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Evaluating the Performancne of DBLA Using Clahe & Dark Channel Prior

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Abstract: This research work has evaluated the performance of different image enhancement techniques. An image enhancement technique has the ability to enhance the visibility in such a manner so that it can improve the performance of the vision applications further. Distinguishing techniques have been projected so far for improving the enhancement quality of the digital images further. To enhance the quality of digital image, enhancement process can specifically improve and limit some data presented in the input picture. It is a kind of vision system which reductions picture commotion, kill antiquities, and keep up the informative parts. The main objective of this paper is to modify the DBLA using the dark channel prior and CLAHE to enhance the results of image enhancement further. The proposed technique has been designed and implemented in MATLAB tool. The comparative analysis has shown the significant improvement of the proposed technique over the CLAHE and the DBLA.

Keywords: Enhancement, Contrast limited adaptive Histogram Equalization, Dominant Brightness level Analysis, Color Normalization

I. INTRODUCTION

A digital stored image required the improvement in its superiority, for this image enhancement is one of the best methods. This is a way which helps to make an image lighter or darker or to increase or decrease contrast of an image and also applicable for demonstrate and analysis of image by accentuating and shaping the image features. Image enhancement is the practice of applying these techniques to assist the improvement of a result to a computer imaging crisis. The key role of enhancement is used as a preprocessing step in some computer vision applications to ease the vision task; it helps to enhance the edges of an object to make easy guidance of a robotic gripper, face recognitions, gesture recognitions, space application, and object recognition. Producing visually natural images or transforming the image such as to enhance the visual information within, is a principal necessity for all vision and image processing tasks. These types of Methods that are essential to implement such transformations are recognized as image enhancement techniques. The task of an image enhancement is a difficult one considering the fact that there is no general unifying theory of image enhancement at present, because there is no universal law of image quality that can serve as a design criterion for an image enhancement processor. Most of the enhancement techniques in existence to date are empirical or heuristic methods, dependent on the particular type of image.

Most of these techniques require interactive procedures to obtain satisfactory results, and therefore are not appropriate for regular application. Besides requiring the user interaction, many such methods require specification of external parameters, which sometimes are difficult to well refrain. This paper represents the integrated approach to overcome the problems of existing techniques. In this perform a contrast enhancement by using the integrated approach using dominant brightness level analysis, contrast limited adaptive histogram equalization and dark channel prior algorithm and color channel normalization as post process step and find the final image with using above method.

Contrast Enhancement

The main objective of contrast enhancement is to get better visibility of image details without introducing impractical visual appearances and unnecessary artifacts. This is the best way that tunes the intensity of each pixels magnitude based on its surrounding pixels.

Contrast enhancement is classified into indirect and direct methods of contrast enhancement. Histogram specification and equalization are two well-known indirect methods, which helps to produce histogram of the image that is modified. Because the global distribution of the intensity is stretched, indirect method is not efficient and effective. In contrast the direct method of contrast enhancement, a definition of the contrast is used to measure the contrast and enhance the image by modifying the contrast measurement.

Contrast Limited Adaptive Histogram Equalization

Contrast limited adaptive histogram equalization prevent the amplification by using contrast limiting. The contrast limiting procedure has to be applied for each neighborhood from which a transformation function is derived in contrast limiting adaptive histogram equalization. CLAHE does not operates on entire image, it is applicable for small regions that known as tiles. Contrast of small region (tiles) is enhanced. After matching histogram of the output region is then combined by using bilinear interpolation to abolish artificially induced boundaries. The contrast of homogeneous areas can be limited because it can reduce the amplification of noise that may occur in the image. CLAHE was basically introduced for medical imaging and it was successful to enhance the low contrast images such as portal films.

Analysis of Dominant brightness level
As increasing demand for enhancing remote sensing images, presented histogram-based contrast enhancement methods notable to conserve edge details and demonstrate saturation artifacts in low and high intensity regions. If do not consider spatially varying intensity distributions, in the same way contrast-enhanced images may have intensity distortion and lose image details in some regions[1]. For overcoming these problems, decompose the input image into four different layers of single dominant brightness levels. Perform the DWT on the input remote sensing image and then estimate the dominant brightness level using the log average luminance in the LL sub band, for this low frequency components used. The low-intensity layer has the dominant brightness lower than the pre specified low bound. The high intensity layer is resolute in the similar manner with the pre specified high bound, and the middle-intensity layer has the dominant brightness in between low and high bounds [1].
Since high-intensity values are dominant in the bright region, and similarly for low –intensity values, the dominant brightness at the position (x, y) is computed as:

$$D(x,y) = \exp\left(\frac{1}{NL}\sum_{(x,y)\in S}\{\, logL(x,y) + \varepsilon\right) \quad (1)$$

Where *S* represents a rectangular region encompassing (x, y), $L(x, y)$ represents the pixel intensity at (x, y), *NL* represents the total number of pixels in *S*, and ε represents a satisfactorily small constant that prevents the log function from diverging to negative infinity. The low-intensity layer, high intensity layer and middle intensity layer has the dominant brightness level determined in the similar manner with pre specified low, high and middle bounds respectively.

Color Normalization
Color normalization is a topic in computer visualization concerned with artificial colour visualization and object recognition. Color image normalization will also be done to reduce the color artefacts. Illumination is the factor on which distribution of color values in an image depend that is depending on different lighting conditions or different cameras. It allows object recognition techniques based on color to compensate for these variations.

II. LITERATURE SURVEY

Eunsung Lee e.tal (2013) [1] discuss the problem that are arises due to the histogram equalization, problem like histogram equalization approaches degrade the image quality by exhibiting saturation artifacts in both low and high intensity regions present the algorithm computes brightness based on adaptive intensity transfer function that uses the low frequency luminance component in the wavelet domain and transforms intensity values according to the transfer function. Discrete wavelet transfer applies on the input images. Intensity transfer functions are predictable by using the knee transfer function and the gamma adjustment function based on dominant brightness level. The result has shown that it successfully enhances the quality and visibility of low contrast satellite images comparing with other methods like RMSHE, GC-CHE, and Demirel’s method. Adela Raju e.tal (2013) [2] demonstrates for preserving the brightness and contrast enhancement of an image clipping and plateau histogram equalization methods. Self-adaptive plateau histogram equalization takes the threshold level by self that impossible in clipping and plateau histogram equalization. Self-adaptive plateau histogram equalization method is complicated and sometimes fails in execution. To overcome above problem modified self adaptive plateau histogram equalization with mean threshold used. To overcome the self-adaptive plateau histogram method problems and also detect the local maximum and global maximum but, instead of median threshold value, mean threshold value is used for histogram modification. It enhances the image without introducing unwanted artifacts and gives better contrast enhancement and brightness preserving. E.ullah e.tal (2013) [3] give a technique for dark channel that raise the superiority of image. Environmental effects degrade the image quality, these effects like haze, fog, snow, etc. light is spread out when it propagates through the water droplet that is in atmosphere that loss the quality of image. The present work has been used the dark channel prior technique for dehazing. The model used the HIS color model is intuitive based on the intensity and saturation components of the foggy pixels. Setiawan e.tal (2013) [4] discuss the contrast limited adaptive histogram equalization approach for enhance the color retinal image. Histogram equalization technique is a common method and simple, low computation load. The enhancement of color retinal image is requiring due to the acquisition process that is used to reduce the noise effect from image. Color retinal image is unique in its properties than other image, this image has important in green channel (G). Ophthalmology has great importance of image enhancement. The enhancement process conduct in G channel is appropriate to enhance the color retinal image quality. Hitam, M.S; (2013) [5] illustrate a new method that developed for underwater image enhancement specifically that is mixture contrast limited adaptive enhancement because from last decades underwater images has received attention to improve the quality due to poor visibility of the image that are caused by physical properties of the water medium. This approach is applying CLAHE on RGB and HSV color models and results of this approach are using Euclidean norm. Experimental results are showing better visual quality as well as reducing noise and artifacts of underwater images by enhancing contrast. Jaehyun Im e.tal (2013) [6] explains a novel contrast enhancement approach for backlit images and this approach is basically divided into three steps. In first step computation of the transmission coefficients is done by using the dark channel prior, in second step generation of multiple images having different exposures based on the transmission coefficients, and in last step image fusion is done. This algorithm first extracts under exposed regions with the help of dark channel prior map and then spatially adaptive contrast enhancement is apply comparatively to global intensity transformation methods and spatially invariant contrast enhancement algorithms. Experimental results preserve image details and color by increasing the contrast of images especially for backlit scenes those have very wide dynamic range. Tae Ho Kil e.tal (2013) [7] discusses the combination of dark channel prior and contrast enhancement approaches for dehazing. Dark channel prior method helps to remove haze and restores colors of objects in the scene but it does not consider the enhancement of image contrast and on other hand image contrast technique improves the local contrast of objects but due to the over- stretching of contrast it may distorted the colors of image. The main advantage of these both approaches together is keeping the color while dehazing. An optimization function is introduce to balance between the contrast and color distortion, where the contrast measure follows the conventional image statistics and hue component is used to constrain the color changes. The experimental results enhance contrast with less color distortion and remove the disadvantages of conventional methods. Qingsong Zhu e.tal (2013) [8] explains approach for improvement of image after dark channel prior approach. This approach is a novel and effective single image enhancement algorithm for haze image. After using the dark channel prior approach the contrast and intensity of haze image will unavoidably tend to be lower than the real scene. After experiments it discover that , if dealing with a haze image with large background area and low contrast, the results of dark channel prior will be dark and general haze image occurs different degree of anamorphous. The different kinds of anamorphous on the hazy images recover with introducing an adaptive algorithm. The experimental results are more close to real scene. Li Peng et al (2012) [9] have proposed a novel atmospheric model–based defogging method from single image, for the image corrupted by spreading due to atmospheric particles. They estimated that the transmission using local extreme standard and bilateral filter that a high class depth map can be obtained. Experiments on a variety of outdoor haze images exhibit that this method can repair well colors and contrast of the experimental objects, progress the visibility of image and keep away from the Halo and jamming effects effectively. Chelsy sapna e.tal (2011) [10] proposed a method that removed the limitation of amplification of speckle noise that loss the information from the image in adaptive histogram equalization. Multilayered contrast limited adaptive histogram equalization method uses frost filter for the speckle noise reduction. The combination of frost filter and median filter on contrast limited adaptive histogram equalization images used. It has been mainly focused on medical images. The medical images like brain, mammograms images, and knee images give better vision by using the frost filter and it's highly efficient. Its helps to remove the speckle noise and give better output. Bin Liu e.tal (2011) [11] discussed that the image contains information that is sometime not clear for human. Enhancement not only enhances the details that hidden in the scene and increases the recognition of interested targets. For executing the histogram projection independently contrast enhancement segmented into the sub-blocks.it has relation with the adjoining three weights and important image and local details can be both enhanced. It enhanced the local details and conserve image brilliance to avoid blocking effect and wash-out effect. It has effective, efficient and flexible. Yisu Zhao e.tal (2010) [12] illustrates a method that combing contrast-limited adaptive histogram equalization (CLAHE) and multi-step integral projection to achieve real time subject independent automatic facial enhancement and detection. Sigma filtering is used to overcome or remove the problem of noise in images and it give fast results without blurring image. CLAHE is applicable here for enhancing the facial features.Multi step integral projection is applied to distinguish the useful facial features regions automatically and distinguish region is extracted by Gabor transformation and facial expression recognition is done by SVMs. In this system is tested by the JAFFE database and attain a high recognition rate of 95.318% on trained data.

III. GAPS IN SURVEY

Following are the major disadvantages that are found in the related work of image enhancement techniques.

1. The survey has found that the most existing techniques are based upon the transform domain methods, which may introduce the color artifacts.
2. Transform domain method may reduce the intensity of the input remote sensing image.
3. The use of dark channel and CLAHE in algorithm ignored by many researchers to reduce the problem of poor brightness which will be presented in the output image due to dominant level.

IV. PROBLEM DEFINITION

Image enhancement is one of the most popular algorithms used in vision applications for improving the visibility of the digital images. Recently much work is done in the field of remote sensing images to improve the visibility for improving their accuracy for further applications. Many algorithms have been proposed so far for enhancing the remote sensing images. It has been found that the most of the existing researchers have neglected many issues; i.e. no technique is accurate for different kind of circumstances. The existing methods have neglected the use of Contrast limited adaptive histogram equalization (CLAHE) to reduce the problem of poor brightness which will be presented in the image due to poor weather conditions. It is also found that the color artifacts which will be presented in the output image due to the transform domain methods; also neglected by the most of the researchers. So the present research work will use dark channel prior as the post processing function to enhance the results further.

V. RESEARCH METHODOLOGY AND EXPERIMENTAL SET UP

In order to implement the proposed algorithm, design and implementation has been done in MATLAB using image processing toolbox. In order to do cross validation we have also implemented the enhanced DCT based image fusion using nonlinear enhancement. The developed approach is compared against some well-known image fusion techniques available in literature. After these comparisons, we are comparing proposed approach against DCT using some performance metrics. Result shows that our proposed approach gives better results than the existing techniques.

To attain the objective, step-by-step methodology is used in this dissertation. Sub sequent are different steps which are used to accomplish this work. Following are the various steps used to accomplish the objectives of the dissertation.

Proposed algorithm
Step 1: Input images: select an input image. This image may be satellite image, foggy image, roadside image, natural image. **Step 2: Discrete wavelet transform:** Now perform the DWT is a wavelet transform for which the wavelets are discretely sampled. Discrete wavelet transform captures both frequency and location information. Wavelet used for feature extraction, denoising, compression, face recognition, image super resolution. **Step 3: Dominant brightness level analysis:** This analysis is done to remove the problem of intensity distortion and lose image details due to contrast enhancement and divide image based on dominant brightness level analysis is into three intensity (low, middle, high). **Step 4: adaptive intensity transfer function:** then apply adaptive intensity transfer function on each layer and do boundary smoothing after weighting map estimation method applied on it. **Step 5: contrast limited adaptive histogram equalization:** then this technique is apply to prevent the limiting amplification and this also applicable for limiting the amplification of noise. **Step 6: inverse discrete wavelet transform:** this technique is applied to reform the data. **Step 7: Fused image** Then image can be fused means to combine the decomposed image into a single one. **Step 8: Dark channel prior:** Basically this technique used for haze removal and improve the quality of image after this perform a post process of color channel normalization for recognitions of object. **Step 9: final image:** Results has been shown in the form of contrast enhanced image.

VI. EXPERIMENTAL RESULTS

Figure 6.1 has shown the input images for experimental analysis. The overall objective is to combine relevant information from multiple images that is more informative and suitable for both visual perception and further computer processing.

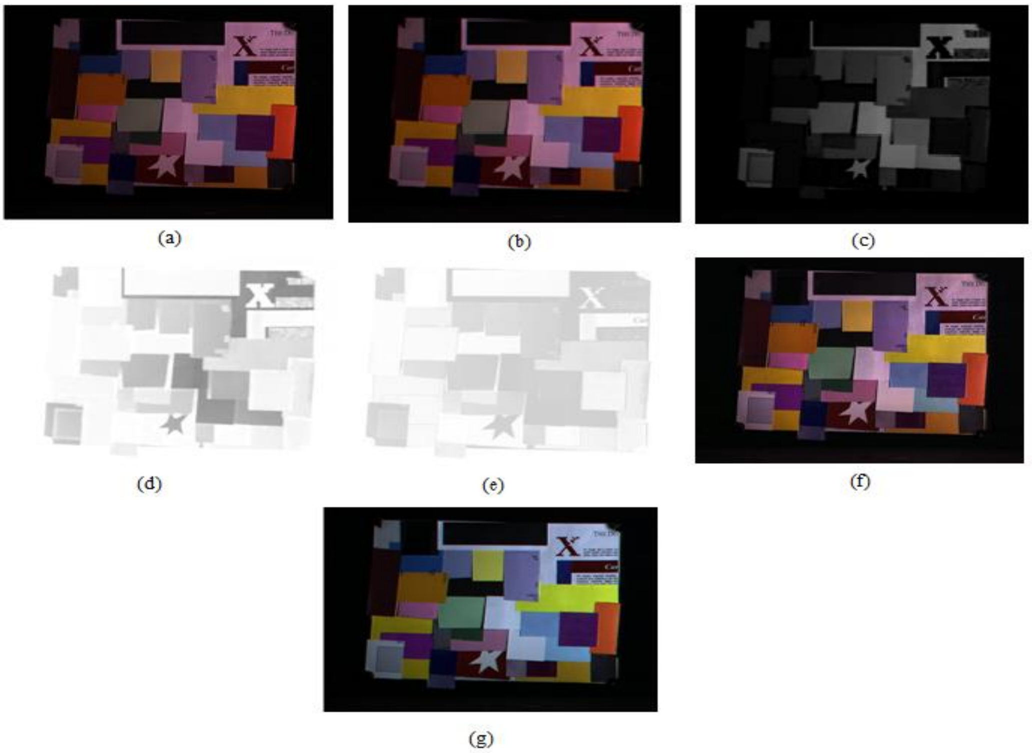


Figure 6.1: represents the final results proposed methodology (a) Input image (b) Dominant brightness level analysis image (c) Depth map (d) Transmission map (e) (f) CLAHE on RGB color model image (g) final image

VII. PERFORMANCE ANALYSIS

This section shows the results between existing and proposed techniques. Some well-known image performance parameters for digital images have been selected to prove that the performance of the proposed algorithm is quite better than the existing methods.

1. Mean square error:

One understandable mode of measuring this correspondence is to calculate an error signal by subtracting the test signal from the reference, and then computing the average energy of the error signal. The mean-squared-error (MSE) is the simplest, and the most widely used, full-reference image quality measurement. This metric is frequently used in signal processing and is defined as follows:

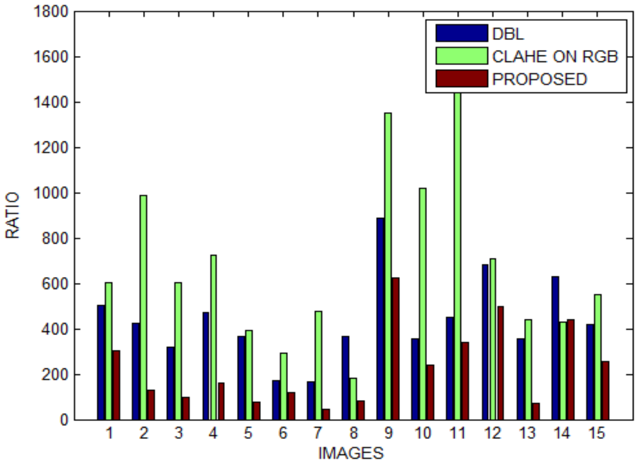
$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left(x(i,j) - y(i,j)\right)^2 \qquad (2)$$

Where $x(i.j)$ represents the original (reference) image and $y(i,j)$ represents the distorted (modified) image and i and j are the pixel position of the M×N image. MSE is zero when $x(i,j) = y(i,j)$.

Table1. Mean square error

image	DBL	RGB	PROPOSED
1.	502	601	305
2.	424	987	131
3.	316	602	96
4.	469	724	158
5.	365	390	75
6.	171	292	120
7.	168	478	44
8.	365	181	79
9.	886	1351	622
10.	356	1017	239

Comparative analysis of mean square error in graph represent as:



Graph1. Analysis of mean square error

Graph 1 has explained that quantized analysis of the mean square error. As mean square error need to be reduced therefore the proposed algorithm is showing the better results than the available methods as mean square error is less in every case.

2. Peak signal to noise ratio:

Larger SNR and PSNR indicate a smaller difference between the original (without noise) and reconstructed image. This is the most widely used objective image quality/ distortion measure. The main advantage of this measure is ease of computation but it does not reflect perceptual quality. An important property of PSNR is that a slight spatial shift of an image can cause a large numerical distortion but no visual distortion and conversely a small average distortion can result in a damaging visual artifact, if all the error is concentrated in a small important region. This metric neglects global and composite error PSNR is calculated using Equation:

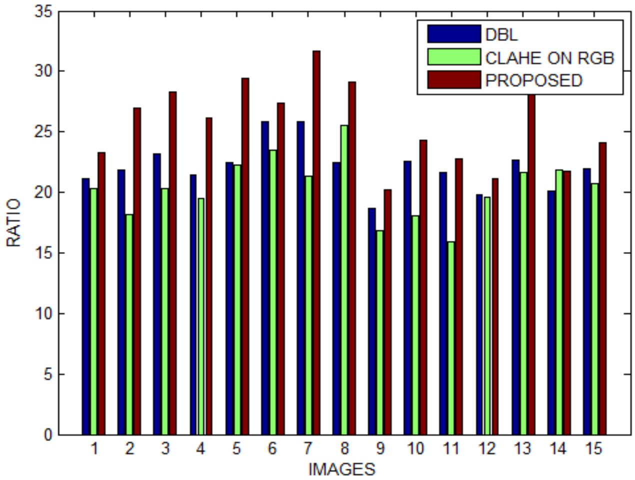
$$PSNR = 20\log_{10}\left(\frac{N}{RMSE}\right)db \qquad (3)$$

Table2. Peak to signal ratio

image	DBL	RGB	PROPOSED
1.	21.1238	20.3421	23.2878
2.	21.8571	18.1876	26.9581

3.	23.1339	20.3348	28.3081
4.	21.4191	19.5334	26.1442
5.	22.5079	22.2202	29.3802
6.	25.8008	23.4770	27.3390
7.	25.8771	21.3365	31.6963
8.	22.5079	25.5540	29.1545
9.	18.6565	16.8243	20.1929
10.	22.6163	18.0576	24.3468

Comparative analysis of peak to signal ration in graph represent as:



Graph2. Analysis of peak to signal ratio

Graph2 is showing the comparative analysis of the Peak Signal to Noise Ratio (PSNR). As PSNR need to be maximized; so the main goal is to increase the PSNR as much as possible. Graph2 has clearly shown that the PSNR is maximum in the case of the DBL technique therefore it is providing better results than the available methods.

3. Root mean square error

The root mean square error is a normally used to calculate of the difference between values predicted by a model and values actually observed from the surroundings that is being modeled. These individual differences are also called residuals, and the RMSE serves to total them into a single measure of analytical power.

Table3. Root mean square error

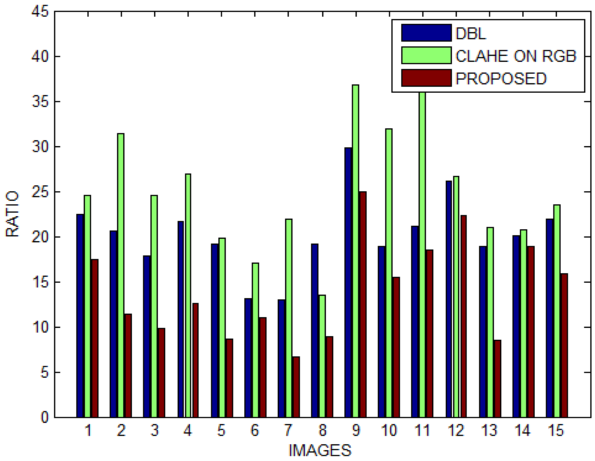
image	**DBL**	**RGB**	**PROPOSED**
1.	22.4054	24.5153	17.4642
2.	20.5913	31.4166	11.4455
3.	17.7764	24.5357	9.7980
4.	21.6564	26.9072	12.5698
5.	19.1050	19.7484	8.6603
6.	13.0767	17.0880	10.9545
7.	12.9615	21.8632	6.6332
8.	19.1050	13.4536	8.8882
9.	29.7658	36.7560	24.9399
10.	18.8680	31.8904	15.4596

The RMSE of a model total with respect to the estimated variable X_{model} is defined as the square root of the mean squared error:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}\left(X_{obs,i} - X_{model,i}\right)^2}{n}} \quad (4)$$

Where X_{obs} is observed values and X_{model} is modeled values at time/place i. As RMSE need to be minimized; so the main goal is to decrease the RMSE as much as possible.

Comparative analysis of root mean square error in graph represent as below:



Graph3. Analysis of root mean square error

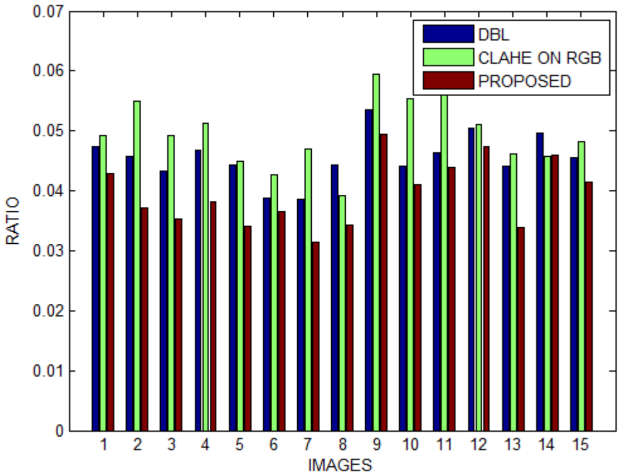
Graph3 is showing the comparative analysis of the root mean square error (RMSE). As RMSE need to be minimized; so the main goal is to decrease the RMSE as much as possible. This is clearly shown that the RMSE is less in dominant brightness level.

4. Bit error rate

Bit error rate need to be minimized. Main goal is to decrease the BER as much as possible.

Table4. Bit error rate

image	**DBL**	**RGB**	**PROPOSED**
1.	0.0473	0.0492	0.0429
2.	0.0458	0.0550	0.0371
3.	0.0432	0.0492	0.0353
4.	0.0467	0.0512	0.0382
5.	0.0444	0.0450	0.0340
6.	0.0388	0.0426	0.0366
7.	0.0386	0.0469	0.0315
8.	0.0444	0.0391	0.0343
9.	0.0536	0.0594	0.0495
10.	0.0442	0.0554	0.0411



Graph4. Analysis of Bit error rate

Graph4 is showing the comparative analysis of the BIT ERROR RATE (BER). As BER need to be minimized; so the main goal is to decrease the BER as much as possible. It has clearly shown that the BER minimum.

5. Average Difference Evaluation

Average difference is simply difference between the reference signal and test image. It is given by the equation.

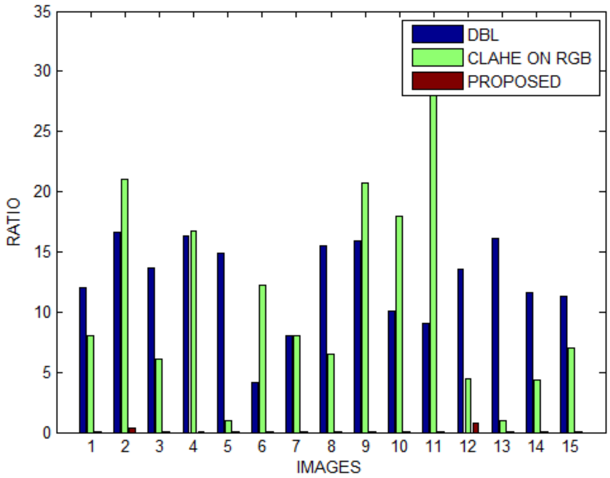
$$AD = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left(x(i,j) - y(i,j)\right) \quad (5)$$

As average difference needs to be minimized; so the main objective is to reduce the average difference as much as possible.

Table5. Average Difference Evaluation

image	DBL	RGB	PROPOSED
1.	12.0080	8.0754	0.0024
2.	16.6750	21.0412	0.3214
3.	13.6926	6.0450	0.0113
4.	16.2771	16.6832	0.0093
5.	14.8485	1.0069	0.0580
6.	4.1410	12.1866	0.0380
7.	8.0118	8.0382	0.0370
8.	15.4574	6.5260	0.0045
9.	15.9257	20.7177	0.0438
10.	10.0481	17.9571	0.0026

Comparative analysis of root mean square error in graph represent as below:



Graph5. Analysis of Average difference evaluation

Graph5 is showing the comparative analysis of the AVERAGE DIFFERENCE EVALUTION (AD). As AD needs to be minimized; so the main goal is to decrease the AD as much as possible. It has clearly shown that the AD minimum.

6. Structural content

SC is also correlation based measure and measures the similarity between two images. Structural content is given by the equation:

$$SC = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}\left(y(i,j)\right)^2}{\sum_{i=1}^{M}\sum_{j=1}^{N}\left(x(i,j)\right)^2} \quad (6)$$

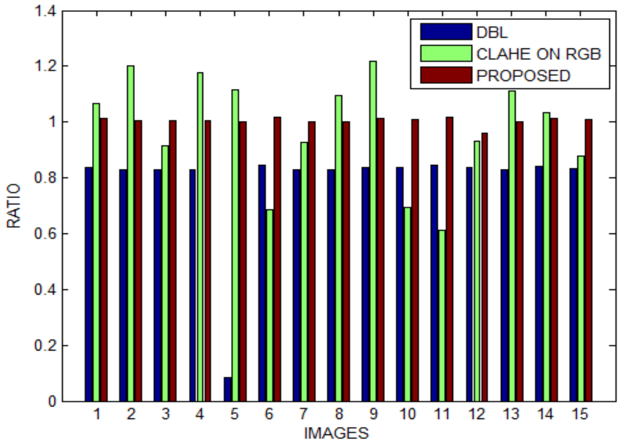
As SC needs to be close to 1, therefore proposed algorithm is showing better results than the available methods as SC is close to 1 in every case.

Table6. Structural content

image	DBL	RGB	PROPOSED
1.	0.8380	1.0667	1.0129
2.	0.8296	1.1998	1.0033
3.	0.8293	0.9148	1.0032
4.	0.8299	1.1768	1.0035
5.	0.0821	1.1140	1.0028
6.	0.8433	0.6869	1.0159
7.	0.8294	0.9279	1.0022
8.	0.8281	1.0957	1.0017

9.	0.8379	1.2168	1.0120
10.	0.8374	0.6948	1.0109

Comparative analysis of structural content in graph represent as below:



Graph6. Analysis of Structural content evaluation

Graph6 is showing the comparative analysis of the STRUCTURAL CONTENT (SC). As SC needs to be one; so the main goal is to maintain the SC as much as possible to one. It has clearly shown that the SC one.

7. Normalized cross correlation

The closeness between two digital images can also be quantified in terms of correlation function. Normalized cross-correlation measures the similarity between two images and is given by the equation:

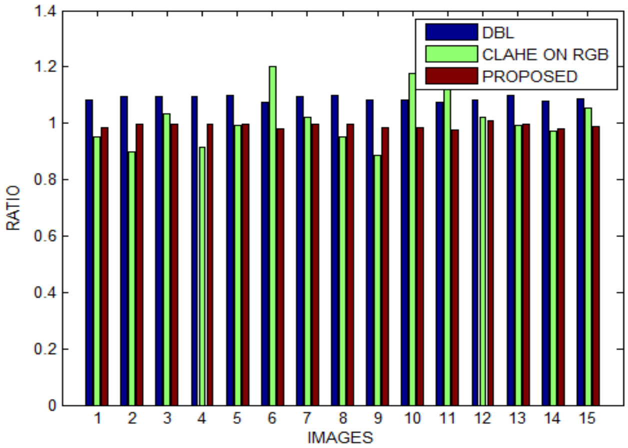
$$NK = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}(x(i,j) \times y(i,j))}{\sum_{i=1}^{M}\sum_{j=1}^{N}\left(x(i,j)\right)^2} \quad (7)$$

Table7. Normalized cross correlation evaluation

image	DBL	RGB	PROPOSED
1.	1.0841	0.9537	0.9860
2.	1.0955	0.9000	0.9961
3.	1.0957	1.0329	0.9962
4.	1.0950	0.9133	0.9957
5.	1.0974	0.9923	0.9973
6.	1.0763	1.1995	0.9805
7.	1.0960	1.0196	0.9971
8.	1.0975	0.9532	0.9978
9.	1.0812	0.8872	0.9831
10.	1.0829	1.1786	0.9850

As NCC needs to be close to 1, therefore proposed algorithm is showing better results than the available methods as NCC is close to 1 in every case.

Comparative analysis of normalized cross-correlation in graph represent as below:



Graph7. Analysis of normalized cross-correlation evaluation

Graph7 is showing the comparative analysis of the normalized cross-correlation (NCC). As NCC needs to be close to one; so the main goal is to maintain NCC as much as possible to close to one. It has clearly shown that the NCC is more close to one.

VIII. CONCLUSION AND FUTURE SCOPE

This paper has used DBLA to overcome the problems of intensity distortion and lose image details in some regions of contrast enhanced images without considering the spatially varying intensity distributions. To overcome the problems of DBLA, this work has decomposed the input image into multiple layers of single dominant brightness levels. To use the low-frequency luminance components, perform the DWT on the input remote sensing image and then estimate the dominant brightness level using the log average luminance in the LL sub band. The low-intensity layer has the dominant brightness lower than the pre specified low bound. The high intensity layer is determined in the similar manner with the pre specified high bound, and the middle-intensity layer has the dominant brightness in between low and high bounds. The proposed technique has modified the DBLA using CLAHE and dark channel prior. The modified DBLA has the potential to overcome the limitations of the earlier work. The proposed technique has been designed and implemented in MATLAB using image processing toolbox. Various kind of images has been considered in this research work to evaluate the effectiveness of the proposed technique. The comparison among CLAHE, DBLA and proposed has shown the significant improvement of the proposed technique. In this paper the use of the image gradients has been neglected which has the ability to improve the edges of the enhanced images. So in near future we will use image gradients as post processing technique to improve the results. Further enhancement will also be considered by the hybridization of the modified DBLA with the fuzzy based image enhancement.

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