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ANALYSIS OF IMAGE ENHANCEMENT USING SVD DCT AND SVD DWT

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ABSTRACT:
Enhancement of satellite images is done using many technologies like SVD DCT , DWT, Genetic algorithm ,etc.,.In this paper an analysis of image enhancement using SVD DCT and SVD DWT is done. Both methods uses histogram equalization as initial step. In SVD DCT method image is converted into DCT domain and in SVD DWT method image is converted into four bands, and inverse transform is applied. The enhanced image of both this methods is analysed based on its mean and standard deviation.

I INTRODUTION

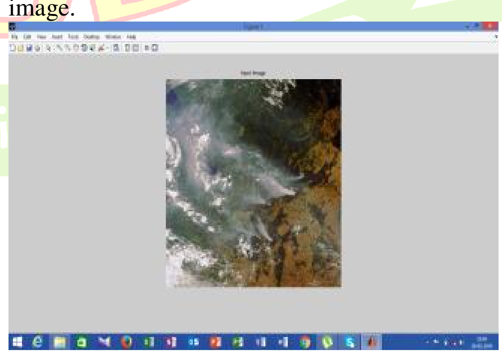
Satelliteimages are used in many applications such as geosciences studies, astronomy, and geographical information systems. One of the most important quality factors in satellite images comes from its contrast. Contrast enhancement is frequently referred to as one of the most important issues in image processing. Contrast is created by the difference in luminance reflected from two adjacent surfaces. In visual perception, contrast is determined by the difference in the colour and brightness of an object with other objects. Our visual system is more sensitive to contrast than absolute luminance; therefore, we can perceive the world similarly regardless of the considerable changes in illumination conditions. If the contrast of an image is highly concentrated on a specific range, the information may be lost in those areas which are excessively and uniformly concentrated.

For this contrast management various enhancement techniques has been used. In this paper satellite image is enhanced using SCD DCT [2] [3] and SVD DWT [4].And analysis of this two methods is done based on mean and standard deviation of the image.

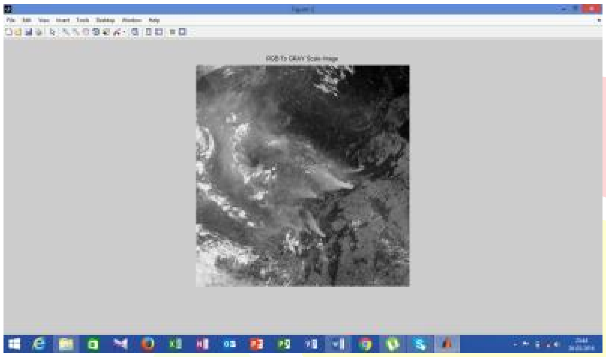
IISVD DWT

HISTOGRAM EQUALIZTION:

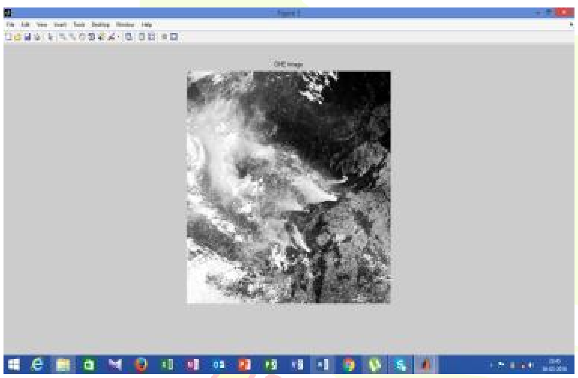
In many image processing applications, the GHE technique[1]is one of the simplest and most effective primitives for contrast enhancement, which attempts to produce an output histogram that is uniform . One of the disadvantages of GHE is that the information laid on the histogram or probability distribution function (PDF) of the image will be lost. Techniques such as BPDHE or SVE are preserving the general pattern of the PDF of an image. BPDHE is obtained from dynamic histogram specification which generates the specified histogram dynamically from the input image.



INPUT IMAGE



RGB TO GRAY SCALE



GHE IMAGE

SVD:

The singular-value-based image equalization (SVE) technique is based on equalizing the singular value matrix obtained by singular value decomposition (SVD). SVD of an image, which can be interpreted as a matrix, is written as follows:

$A = U_A \Sigma_A V^T_A$ (1)

where U_A and V_A are orthogonal square matrices known as hanger and aligner, respectively, and the Σ_A matrix contains the sorted singular values on its main diagonal. The idea of using SVD for image equalization comes from this fact that Σ_A contains the intensity information of a given image.

SVD was used to deal with an illumination problem. The method uses the ratio of the largest singular value of the generated normalized matrix, with mean zero and variance of one, over a normalized image which can be calculated according to

$$\varepsilon = \frac{max \Sigma_{N(\mu = 0, \mathrm{var} = 1)}}{max \sum A}$$

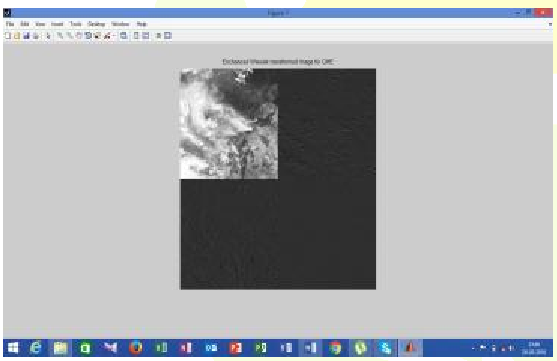
where $\Sigma_{N(\mu=0,\mathrm{var}=1)}$ is the singular value matrix of the synthetic intensity matrix. This coefficient can be used to regenerate an equalized image using

$E_{equalized_A} = U_A (\xi \Sigma_A) V^T_A$ (3)

where $E_{equalized_A}$ is representing the equalized image A.

DWT:

Nowadays, wavelets have been used quite frequently in image processing. They have been used for feature extraction, denoising,compression, face recognition , and satellite image super-resolution . The decomposition of images into different frequency ranges permits the isolation of the frequency components introduced by "intrinsic deformations" or "extrinsic factors" into certain subbands . This process results in isolating small changes in an image mainly in high frequency subband images. Hence, discrete wavelet transform (DWT) is a suitable tool to be used for designing a poseinvariantface recognition system. The 2-Dwavelet decomposition of an image is performed by applying 1-D DWT along the rows of the image first, and, then, the results are decomposed along the columns. This operation results in four decomposed subband images referred to as low–low (LL), low–high (LH), high–low (HL), and high–high (HH). Christo Ananth et al. [7] proposed a system which uses intermediate features of maximum overlap wavelet transform (IMOWT) as a pre-processing step. The coefficients derived from IMOWT are subjected to 2D histogram Grouping. This method is simple, fast and unsupervised. 2D histograms are used to obtain Grouping of color image. This Grouping output gives three segmentation maps which are fused together to get the final segmented output. This method produces good segmentation results when compared to the direct application of 2D Histogram Grouping. IMOWT is the efficient transform in which a set of wavelet features of the same size of various levels of resolutions and different local window sizes for different levels are used. IMOWT is efficient because of its time effectiveness, flexibility and translation invariance which are useful for good segmentation results. The resultsindicate the superiority of the proposed method over the aforementioned methods.



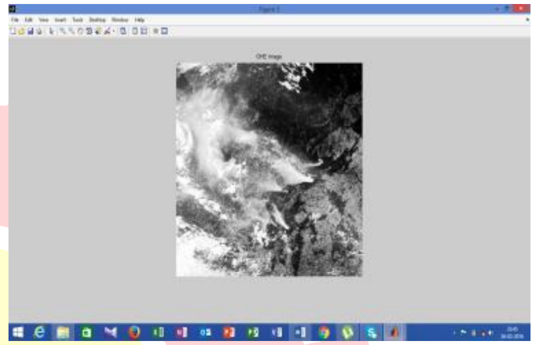
ENHANCED OUTPUT IMAGE

III SVD DCT

HISTOGRAM EQUALIZATION:

There have been several technique reported in literature for the contrast analysis of satellite image such as General Histogram Equalization (GHE), Gamma correction and local histogram equalization (LHE) . These techniques are very simple and effective Indies for the contrast enhancement.But these techniques are not efficient as the information laid on the histogram of the image which is totally lost.

During the last decade, the Wavelet Transform, more particularly Discrete Wavelet Transform has emerged as powerful and robust tool for analyzing and extracting information from non-stationary signal such as speech signals due to the time varying nature of these signals.



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where U_A and V_A are orthogonal square matrices known as hanger and aligner, respectively, and the Σ_A matrix contains the sorted singular values on its main diagonal. The idea of using SVD for image equalization comes from this fact that Σ_A contains the intensity information of a given image.

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where $\Sigma_{N(\mu=0,var=1)}$ is the singular value matrix of the synthetic intensity matrix. This coefficient can be used to regenerate an equalized image using

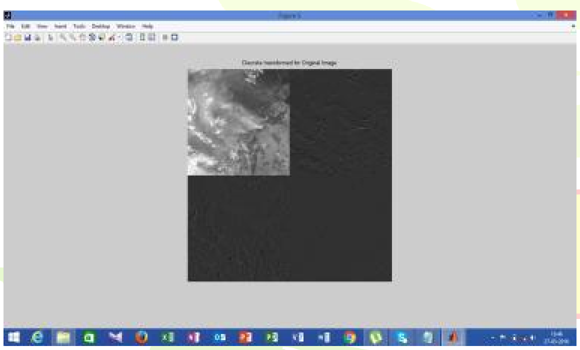
$$E_{equalized_A} = U_A(\xi \Sigma_A) V_A^T \quad (3)$$

where $E_{equalized_A}$ is representing the equalized image A.

DCT:

The discrete cosine transform is a technique for converting a signal into elementary frequency components. It is widely used for extracting the features. The one-dimensional DCT is useful in processing of one-dimensional signals such as speech waveforms. For analysis of the two-dimensional (2-D) signals such as images, a 2-D version of the DCT is
required. The DCT works by separating images into parts of differing frequencies.

The DCT helps to separate the image into parts (or spectralsub-bands) of differing importance (with respect to the image's visual quality). The DCT is similar to the discrete Fourier transform: it transforms a signal or image from the spatial domain to the frequency domain as show in Fig.1. The
popular block-based DCT transform segments an image nonoverlapping block and applies DCT to each block. It gives result in three frequency sub-bands: low frequency sub-band, mid-frequency sub-band and high frequency sub-band. DCTbased enhancement is based on two facts. The first fact is that much of the signal energy lies at low-frequencies sub-band which contains the most important visual parts of the image .The second fact is that high frequency components of the image.



DCT OUTPUT IMAGE

IV ANALYSIS

TABULAR COLUMN:

	MEAN	STANDARD DEVIATION
Input image	80.19	20.07
SVD DCT	102.48	46.49
SVD DWT	103.47	48.35

From the above tabular column clear analysis of SVD DCT and SVD DWT can be obtained.Mean (μ) represent the intensity of the image and the standard deviation represent (σ) the contrast present in the images. The intensity and contrast is more for the same satellite in wavelet transform compared to discrete transform. And hence wavelet transform produces better enhanced image compared to discrete transform.

V. CONCLUSION

The paper has given an analysis between SVD DWT and SVD DCT. The analysis was given by comparing the mean and standard deviation of the enhanced images by the two techniques. The DWT technique decomposed the input image into the DWTSubbands, and, after updating the singular value matrix of the LL subband, it reconstructed the image by using IDWT.In SVD DCT, the basic enhancement occurs due to scaling of singular values of the DCT coefficients. The results show that the SVD DWT technique gives better performance in terms of contrast (variance) as well as brightness (mean) of the enhanced image as compared to SVD DCT technique.

REFERENCES:

[1] T. Kim and H. S. Yang, "A multidimensional histogram equalization byfitting an isotropic Gaussian mixture to a uniform distribution," in *Proc.IEEE Int. Conf. Image Process.*, Oct. 8–11, 2006, pp. 2865–2868.
[2] H. Demirel, G. Anbarjafari, and M. N. S. Jahromi, "Image equalization based on singular value decomposition," in *Proc. 23rd IEEE Int. Symp.Comput. Inf. Sci.*, Istanbul, Turkey, Oct. 2008, pp. 1–5.
[3] H. Demirel and G. Anbarjafari, "Pose invariant face recognition using probability distribution function in different color channels," *IEEE SignalProcess. Lett.*, vol. 15, pp. 537–540, May 2008.
[4] Hasan Demirel and GholamrezaAnbarjafari ―Discrete Wavelet Transform-Based Satellite Image Resolution

Enhancement,‖ in Proc. IEEE Transactions on Geoscience and Remote Sensing, Vol 49, No.6, June 2011.
[5]Ammu Anna Mathew , S. KamatchiBrightness and Resolution Enhancement of Satellite Images using SVD and DWT *International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013*
ISSN: 2231-5381 http://www.ijettjournal.org Page 712
[6] G.Praveena, M.Venkatasrinu A Modified SVD-DCT Method for Enhancement of Low Contrast Satellite Images,*International Journal Of Computational Engineering Research (ijceronline.com) Vol. 2 Issue. 5*
[7] Christo Ananth, A.S.Senthilkani, S.Kamala Gomathy, J.Arockia Renilda, G.Blesslin Jebitha, Sankari @Saranya.S., "Color Image Segmentation using IMOWT with 2D Histogram Grouping", International Journal of Computer Science and Mobile Computing (IJCSMC), Vol. 3, Issue. 5, May 2014, pp-1 – 7
[8] Mahesh M and VenkataSrinu. M,―Low-Resolution satellite image enhancement using DT-CWT & SVD ― in International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) , October 2012 , Volume 1, Issue 4, pp. 40-45
[9] HasanulKabir , and Abdullah Al-Wadud , and OksamChae , ―Brightness Preserving Image Contrast Enhancement Using Weighted Mixture of Global and Local Transformation Functions ―in The International Arab Journal of Information Technology,October 2010 , Vol. 7, No. 4, pp. 403-410
[10] Battula.R.V.S. Narayana and K. Nirmala, ―Image ResolutionEnhancement by Using Stationary and Discrete WaveletDecomposition ― in International Journal of Modern EngineeringResearch (IJMER) , Sep.-Oct. 2012, Vol. 2, Issue. 5, pp-3553-3555.
[11] Y. Tian, T. Tan, Y. Wang, and Y. Fang, "Do singular values containadequate information for face recognition?" *Pattern Recognit.*, vol. 36, no. 3, pp. 649–655, Mar. 2003.
[12] J. W. Wang and W. Y. Chen, "Eye detection based on head contour geometry and wavelet subband projection," *Opt. Eng.*, vol. 45, no. 5, pp. 057001-1–057001-12, May 2006.
[13] J. L. Starck, E. J. Candes, and D. L. Donoho, "The curvelet transform for image denoising," *IEEE Trans. Image Process.*, vol. 11, no. 6, pp. 670–684, Jun. 2002.
[14] M. Lamard, W. Daccache, G. Cazuguel, C. Roux, and B. Cochener, "Use of a JPEG-2000 wavelet compression scheme for content-based ophthalmologic retinal images retrieval," in *Proc. 27th IEEE EMBS*, 2005, pp. 4010–4013.
[15] C. C. Liu, D. Q. Dai, and H. Yan, "Local discriminant wavelet packet coordinates for face recognition," *J. Mach. Learn. Res.*, vol. 8, pp. 1165–1195, 2007.
[16] H. Demirel and G. Anbarjafari, "Satellite image super resolution using complexwavelet transform," *IEEE Geosci. Remote Sens. Lett.*, vol. 7, no. 1, Jan. 2010, to be published. [Online]. Available: http://ieeexplore.ieee.org/xpl/freepre_abs_all.jsp?isnumber=4357975&arnumber=5235113
[17] D. Q. Dai and H. Yan, "Wavelet and face recognition," in *Face Recognition*, K. Delac and M. Grgic, Eds. Vienna, Austria: I-Tech Edu.Publ., 2007, ch. 4, pp. 59–74.