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An Effective Enhancement Method for Satellite Images Using AHE-RWT Technique

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ABSTRACT*:* In this paper a new approach for enhancement of satellite image, which is based on AHE-RWT with SVD and CS algorithm for quality improvement of the low brightness satellite images. The satellite image is corrupted due to noise, so removing of noise is necessary from the images for better visualization. The input image is first applied for enhancement by using Adaptive Histogram Equalization (AHE) and the image is decomposed into the four sub band through the redundant wavelet transform (RWT). Optimization of each sub band of RWT is done by using cuckoo search algorithm and LL threshold sub band of the image is obtained by using singular value decomposition, finally enhanced image is reconstructed by applying inverse redundant wavelet transform (IRWT). The Particular gray scale information of the satellite image is employed by singular value decomposition (SVD). The result of proposed method is shown in terms resolution, and mean deviation over state of the art and conventional techniques.

KEYWORDS*:* Adaptive histogram equalization (AHE), Redundant wavelet transforms (RWT), Cuckoo search algorithm, Singular value decomposition (SVD), and Wavelet thresholding.

I.INTRODUCTION

The enhancement is method used to make the pictures clearer. Satellite picture is contains photo of the entire or part of the earth which is taken by simulated satellite. So pictures caught by the satellite and remotely detected satellite pictures are have applications in different field, for example, geography, ranger service, agriculture, insight ,fighting .and so on [1]. The satellite pictures are broadly utilized for parameter investigation and to comprehend the earth environment proficiently. Be that as it may, some satellite pictures will be in various ranges and in noticeable hues. When all is said in done, we can say crude satellite pictures are generally low scope of differentiation; henceforth contrast improvement is utilized for better show of pictures for good perception and translation.

There have been created a few procedures to beat these issues, for example, adaptive histogram equalization and general histogram equalization systems. When all is said in done, because of lacking illumination of the satellite pictures contain low element force estimation of district. So satellite pictures should be better show by preparing them. There are numerous techniques have been redesigned to improvement of force level satellite pictures this handled under spatial area. This sort of system consider general histogram equalization, high pass channel, low pass channel, gamma remedy, and so on. In some condition, DCT is a one kind of space which gives partition of ghostly and which has property with practicality to upgrade the elements by considering the particular quality recurrence segments in various structure. Be that as it may, these sorts of strategy have some drawbacks in changing the satellite pictures utilizing DCT piece [2].

In this manner, AHE is exceptionally powerful technique for low complexity upgrade of satellite pictures, so information sets are gathered from blood vessel satellite are polluted by noise. There are different sorts of noises, for example, white Gaussian commotion, dot noise, speckle noise(multiplicative noise) and in various pictures antiques modalities will degenerate the pictures, furthermore there are numerous debasements, for example, blemished instruments, issues connected with the information procurement working. Because of these sorts of corruption it will influences on human translation from the satellite pictures. Because of low quality picture the estimations of quantitative and PC helped investigation get to be issue. In this way, picture improvement gets to be vital in numerous applications, the noise expulsion from pictures still a test to the analysts.

The two areas which are extensively partitioned by picture upgrade exploration are: wavelet domain and spatial domain. From these domains in most recent three decades, numerous trials are led from wavelet transform

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domain. The wavelet transform domain is extremely powerful procedure for picture preparing and valuable for improvement of picture. The wavelet transform domain has characteristics coefficients such as decays and sparsity; compelling, rearranged and effective. So the work in this technique is done by using AHE for partial enhancement and RWT is used to generate coefficients for enhancement of image through cs algorithm.

The paper is organized as follows. Section 2 is gives the brief overview of the methodologies related to the work, section 3 gives the proposed architecture work; section 4 gives the simulation result of proposed work, section 5 conclude the paper.

II.RELATED WORK

A) REDUNDANT WAVELET TRANSFORM

Redundant Wavelet Transform is effective tool for image processing. Compare to Fourier transform the RWT is much flexible and has few computational loads [9]. This method constructs the better resolution image by processing all the low quality images with the reference input image. The RWT combines wavelet and interpolation with filter coefficients. The main difference between the DWT and RWT is that, DWT uses decimator factor in its operation and RWT uses interpolation in its operation. In this method decimators are omitted in the wavelet decomposition and for every decomposition level length of coefficient of wavelet kept same. It is shift invariance at expense of the more storage and computation [6]. In the data analysis all resolution levels distributed equally at same time. RWT works on simple basic idea, in this technique we just apply input to an appropriate low–pass and high–pass filter, in which data at each level is generate from one sequence to next level. Here up sample the sequence of the filter by factor two at every time.

The original data is on top line will be decomposed in three levels. In this method two filters are used to generate sub band frequency, from these bands the different coefficients are used for tuning purpose. It splits the input image into four frequency sub band of the image; the four sub bands are LL, LH, HL, and HH bands. The information value contained in the LL sub band has good resolution than the other bands. The interpolation with factor 2 is used to construct the frequency sub band from the image. The interpolation is Estimating process of continuous value function from the discrete samples.

The applications of the RWT method found in addressing of the high resolution problem in ordered to revalue the detailed information which is hidden by noise in the image, and RWT applications have found in image acquisition processing. And other applications of RWT with interpolation are; the interpolation is magnification of image, registration of sub pixel value image, and spatial distortion are corrected.

B) ADAPTIVE HISTOGRAM EQUALIZATION

Various kinds of image enhancement schemes are established to extract the gray scale manipulation. The adaptive histogram equalization is most popular method for contrast enhancement because; the AHE technique is most effective and simple [2]. Input image is contaminated by various kinds of noises. And which will affects in interpretation and visualization. So the noise is required to be removed from the image.

In order to remove the noise and for processing AHE, the input image must first convert one form of colour space into another form. In AHE method, the input is in form of RGB colour space will be converted into YCbCr colour space; because YCbCr colour space has only two axes, those are luminance and chromaticity; Y is intensity component and Cb, Cr are difference chromaticity component of blue and red colour respectively [11]. From these two axes we can easily enhance the intensity value of the image. Once we convert the colour space, first we need to separate both luminance and chromaticity axes, from that we are considering only intensity (luminance) axes. After separating the axes, the intensity information will be equally distributed in window.

The AHE technique is used to increase the brightness of the satellite image, and method which computes the several histograms, each histograms of the AHE is corresponds to the distinct pixel of the image and uses those values to redistribute the intensity value of the image [3]. Hence, AHE is applicable for improvement of the low brightness satellite images and enhancing the definition of the edge.

C) CUCKOO SEARCH ALGORITHM

The cuckoo search algorithm is proposed recently in the year 2009; this algorithm is used for solving the optimization problem which is involved in the satellite images. This technique inspired by many cuckoo birds by leaving their eggs in other host bird nest. The cuckoo is fascinating bird not only of their charming sounds is can make, but also of their aggressive regeneration strategy [5]. The Cuckoo search algorithm is under obligate parasitic

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characteristic of few cuckoo species which is combined with L'evy flight characteristic of fruit flies and some other birds [1]. For optimization purpose many algorithm are inspired through nature become increasingly popular. The optimization considers many disciplines in many applications, like money, resources time which are always limited, so optimization is must in many cases [7].

Why Cuckoo Search is so efficient?

Hypothetical investigations of molecule swarm advancement have proposed that PSO can unite rapidly to the present best arrangement, yet not as a matter of course the worldwide best arrangements .Indeed, a few investigations recommend that PSO upgrading conditions don't fulfil the worldwide merging conditions, and in this manner there is no surety for worldwide meeting. Then again, it has demonstrated that cuckoo search fulfil the worldwide merging necessities and in this manner has ensured worldwide meeting properties. This suggests for multimodal advancement, PSO may unite rashly to a nearby ideal, while cuckoo pursuit can as a rule unite to the worldwide optimality [7].

Applications of cuckoo search algorithm:

Cuckoo search has been connected in numerous zones of advancement and computational intelligence with promising effectiveness. For instance, in the building plan applications, cuckoo seek has unrivalled execution over different calculations for a scope of constant streamlining issues, for example, spring outline and welded bar plan issues.

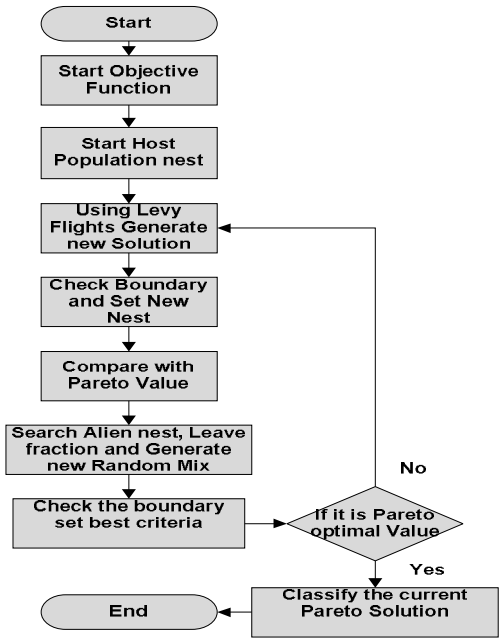

Fig. 2 CS algorithm flow chart

In the Fig. 2 shows how the cuckoo search algorithm is performed in the proposed method.

Step 1: Set the number of objective function by generating the threshold value for different solutions.
Step 2: Set the host value for different nest and obtaining the solutions.
Step 3: Generate new nest by using the levy flight and keep the current best.
Step 4: check the boundary for the different coefficients and compare those with Pareto value.
Step 5: Evaluate the set of functions and generate maximum random coefficient.
Step 6: Repeat the process and stop for some criteria is achieved.

D) SINGULAR VALUE DECOMPOSITION

Singular value decomposition uses their properties to decompose the real or complex matrix. It is method for decomposing of a correlated variable with the set of the uncorrelated variable and it is used to provide the improved representation of many relationships between the original data sets. It is technique for reduction of data and for feature

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detection [10]. The SVD is applied to midlevel of image processing, and for area of compressed image and recognition of the image. In this method the matrix A is factorizing into three Matrices U, V, and Σ in such way that;

$$A = U\sum V^T \dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where U and V are orthogonal matrices and Σ is diagonal matrix.

The total decomposition method is known as singular value decomposition and which is given by

$$A_i = U_A\sum_A V_A^T \dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Σ_A matrix contains the set of singular value and which is fixed on main diagonal of the matrix. The gray scale image is represented by the singular value matrix.

The equalization of the image using the SVD method is depending upon the equalization of the singular matrix which is realized by the SVD. The rectangular matrix is generated by the SVD method and which decomposes the product of other three matrices. The gray scale information of the image is represented by the singular value matrix, and input image brightness will changed by making alteration in the singular value.

III.PROPOSED METHODOLOGY

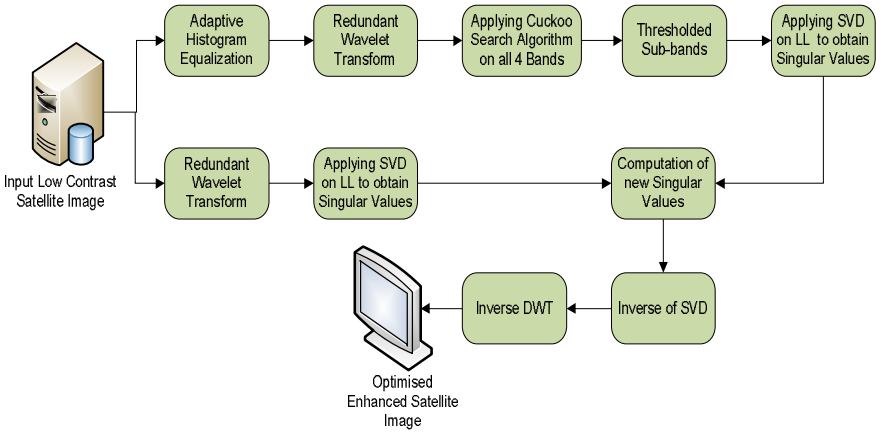

Fig. 3 Block diagram of the proposed system.

The improved technique which is based on the cs algorithm, for enhancement of brightness and contarst of the satellite images is devolped. The fig. 3 shows the block diagram of the proposed system. The AHE-RWT based with cuckoo search algorithm is employed. The enhancement is need for the satellite images because the presence of uncertainty, affected image due to some factor like environment conditions, low resolution, and low illumination and poor spatial resolution. Therefore efficient enhancement has been introduced in the work.

The proposed methodology for image enhancenment is taken in two steps. The first one is AHE which is mentioned in section II. And it contains expanded value information of the image. The low contrast satellite image, such as in the case of LANDSAT image having 7 band data which is applied to AHE and in other way the same input image is applied to RWT block, The AHE is basic enhancement technique which increase the pixel value distribution of the input image, by this we can inrease perceptional information of the satellite image. The enhancemenced image is converted into coefficients by using RWT technique, these coefficients are tuned for particular value from cs algorithm.

The wavelet coefficients created and which are modified through the threshold tuning function. In this type of thresholding functions flexiblity will not exhibits because which has no fixed structure and dependancy on threshold value is fixed. To overcome these drawback, their have been several set of thrsholding values are created.

In this work, the energy level information of the satellite image has bands such as red, green and blue on which RWT is applied to get clearer image. The RWT scheme shifts the input image into four sub bands, as LL, LH, HL, and HH. The input image contains frequency components which covered in these four sub bands. Therefore after taking IRWT we will get enhanced image with good contrast and sharper. Original image is reconstructed by using IRWT to generate the resultant enhanced satellite image.

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A effective method is proposed is as follows firstly take the low brightness input satellite image for precessing, AHE expands the pixel value information by this we will get more clearer image. After this, both input and AHE output images are transformed with RWT, which genarates four subband of the frequency.

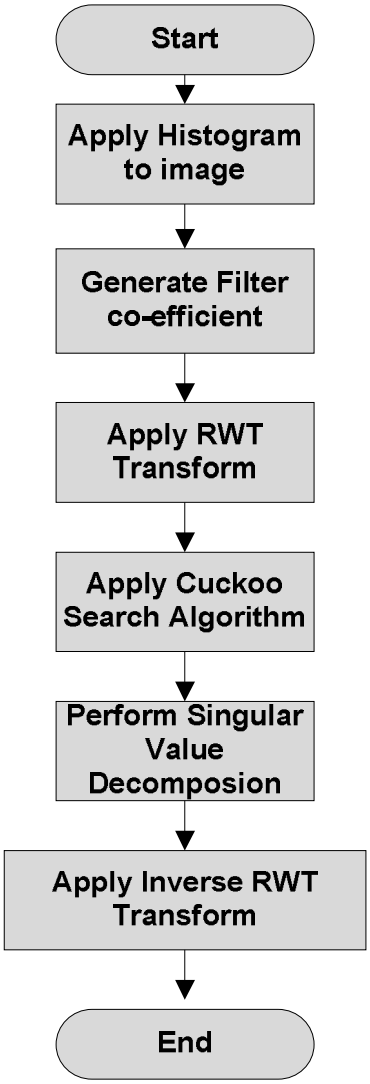

Fig. 4 Basic flow chart of proposed methodology

Finally cuckoo search algorithm is applied for optimizing all the bands.Basic flow of the proposed method is shown in Fig. 4.

The computational process of the proposed system is as follows:

Step 1: In the first step, selected a query image for processing.

Step 2: Convert input image of RGB color space into YCbCr color space for applying AHE.

Step 3: Consider only pure Y plane from the YCbCr color space.

Step 4: Apply adaptive histogram equalization on Y plane. Which contains the intensity information with expanded pixel values.

Step 5: Generats filter coefficient by using RWT.

Step 6: The cs algorithm is applied on each band of the RWT for optimization.

Step 7: Compute the singular value decomposition on each plane of the LL bannd of input image .

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Step 8: After calculating the maximum element, apply the ISVD to create new coefficients.
Step 9: Apply the IRWT using ($LL^{\wedge}_{SVD}$,$LH^{\wedge}$,$HL^{\wedge}$,$HH^{\wedge}$) after taking the new $LL^{\wedge}_{SVD}$.
Step 10: Optimised enhanced satellite image is obtained.

IV. SIMULATION RESULT

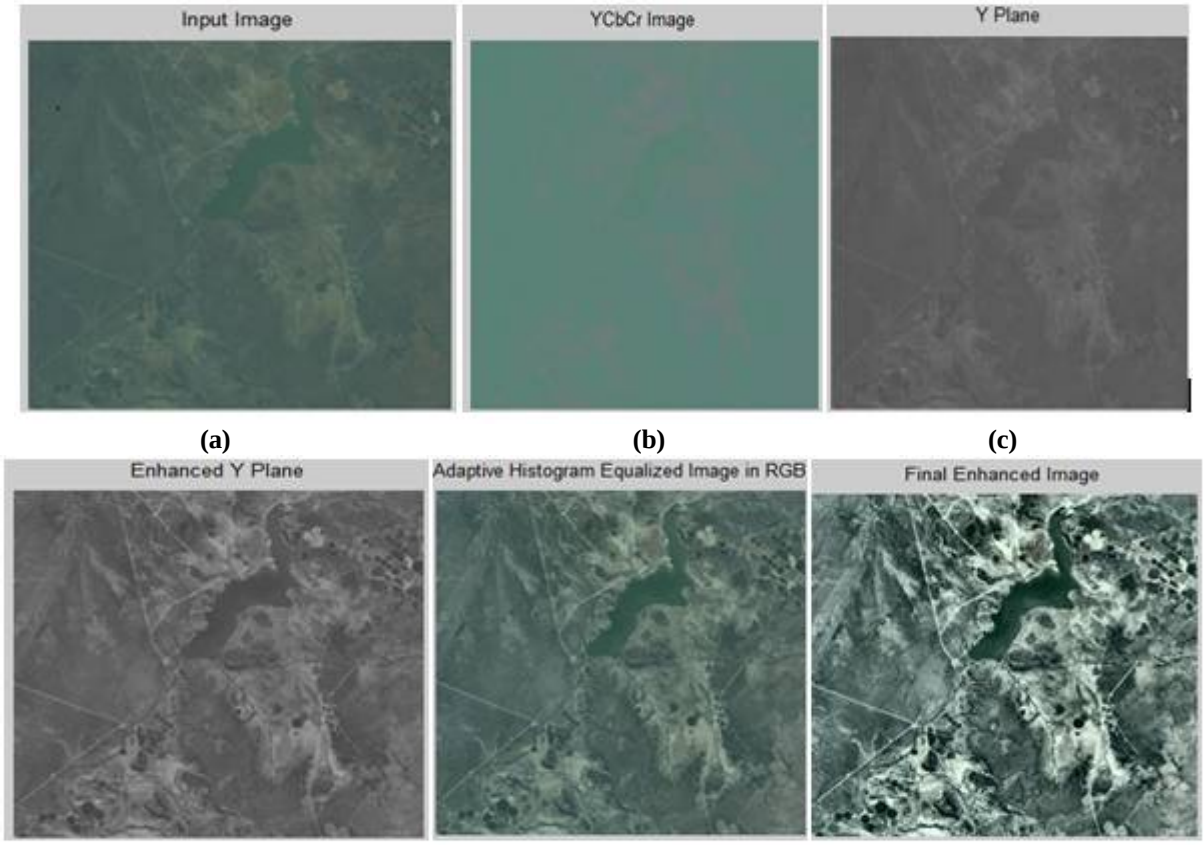

Fig. 4 (a) low quality satellite image,(b) converted colour space image from AHE,(c) y palne image,(d) enhancedy plane image (e) AHE image in YCbCr plane,(f) enhanced image.

In the fig. 4, shows how the low brightness satellite is processed for the enhancement and by the result we can observe that image is getting enhanced by applying different methods.

V. CONCLUSION

The numerous satellite pictures are sullied with noise. The numerous kind noises, for example, white Gaussian noise, speckle noise will degenerate the pictures. The corruptions the information of interest will influence the human representation and understanding. So upgrade of the satellite pictures is required in numerous applications. In this paper, another technique for improvement of the force and splendour of the satellite picture is drawn closer by utilizing the AHE-RWT based through the cuckoo search algorithm is presented. The two strong strategies cs algorithm and AHE-RWT are consolidated to accomplish the best upgrade for satellite picture in this paper.

In this paper, another methodology for upgrade of the satellite picture is presented. This paper gives a novel for the shine upgrade for low quality satellite picture utilizing the AHE-RWT and cuckoo search algorithm. The solitary worth decay gives the dim level data for the given picture. The proposed technique changes over information picture into AHE-RWT coefficients and these coefficients are standardized utilizing particular quality decay. The

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information pictures is improved and recreated by utilizing IRWT. The proposed algorithm has been checked with numerous satellite pictures. The algorithm is helpful for some satellite pictures those are having low determination. The proposed algorithm is uncovers with upgrade result which is outwardly analysed. AHE-RWT is proposed.

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