. 6, pp. 965-976, 1997.

[17] Z. Rahman, D. J. Jobson, and G. A. Woodell, "Retinex Processing for Automatic Image Enhancement", Journal of Electronic Imaging, January ,2004.