ENHANCEMENT OF SATELLITE IMAGES BY DWT-SVD BASED UPON BFO TECHNIQUE

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ABSTRACT:-The satellite images are of low quality mostly and they are degraded. So they need to be enhanced. The proposed methodology is using DWT-SVD based upon BFO for enhancing the satellite images. BFO is Bacterial Foraging Optimization. The proposed methodology is compared with the existing methodology in terms of PSNR, MSE, BER and MAE .The results show that the proposed methodology is better than the existing technique.

KEYWORDS:- BFO, DWT, SVD, PSNR, MSE, BER, MAE.

I. INTRODUCTION

Satellite images are the common type of the remote sensing images. The remote sensing technique has been used for capturing the images of the objects without making the direct contact with the objects. The remote sensing images are captured by remote sensors. The satellite images are captured by the satellite. The satellites do not make the direct contact with the object whose image has to be captured. The satellite images are the biggest source of the information. The satellite images are used for various applications. They are used in the field of weather prediction, agriculture, education, medical and many more. The satellite images are also used of exploration of those areas where the human cannot reach. So the satellite images are very useful and important. The satellite images are mostly of poor quality. The satellite images are captured usually in the areas where the enlightenment is poor. The satellite image may contain the noise. The noises are of different types. The satellite images are degraded because of the image acquisition device. The image acquisition device can be improper. So this results in the degraded image. The satellite images are degraded and there is the requirement of improving the quality of the satellite images as the satellite images are important source of the information. The satellite images need to be enhanced. There are different types of the image enhancement techniques. The image enhancement techniques can be in the spatial domain and it can be in the frequency domain. When the spatial domain methodology is used then the direct manipulation on the pixel is done. These methods are simple and easy to use. The common examples of the spatial domain methodology are Histogram Equalization, Transformation Functions etc. In the frequency domain methodologies, the Fourier Transformation of the images is considered. The operations are performed on the Fourier Transformation on the images. The image enhancement techniques are no used with the optimization algorithms. These enhance the results of the image enhancement. The optimization algorithm helps in generating better results for the image enhancement.

Figure 1 Image Enhancement of two images [1]

II. LITERATURE REVIEW

In [2], a technique has been found for training the neural networks by using the optimization technique Bacterial Foraging Optimization (BFO). BFO is also accepted as a global optimization algorithm. A technique for image resolution enhancement has been presented in [3]. The proposed technique is using the stationary wavelet transform and discrete wavelet transform. This technique shows better results than the conventional and state-of-the-art techniques. Fingerprints are very useful in today's life. They are the most important source for identifying a person. The fingerprints are enhanced in [4]. A novel methodology for enhancing the fingerprints is given in [4]. In [5], the technique for image enhancement is presented which has modified the histogram equalization. This technique is used for contrast enhancement. In [6], the image enhancement of the remote sensing images is done. In this technique, Cuckoo Search Algorithm is used with DWT-SVD for remote sensing images enhancement. The remote sensing

image is decomposed into corresponding four sub-band images. Cuckoo Search Algorithm is used for optimizing the four sub-bands. In [7], the contrast enhancement is done by using the Bacteria Foraging Optimization. This technique is used for improving the contrast of different images. In [8], the resolution and the brightness have been improved and enhanced using the Discrete Wavelet Transform (DWT) and Singular Value Decomposition (SVD). A new methodology for image enhancement has been presented in [9] in which the cuckoo search is combined with the particle swarm optimization. This technique has been implemented in Matlab. In [10], the image enhancement has been done by histogram equalization which is based upon the genetic algorithm.

III. PROPOSED WORK

The proposed work is using the Bacterial Foraging Optimization (BFO) with DWT-SVD. BFO is the globally accepted optimization algorithm. It is generating more efficient results. The BFO has been introduced by Passino. BFO is dependent upon the foraging behavior of the bacterium E.Coli. The BFOA is basically depending upon the four basic processes: Chemotaxis, Swarming, Reproduction, Elimination-Dispersal. DWT is the Discrete Wavelet Transform. It is used to obtain the corresponding four sub-band image of the given image on which DWT is applied. DWT is applied for getting the four sub-bands (LL, HL,LH, HH). SVD is the singular value decomposition. It is used to obtain the illumination information of the images. If any changes are made to this information this will affect the intensity of the image. The SVD is applied only on the LL sub-band image.

The steps of the proposed work are:

1. The satellite image is taken as input.

2. The image is then equalized using histogram equalization concept.

3. 1- Level DWT is applied on the equalized image and it is also applied on the input satellite image.

4. BFO is applied on the components of DWT of the equalized image.

5. Then SVD is applied and the correction coefficient is obtained.

6. Finally inverse SVD is applied and inverse DWT is applied to obtain the enhanced image as output image.

IV. RESULTS

The results show that the proposed methodology is better than the existing technique. In the Cuckoo search algorithm based satellite image contrast and brightness enhancement using DWT-SVD (which is the existing methodology), the Cuckoo Search Algorithm is used for optimization purpose [6]. The existing methodology is compared with the propose methodology in terms of Peak- Signal-to-Noise Ratio (PSNR) , Mean Square Error (MSE) ,Bit Error Rate (BER) and Median Angular Error (MAE). MSE represents cumulative squared error between the enhanced and original image, whereas PSNR represents a measure of the peak error [6] .PSNR is the quality measure which used to compare the original image and the improved image. BER is the ratio of the number of bits received in error to total number of the bits received. MAE is also the measure that is used for enhancement. The following results show that the proposed methodology is better than the existing technique. Moreover, the image results are also showing that proposed methodology is better than the existing methodology. Larger value of PSNR shows that the proposed methodology is better than the existing methodology. Smaller values of BER, MSE and BER show that the proposed methodology is better than the existing methodology.

Figure 2 Input Satellite Image [11]

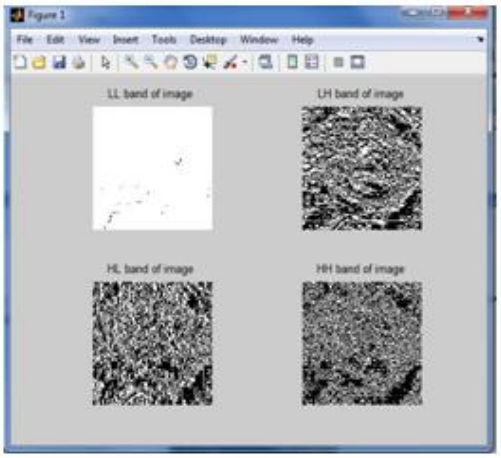

Figure 3 DWT Components of Input Image

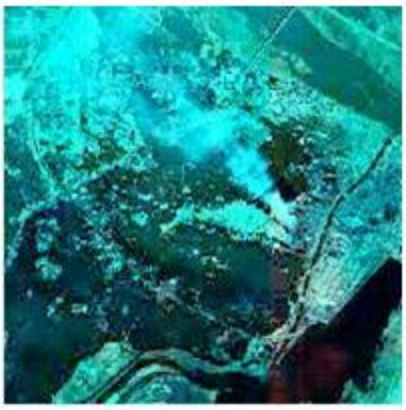

Figure 4 Output of existing methodology

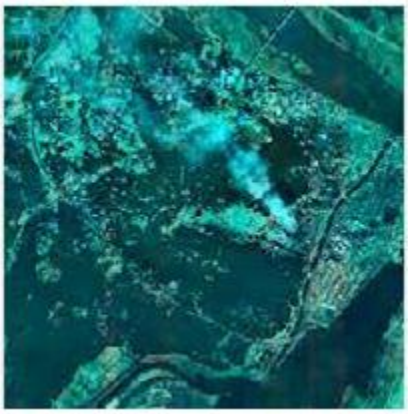

Figure 5 Output of Proposed Methodology

The following tables show the results of different images:

Table 1 Comparison of proposed methodology with existing methodology in terms of PSNR (in dB)

Image No	PSNR (proposed methodology)	PSNR (existing methodology)
1	50.1984	41.1025
2	52.9516	40.4889
3	60.4834	40.331
4	54.6962	39.9827
5	58.3826	40.1375
6	59.5517	40.9925
7	58.4426	40.8687
8	56.5222	40.2094
9	54.4625	40.3433
10	52.9004	40.3218

Table 3 Comparison of proposed methodology with existing methodology in terms of MSE

Image No	MSE(proposed methodology)	MSE(existing methodology)
1	0.62122	5.0446
2	0.32955	5.8102
3	0.058176	6.0254
4	0.22053	6.5285
5	0.094368	6.2999
6	0.072096	5.1741
7	0.093072	5.3236
8	0.14483	6.1965
9	0.23272	6.0083
10	0.33346	6.0381

Table 3 Comparison of proposed methodology with existing methodology in terms of BER

Image No	BER(proposed methodology)	BER(existing methodology)
1	0.019921	0.024329
2	0.018885	0.024698
3	0.016533	0.024795
4	0.018283	0.025011
5	0.017128	0.024914
6	0.016792	0.024395
7	0.017111	0.024469
8	0.017692	0.02487
9	0.018361	0.024787
10	0.018903	0.0248

Table 4 Comparison of proposed methodology with existing methodology in terms of MAE

Image No	MAE(proposed methodology)	MAE(existing methodology)
1	0.41351	3.8819
2	0.96415	5.2995
3	2.4705	4.6433
4	1.3131	5.0343
5	2.0504	4.1318
6	2.2842	4.9984
7	2.0624	4.7453
8	1.6783	6.111
9	1.2663	5.189
10	0.33346	6.0381

V. CONCLUSION

The proposed methodology is using DWT-SVD technique with BFO for image enhancement. The satellite images are enhanced by using this proposed methodology. The proposed methodology is compared with the existing technique which shows the superiority of the proposed methodology in terms of PSNR,MSE, BER and MAE.

VI. REFERENCES

[1] Yudong ZHANG, Lenan WU and Shuihua WANG, "Bacterial Foraging Optimization Based Neural Network for Short-term Load Forecasting", Journal of Computational Information Systems, Vol. 6, pp. 2099-2105, 2010.

[2] Hasan Demirel and Gholamreza Anbarjafari, "IMAGE Resolution Enhancement by Using Discrete and Stationary Wavelet Decomposition", Image Processing, IEEE Transactions, Vol. 20, pp. 1458-1460, 2011.

[3] D. Bennet and Dr. S. Arumuga Perumal, "Fingerprint: DWT, SVD Based Enhancement and Significant Contrast for Ridges and Valleys Using Fuzzy Measures", Journal of Computer Science And Engineering, Vol. 6, 2011.

[4] M. Abdullah-Al-Wadud, "A Modified Histogram Equalization for Contrast Enhancement Preserving the Small Parts in Images", International Journal of Computer Science and Network Security,Vol .12, 2012.

[5] A.K. Bhandari, V. Soni, A. Kumar and G.K. Singh, "Cuckoo search algorithm based satellite image contrast and brightness enhancement using DWT–SVD", ISA transactions, Elsevier, Vol. 53, pp. 1286-1296, 2014.

[6] Jassimrat Kaur and Er. Sukhpreet Kaur, "Contrast Enhancement Using Bacteria Foraging Optimization", International Journal on Recent and Innovation Trends in Computing and Communication, Vol. 2, 2014.

[7] Ammu Anna Mathew and S. Kamatchi, "Brightness and Resolution Enhancement of Satellite Images using SVD and DWT", International Journal of Engineering Trends and Technology, Vol. 4, 2013.

[8] Zhiwei Ye, MingweiWang, Zhengbing Hu, Wei Liu, "An Adaptive Image Enhancement Technique by Combining Cuckoo Search and Particle Swarm Optimization Algorithm", Computational Intelligence and Neuroscience, Vol. 2015, 2015.

[9] Chahat, Mahendra Kumar Patil ,"Image Enhancement Using Histogram Equalization Based on Genetic Algorithm", International Journal of Engineering Research and Development, Vol 7, pp 12-17, June 2013.

[10] Ehsan Valian, Shahram Mohanna and Saeed avakoli, "Improved Cuckoo Search Algorithm for Global Optimization", International Journal of Communications and Information Technology, Vol. 1, 2011.

[11] Muhammad SHARIF, Saad ANIS, Mudassar RAZA and Sajjad MOHSIN , "Enhanced SVD Based Face Recognition", Journal of Applied Computer Science & Mathematics, Vol. 12, 2012.

[12] Sulochana S and Vidhya R, "Satellite Image Contrast Enhancement using Multiwavelets and Singular Value Decomposition (SVD)", International Journal of Computer Applications ,Vol. 35, 2011. [15] P. Karunakar, V. Praveen and O. Ravi Kumar, "Discrete Wavelet Transform-Based Satellite Image Resolution Enhancement", Advance in Electronic and Electric Engineering, Vol. 3, pp. 405-412, 2013.

[13] S. Walton, O. Hassan, K. Morgan and M.R. Brown, "Modified cuckoo search: A new gradient free optimisation algorithm", Chaos, Solitons & Fractals , Elsevier, Vol. 44, pp. 710–718 ,2011.

[14] Pauline Ong, "Adaptive Cuckoo Search Algorithm for Unconstrained Optimization" ,The Scientific World Journal, Vol. 2014 , 2014.