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Performance Evaluation of DBLA Technique Based on Image Enhancement by using Fuzzy Logic

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***Abstract*—- Image enhancement is the utmost standard process for visualization uses. In recent times ample effort is done to enhance the brightness for improving the accuracy of remote sensing images. This research work proposed the DWT, Guided filter as well as Fuzzy logic technique as the post processing function to enhance the accuracy of image by reducing the problem of noise which has been present in the images.**

Keywords: Adaptive histogram transfer function, DWT, dominant brightness level analysis, fuzzy based enhancement.

I INTRODUCTION

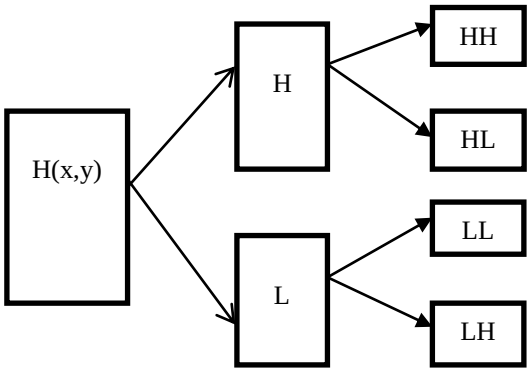
Remote sensing images have an essential function in several areas for example for instance metrology, agriculture geology etc[1]. Dominant brightness level analysis(DBLA)[1] indicates that it is an efficient method for the image enhancement. Contrast improvement images could have power distortion and eliminate image data in number of sections. To irresistible the glitches of images ,decompose the original image into numerous levels. The projected algorithm conduct discrete wavelet transform (DWT)[2] on the original images that decompose the original image into different sub-bands LL, HL, HH and HL[2]. From then decompose the LL sub-band into low, middle, and high intensity layers. Intensity transfer functions are adaptively estimated by applying the knee transfer function and the gamma adjustment function. The resultant improved image is obtained by applying the inverse DWT(IDWT).

fig(a)dominant result

fig(b)Proposed dominant result

A. DWT

Image enhancement is the process of enhancing the feature of the digital images. The cause may be a low resolution camera or poor brightness. [3]They usage wavelet transforms due to their integral property. These transforms decomposed the input image into different frequency components. DWT has various uses in image processing, like feature extraction ,de-noising face recognition ,satellite image super resolution etc. I practice 2-D DWT to decompose the image into four sub-band HH, HL,LL,LH[1]. The LL sub-band contains illumination information while the other sub-bands set up the information of edges.



Block diagram of DWT

B. DBLA

This algorithm computes brightness by using the Low–intensity factor in the wavelet domain and transfer intensity values[12]. First of all DWT is attained on the new images and formerly utilise the log-average luminance. The LL sub group split in to three different forms. Power transfer functions are adaptively predicted utilise the log transfer function and the gamma adapt function. Since at that point, the subsequent improved image is attained usage the inverse DWT[10]. The algorithm promotes the complete contrast and recognition facts better than present techniques.

C. ADAPTIVE INTENSITY TRANSFER FUNCTION:

This function figured in three disintegrated by using the knee transfer function and the gamma transfer function[12]. Formerly, this function is applied for colour-preservation. The ensuing enhanced image is acquired via the IDWT.

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D. ADAPTIVE HISTOGRAM EQUALIZATION

Adaptive histogram equalization [AHE] is an excellent contrast improvement method for both natural images and medical images. It is dissimilar from standard HE in the respect that the adaptive process figures numerous histograms, each equivalent to a dissimilar part of the image[8]. AHE is the process by which at lower scales contrast is improved, though at larger scales contrast of a image is reduced. The benefit of AHE is that it is , reducible and frequently creates superior images.

E. FUZZY BASED IMAGE DEVELOPMENT

This technique is among the vital methods of image processing. It has two essential parameters M and k. M is the average intensity value and K is the contrast intensity parameter. Only the V component spread with contrast enhancement techniques as well as compared with advanced algorithms

II RELEATED WORK

Jafar et al. (2007) [1] has proposed that contrast enhancement is a vital stage in virtually apiece image processing. This method is simple and effective. Li et al.(2008)[2] has suggested a novel color image enhancement process which is based on (Multi Scale Retinex)MSR. Apposite wavelets bases input image fragmented in three levels. Then decompose the process input image into different enhancements algorithms. Then coefficients were employed to scale. Chen et al.(2008)[3] has planned a new contrast enhancement technique for remote sensing images which is based on fuzzy. Fuzzy set theory proposed use grey due to the traditional division by values to evade claps. The foremost conception of the principle is that the elements of an interval [0, 1] instead of binary value membership degree. Sheets et al. (2010) [4] has proposed a new method to increase its brightness and contrast enhancement capabilities.Performance time-dependent on subdivision size and histogram. Yang et al. (2010) [5] has defined some nonlinear transform image contrast enhancement method. It is the most used functions to represent a regularized incomplete beta function estimates. But how to define beta function coefficients for Marg is a problematic. To avoid tricking in local optimum, a chaotic differential evolution algorithm is suggested. Men et al (2010) [6] has described a fuzzy contrast enhancement procedure using fuzzy principle in non-subsampled contour-let transform (NSCT) domain. In this technique the input image high pass sub-band and decomposed in sub-band low pass by NSCT. Then, map each high pass membership function in Fuzzy domain for applying to image contrast. Finally, modify the NSCT fuzzy domain and modified from image NSCT coefficients to regroup. Demirel et al.(2010)[7] has presented a new satellite image contrast enhancement process. It is based on the DWT and SVD. In these techniques divide the input image using dwt-up and low-sub-band image. Then singular value matrix estimates and again it is the inverse DWT. Experimental results shows that the planned process has the superiority over previous and State-of-artprocesses. Akho et al. (2012) [8] has suggested a novel fuzzy logic and histogram based algorithm for image enhancement. It has two essential parameters M and k. M is the average intensity value and K is the contrast intensity parameter. Only the V component spread with traditional contrast enhancement techniques as well as compared with advanced algorithms. Ramadan et al (2014)[9]] has presented a novel technique for an images impulsive noise decrease and edge protection. There are two conditions to determine whether an image pixel is noisy or not in the detection stage. To distinguish between corrupted and uncorrupted pixels two predetermined threshold values are elaborate in the computation of the second condition.Only pixels detection stage to be set for the noise in the next filtering stage. Yu et al.(2014)[10] has provided that Edge preservation ratio (EPR) is a full-reference metric for objective image quality assessment(IQA).The probability and supremacy of EPR have now been validated via image amplification and noise decrease. Tentative effects propose it is tough to totally recover missing communications by image zoom and high image distinction may be produced from brief and distinctive image assemblies. Deshmukh et al.(2015)[11] has presented novel contrast enhancement method which is based on fuzzy. The image fuzzify, function and defuzzify is proposed.To capture the medical image contrast this method is applied**.** Arora et al.(2015)[12]**has** defined that a vastly overexposed color image is considered by high brightness, low chromaticity and loss of feature.Based on the intensity of exposure, split two areas, dark and bright image. Contrast improvement and bright areas darker than V components are fuzzified and choosing modify membership functions. For being illuminated , s component is modified and fuzzified. Sarangi, p. P. Et al (2014) [13] has presented an examination procedure for engineering and machine knowledge optimization problems. Enhance its adaptability and effectiveness in a gray scale image detail. Jin et al.(2015)[14] has offered a new method for both noise suppression and edge protection. To perceive the edge info the building tensor is proposed. In this technique reduction, detection and quantified process are integrated as a matrix mask.

III GAPS IN LITERATURE

Following are the various gaps in earlier work on image enhancement techniques.

1.The DBLA has neglected the use of guided image filter to decrease the problem of noise which will bes in the image.

2. It is also found the color artifacts which are existing in the image because of the transform domain methods are also ignored in DBLA.

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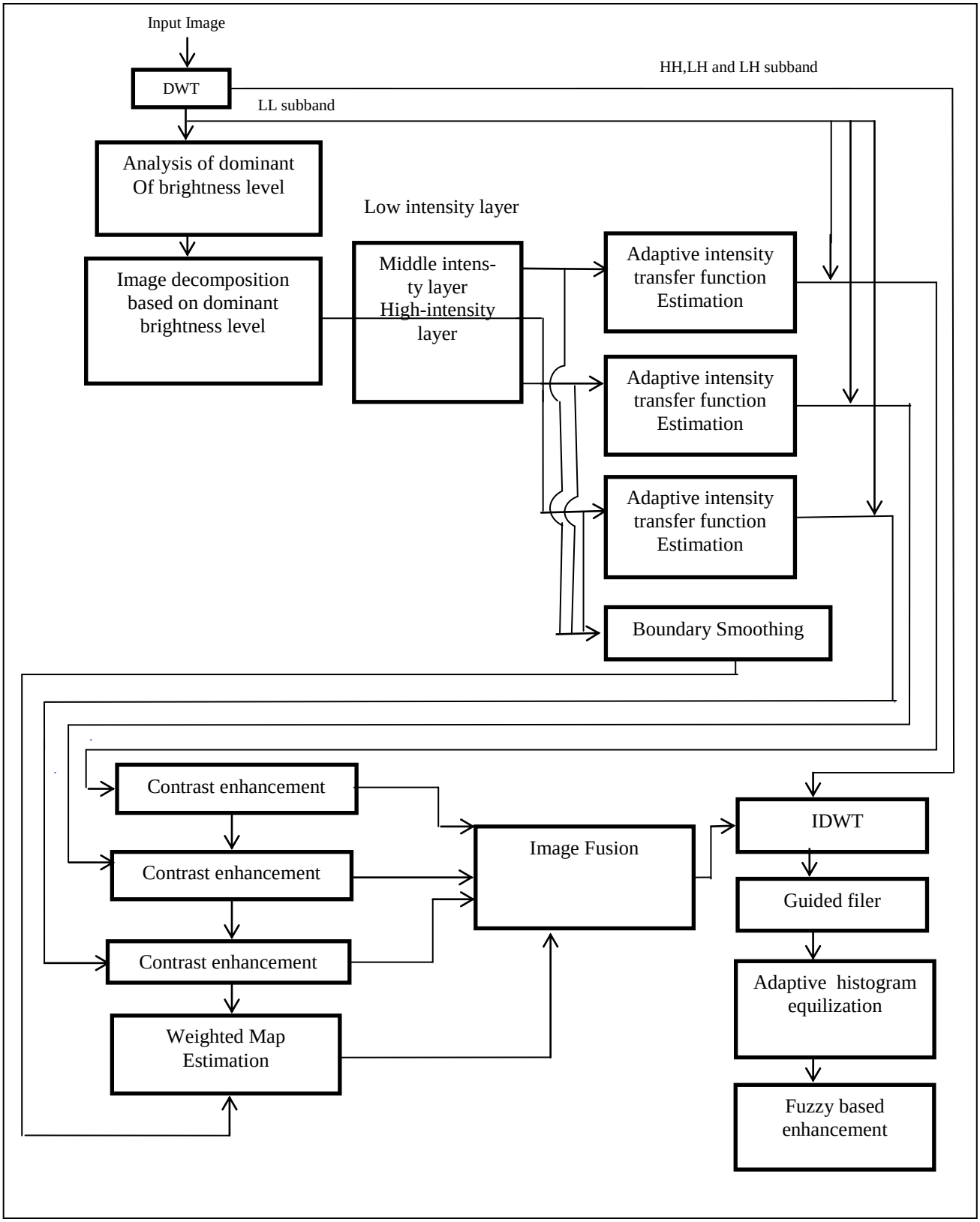
IV PROPOSED METHODOLOGY



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V RESULTS AND DISCUSSIONS

Towards appliance the planned algorithm, plan and implementation has been prepared in MATLAB applying image control toolbox. Outcome appearances that this method provides superior effects than surviving procedures.Table 1 is show the numerous images that are found in that research work. As revealed in provided numbers, we're comparing the outcomes of many images. Results shows assessed method results which are a lot better than existing methodologies. The outcomes shows the performance analysis between existing and in the projected methods. There are various parameters are used to show the performance of projected technique

Table1. Images used in research work

Image name	Extension	Size in KBs
image1	.jpg	69.8KB
image2	.jpg	9.97KB
image3	.jpg	24.5KB
image4	.jpg	43.7KB
image5	.jpg	66.3KB
image6	.jpg	13.2KB
image7	.jpg	7.36KB
image8	.jpg	14.9KB
Image9	.jpg	10.0KB
Image10	.jpg	7.20KB

Mean Square Value(Mse)

MSE is the best process to show dimension of the persisting technique and proposed technique. This is process is forthright to project algorithm that fall the mean square error.

$$\text{MSE} = \frac{1}{\text{GH}}\sum_{i}^{G} = 1\sum_{j}^{G} = 1(f(r,s) - f'(r,s))^2$$

Table2. Mean square error value

Image	Dominant results	Proposed dominant results
Image 1	200	24
Image 2	227	11
Image 3	295	44
Image 4	220	17
Image 5	286	14
Image 6	261	35
Image 7	256	7
Image 8	199	7
Image 9	148	9
Imag 10	121	12

It necessities to be abridged so the projected algorithm is show the enhanced results than the accessible method such as MSE is less in entirely case

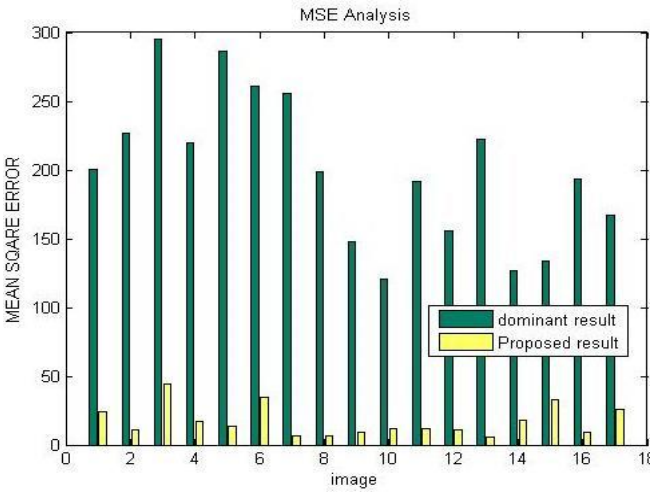

Fig1.Analysis of MSE

Peak Signal To Noise Ratio(Psnr)

This process is the relation between the determined probable unit of signal and debasing noise that affect the value of image. PSNR signify the peak error. To calculate the PSNR firstly find out the value of the MSE.

It is defined as:

$$PSNR = 10.\log_{10}\frac{MAX_I^2}{\text{MSE}}$$
$$= 20.\log_{10}\frac{MAX_I^2}{\text{MSE}}$$
$$= 20\log_{10}(MAX_{10}) - 10.\log_{10}(MSE)$$

Table3. peak signal to noise ratio

Images	Dominant results	Proposed dominant results
image 1	25.1205	34.3287
image 2	23.1754	34.1514
image 3	23.4326	31.6963
image 4	24.7066	35.8263
image 5	23.5671	36.6695
image 6	23.9644	32.6901
image 7	24.0484	39.6798
image 8	23.2453	33.5068
image 9	21.2644	36.3699
image 10	27. 3029	37.3390

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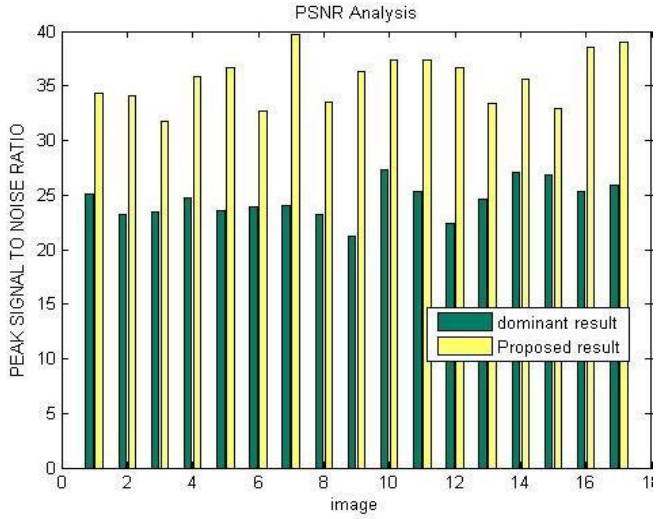

Fig2.Analysis of peak signal to noise ratio

ROOT MEAN SQUARE ERROR(RMSE)

The RMSE is used to figure the change amid the expected values and values detected from the surrounds that is being demonstrated. RMSE need to be minimized.

Table 4.Root mean square error

Image	Dominant results	Proposed dominant results
image 1	14.1421	4.8990
image 2	17.6918	5
image 3	17.1756	6.6332
image 4	14.8324	4.1231
image 5	16.9115	3.7417
image 6	16.1555	5.9161
image 7	16	2.6458
image 8	17.5499	5.3852
image 9	22.0454	3.8730
image 10	11	3.4641

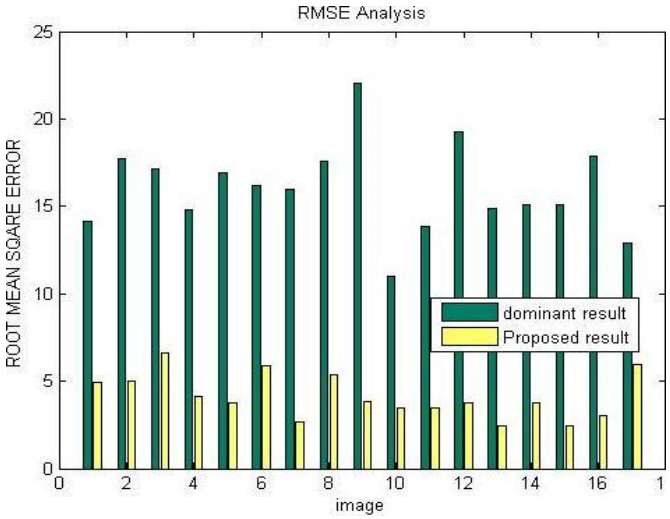

Fig4.Analysis of rot mean square error

BIT ERROR RATE(BIR)

This is simply the Bit Error Ratio among the input image and final image. It need to be minimized.

$$\text{BER} = \frac{1}{GH}\sum_{s=1}^{G}\sum_{r=1}^{H}[f(s,r) - f'(s,r)]$$

Table 5.Bit error rate

Image	Dominant results	Proposed dominant results
image 1	0.0398	0.0291
image 2	0.0431	0.0293
image 3	0.0427	0.0315
image 4	0.0405	0.0279
image 5	0.0424	0.0273
image 6	0.0417	0.0306
image 7	0.0416	0.0252
image 8	0.0430	0.0298
image 9	0.0470	0.0275
image 10	0.0366	0.0268

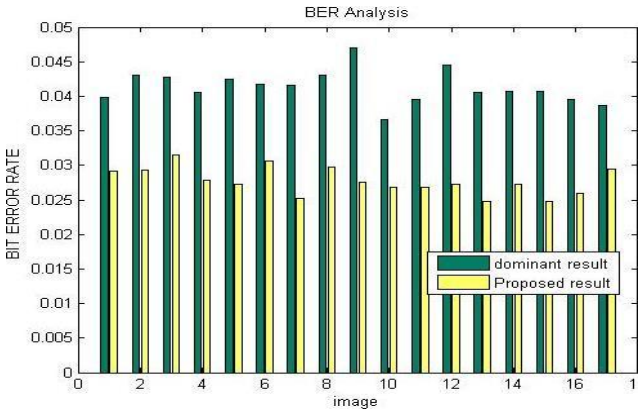

Fig3.Analysis of bit error rate

Normalize Cross Co-Relation(Ncc)

NCC necessities to be close to 1, so planned algorithm show improved outcomes than the existing procedures as NCC is close to 1 in each instance .The main objective is to preserve NCC as much as possible to close to one.

$$\text{NCC} = \frac{\sum_i^m = 1\sum_j^n = 1(A_{ij} - B_{ij})}{\sum_i^m = 1\sum_j^n = 1(Aij^2)}$$

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Table6. Normalized cross co-relation

Image	Dominant results	Proposed dominant results
image 1	0.9023	0.9991
image 2	0.9006	0.9997
image 3	0.9007	0.9988
image 4	0.9005	0.9998
image 5	0.900o3	0.9983
image 6	0.9004	0.9991
image 7	0.9004	0.9997
image 8	0.9005	0.9986
image 9	0.9005	0.9992
image 10	0.9010	0.9995

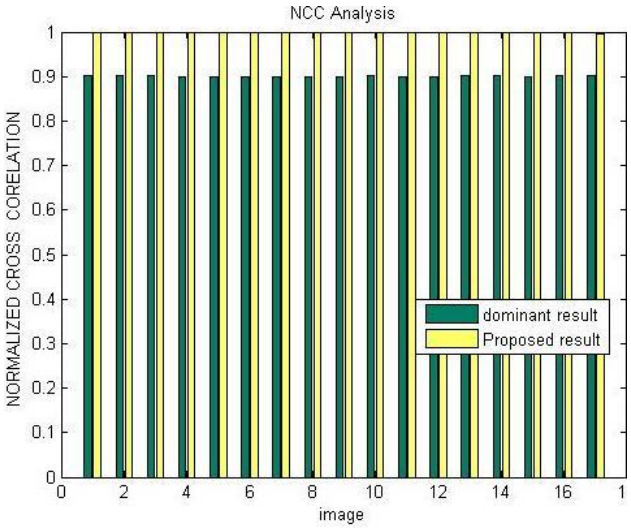

Fig5Analysis of normalization cross co-relation

NORMALIZED ABSOLUTE ERROR(NAE)

NAE is a degree of exactly how distant is the fused image from the novel image. Large value of Normalized absolute error shows poor quality of the image.

$$NAE = \frac{\sum_{s}^{G} = 1 \sum_{r}^{H} = 1|X(s,r) - X\hat{}(s,r)|}{\sum_{s}^{G} = 1 \sum_{r}^{H} = 1|X(s,r)|}$$

Table7.Normalized absolute error

Images	Dominant results	Proposed dominant results
image 1	0.1001	0.0293
image 2	0.1000	0.0216
image 3	0.1000	0.0279
image 4	0.1001	0.0196
image 5	0.1000	0.0152
image 6	0.0999	0.0286
image 7	0.1000	0.0132
image 8	0.1000	0.0215
image 9	0.1000	0.0129
image 10	0.0997	0.0288

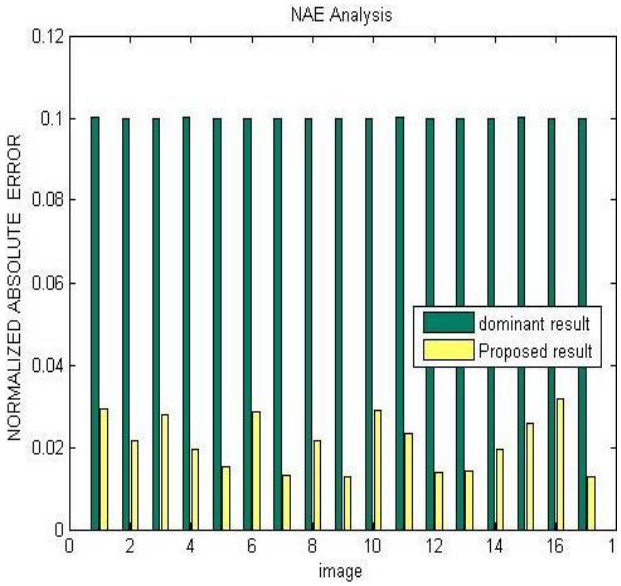

Fig6.Analysis of normalized absolute error

VI CONCLUSION

This paper represents enhancement approach based on dominant brightness level analysis Fuzzy logic for remote sensing images. The existing technique has been done work on the low-contrast images acquired by a satellite camera . As such no work has done for the images having the color artifacts.In this work proposed the DWT as well as adaptive histogram equalization as the post processing function and also uses the illuminate normalization to enhance the accuracy of image by reducing the problem of noise.The evaluation of technique is done on the basis of the parameters Mean square error, Peak signal to noise ratio, Root mean square value, Bit error rate, Normalize cross co-relation, Normalize absolute error has performed well as compared to existing technique.

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will compare the Gray Stretch Based algorithm for image