

Image Enhancement Based on NPEA and USM Approaches

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Abstract - Image enhancement (IE) is a common thing we use to show signs of improvement results from past symbolism. This IE isn't just utilized by us, yet it is executed in numerous fields. Such as implementation in the military field, medical field, legal field, industry field, entertainment field and much more. The essential utilization of IE in each field is to get clear data. Since this data is something that is imperative in regular day to day existence. In Propose Work, naturalness preserved enhance algorithm (NPEA) enhancement method is proposed. Our algorithm is very effective in the manner of above problem. These strategies can be characterized into two vital gatherings – spatial domain based and change space based techniques. DWT isolates picture into high and low recurrence added substances. High recurrence added substances characterize evaluation of a photo. Here an improvement strategy utilizing DWT-USM, homomorphic filter, NPEA Techniques is proposed.

Keywords—Image Enhancement; DWT; Homomorphic Filter; USM; NPEA;ABC.

I. INTRODUCTION

With the continuous development of computer science and technology, the field of Image processing (IP) is considered as a very active area of research. Digital Image Processing (DIP) alludes to preparing of digital images (DI) by methods for advanced PC. The aim is to produce DI with better contrast and hidden details. To process an information picture with the goal that yield picture will be more reasonable, IE strategies are required. Image Enhancement refers to highlight some key information in an image and to remove some secondary information which aims to improve the quality of identification in the process at same time [1]. It is described as process which incorporates contrast enhancement, image sharpening, picture honing activities to deliver picture of fine quality. Contrast enhancement plays an important role in image processing and in this gray level levels of the input image are mapped to a new set of values so that the histogram of the image becomes flatter to get more homogenous distribution of these gray levels [1].

This IE has numerous techniques, going from separating strategies, histogram strategies, and techniques with various calculations to even the consolidation of a few strategies to deliver magnificent picture repairs. To utilize the IE, we should comprehend what is contained in the picture or the issue as far as what underlies us to utilize the picture repair technique, regardless of whether from detail, color, lighting, and others. Since in picture upgrade, not all strategies will create a decent picture in the wake of being

prepared. Sometimes we initially want to improve the image but instead aggravate the image. With this, we must estimate what image improvement method is needed.

With the current technological advancement of picture improvement should be possible effectively as per our very own wants. For example, if we want to improve our pictures or photos, we can fix them with the app on your laptop or smart phone without having to fiddle with the inside of the image. Apart from that, the image repair app was originally a collection of some of the image repair methods implemented in the app. In this paper, will discuss the implementation of some image improvements for everyday life.

Basically, IE is the initial step to IP to enhance the visual quality by reinforcing the edges and smoothing the info picture region. Picture changes are ordered as pursues [2]:

1. Spatial Domain (SD) Strategy In this technique IE can be accomplished by controlling every pixel esteem additionally called a point treatment.
2. Frequency Domain (FD) Method In this method, there are two frequencies that influence, namely high frequency and low frequency. To deliver smoother pictures can dispense with high frequencies and to create more honed pictures can kill low frequencies. This technique can likewise be known as a High-pass channel and Low-pass channel utilizing Fourier change.
3. Hybrid Method This strategy is a mix technique for spatial area strategy and recurrence space that can improve the infrared picture by altering the complexity by smoothing diagram. This methodology utilizes calculations, for example, the Gaussian capacity to enhance the detail, top edge, and base edge to smooth the substance of the picture.

Ongoing years numerous Evolutionary calculations have been connected to Image Enhancement which incorporates Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Artificial Bee Colony (ABC), and Differential Evolution et cetera. Since DE is a basic pursuit technique and execution of union is quick, it is more suited for upgrade reason. The goal of this paper is to provide a state of art survey of image enhancement method based on the DE. [3]

II. IMAGE ENHANCEMENT

Introduction: Image enhancement (IE) alludes to emphasis, or honing of picture highlights, for example, edges, limits, or difference to make a realistic presentation more valuable for showcase and investigation. The upgrade procedure does not build the natural data content in the information. In any case, it increases the dynamic scope of the picked includes with the goal that they can be distinguished effectively. IE is utilized to enhance the nature of a picture for visual impression of individuals. It is additionally utilized for low level vision applications. IT is the mechanism to process the input image to make it more appropriate and clearly visible for the required application. IT enhances the data substance of the picture and modifies the visual effect of the picture on the spectator. [4] Its goal is to alter credits of a picture to make it more reasonable for a particular assignment. In the image enhancement process, one or more attributes of the image are modified and processed. The choice of attributes and the way they will be modified are specific to a given task. Upgrade is pre processing venture in some PC vision applications to facilitate the vision undertaking, for instance to improve the edges of a protest encourage direction of automated gripper. Upgrade is additionally utilized as pre handling advance in applications where human survey of a picture is required before further preparing. IE is utilized for post preparing creates an alluring picture.

III. USING TECHNIQUES

a. Discrete Wavelet Transform (DWT)

It is a tested wavelet function. The DWT that is principally founded absolutely on sub-band coding is found to yield a concise calculation of Wavelet Transform (WT). It is clear to actualize and diminishes the calculation time and sources required. As opposed to figure the wavelet coefficients at each factor, the DWT utilizes best a subset of positions and scales. These methodology results in a perfect and additional proficient method for a WT. The photo is disintegrated into four recurrence groups and they're LL, LH, HL and HH. [5]

b. Homomorphic filter based Enhancement

It all the while standardizes the brilliance sooner or later of a photo and builds correlation. Light and reflectance aren't distinguishable; yet their surmised areas in the recurrence area might be situated. Since light and reflectance coordinate multiplicatively, the added substances are made added substance by utilizing taking the logarithm of the photograph force, just so those multiplicative added substances of the photo might be isolated straightly inside the recurrence area. Illumination forms can be idea of as a multiplicative commotion, and can be diminished through way of sifting in the log zone. The HF is the satisfactory method to The HF is the palatable strategy to enhance the

photo, because of its actual control over added substances, light reflectance. [6].

c. Multi scale retinex (MSR)

MSR is a combination of a weighted sum from the outputs of different single scale retinex operations. The multi-scale retinex is obtainable in Equation

$$R_{MSR} = \sum_{n=1}^N W_n R = \sum_{n=1}^N W_n [f(x, y) - \log(f(x, y) \otimes G_n(x, y))]$$

Where N is the numeral of scale used, and W_n is weight associated with the n-th scale. Multi scale retinex is proven to enhance image resolution in certain region. Yet, it still sharing the same problem with single scale retinex, where their outputs may in faded appearance. [7].

D. Unsharp Masking (USM)

In DIP, a USM is a basic strategy used to hone a picture, affecting differentiation upgrade (CE). It doesn't build picture goals, but instead enhances little scale acutance. A marginally obscured rendition of the first picture is made and afterward subtracted from the first picture, making a highpass separated contrast picture considered the USM that accentuates districts of change (edges). This veil is then used to change the first picture to underline the difference along these edges. The size of the CE in this task is dictated by the obscure separation. The more obscured the picture that is at first subtracted from the first, the lower the corner recurrence of the subsequent USM, and the bigger the size of the CE. The impacts of bigger scale CE are more extensive and less limited to the sharp edges of the first picture. 3. Proposed Underwater IE Algorithm. [8]

IV. LITRATURE SURVEY

SEONHEE PARK, et al. [2018] This paper displays a double autoencoder arrange show in light of the retinex hypothesis to play out the low-light upgrade and clamor decrease by joining the stacked and convolutional autoencoders. The proposed technique first gauges the spatially smooth brightening part which is more splendid than an info low-light picture utilizing a stacked auto encoder with few shrouded units. Next, we utilize a convolutional auto encoder which manages two-dimensional picture data to diminish the intensified clamor in the brilliance upgrade process. We examined and looked at jobs of the stacked and convolutional autoencoders with the requirement terms of the variational retinex demonstrate. In the trials, we show the execution of the proposed calculation by contrasting and the best in class existing low-light and difference improvement methods. [9]

Shilpa Suresh et al. [2017] In this paper, a strong and novel versatile Cuckoo look based Enhancement calculation is

proposed for the upgrade of various satellite television for pc pics. The proposed calculation incorporates a disordered introduction area, a versatile Levy flight approach and a mutative randomization stage. Execution assessment is finished by method for quantitative and subjective results differentiation of the proposed calculation with other front line metaheuristic calculations. Box-and-stubble plots are likewise covered for looking at the soundness and joining capacity of the considerable number of calculations analyzed. Test results substantiate the productivity and power of the proposed set of standards in enhancing an extensive variety of satellite television for pc photographs [10].

H. Kaplan et al. [2017] in this examination, an improvement strategy in light of bilateral filtering is proposed. We propose to extricate the subtle elements of the picture by a multi scale bilateral filtering and add these points of interest to the first picture utilizing a weighting plan. Visual outcomes and assessment measurements demonstrate that the proposed strategy, improve the picture superior to anything the previous strategies while it better than the 1stcolor information [11].

Silviu-IoanBejinariu et al. [2017] in this paper a photo separate change strategy in perspective of multi objective headway is proposed. The differentiation pick up which must be amplified and tone contortion which must be limited are utilized as streamlining criteria. Since the histogram advancement is a high-dimensional issue, as improvement calculation the use of nature-propelled heuristics is proposed. Especially, inside the analyses provided on this paper, the PSO set of guidelines is utilized. Our differentiation upgrade strategy ends up being better than customary procedures like HE regarding contrast pick up and tone mutilation, the two criteria being improved [12].

Su-Ling Lee et al. [2017] in this paper, a shading picture upgrade technique is introduced by utilizing power HE approach without changing tint and immersion in HSI shading space. The proposed technique has preferable visual beauty over the ordinary HE strategy since tint and immersion are saved in the upgrade procedure. The backdrop illumination picture and evening time picture are utilized to exhibit the viability of the proposed color improvement technique [13].

Bo-Hao et al. [2017] In this paper, our propose another HE-based calculation that enhancement picture differentiate in view of a suspicion of greatest entropy to keep up different highlights of picture quality. The exploratory outcomes check that our proposed calculation is ideal for creating improved pictures, as per both quantitative estimation and subjective human visual investigation [14].

Zhou Zhao et al. [2017] In this paper our propose another picture differentiate enhancement calculation. It implants PLIP operations directly into a solid histogram revision structure. Trial impacts demonstrate that the proposed set of guidelines can proficiently brighten picture assessment in the meantime as ceasing extreme upgrade [15].

V. PROPOSE WORK

There are techniques which are being use for the development of the images. All the for methods could enhance the image contrast both the subjective visual testing and the objective evaluation for gray image. In Propose Work, naturalness preserved enhance algorithm (NPEA) enhancement method is proposed .Our algorithm is very effective in the manner of above problem. These strategies can be characterized into two vital gatherings – spatial domain based and change space based techniques. DWT isolates picture into high and low recurrence added substances. High recurrence added substances characterize evaluation of a photo. Here an improvement strategy utilizing DWT-USM, homomorphic filter, NPEA Techniques is proposed. The ambience of the picture ought not to be changed extraordinarily after improvement; no light source ought to be acquainted with the scene. There is no impact ought to be included and no Blocking impact ought to be increased due to over upgrade.

A picture can be deteriorated into various component space. The main aim is to improve the local variation of the image and to preserve the global trends of the intensity at the same time. Therefore, we propose two constraints. The first one is the detail constraint, that the reflectance should be limited to a proper range, by considering the property of reflectance. The second one is the expectation limitation, that the relative request of brightening in various neighborhoods not be changed radically. As a result, the rest of this paper focuses on reflectance extraction regarding to its range property, and illumination compression without changing the relative.

VI. PROBLEM STATEMENT:

In The Base paper, Image enhancement technique Artificial bee colony (ABC) is taking more time to run the code which increase its computation time. And the brightness of an image is increased which destroy the quality of an image. These procedures experience the ill effects of issues like over improvement, brightening of the picture, non conservation of picture splendor, and so on.

Propose Algorithm-

STEP 1:Take an original image from dataset.

STEP 2: Apply Homomorphic filter to modify the intensity of an image by correcting non-uniform illumination.

STEP 3: Apply Discrete Wavelet Transform (DWT) that decomposes image signal into four sub bands with smaller bandwidth named as LL, LH, HL and HH sub band in first level of decomposition.

STEP 4: Apply Un-sharp masking (USM) technique used for image manipulation (mainly sharpening).It enhances edge Contrast and other high frequency components.

STEP 5: Apply Artificial Bee colony(ABC).

STEP 6: Apply Histogram equalization method for given image.

STEP 6: Apply for Propose techniquenaturalness preserved enhance algorithm (NPEA)

STEP 7: Calculate parameter PSNR, MSE, and SSIM.

PSNR (Peak signal to noise ratio) PSNR frequently PSNR much of the time condensed as PSNR is the proportion between the most extreme conceivable esteem (power) of a signal and the intensity of mutilating clamor that influences the nature of its portrayal. Normally, PSNR is communicated as the terms of the logarithmic decibel scale. The numerical articulation of PSNR is

$$PSNR = 20 \log_{10} \left(\frac{MAX_f}{\sqrt{MSE}} \right)$$

MSE (Mean Square error) MSE shows normal square distinction of the pixels all through the picture between the first picture (spotted) $g(x,y)$ and Despeckled picture $f(x,y)$. A lower MSE implies that there is a huge channel execution. But small MSE values did not always correspond to good visual quality.

$$MSE = \frac{1}{MN} \sum \sum [g(x,y) - f(x,y)]^2$$

SSIM ()

The SSIM index assesses a test picture X regarding a reference picture Y to measure their visual closeness. In this sense, it is a SKE undertaking. SSIM assesses the nature of X, as for Y, by registering a neighborhood spatial file that is characterized as pursues.

$$SSIM(x, y) = [l(x, y)]^\alpha \cdot [c(x, y)]^\beta \cdot [r(x, y)]^\gamma,$$

where α , β , and γ are parameters that define the relative importance of each component. SSIM ranges from 0 (completely different) to 1 (identical patches). Finally, a mean SSIM index is computed to evaluate the global image similarity

STEP 7: EXIT

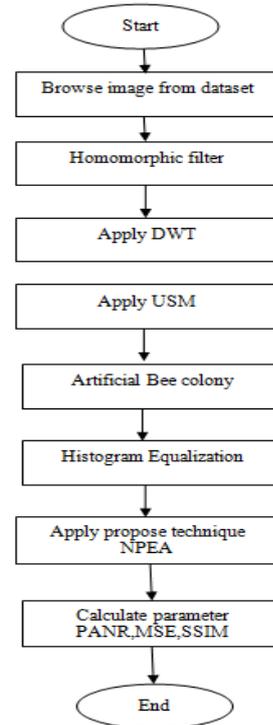


Fig.1. Flow chart of propose methodology

VII. RESULT ANALYSIS

The experimental analysis is used image enhancement pictures for performance evaluation. It takes color images for evaluation. It estimates the value of PSNR, MSE and SSIM. The algorithm is designed on MATLABR17 using Image Processing toolbox. In this implementation, this algorithm is compared with different algorithms.

As we seen in experimental result.

Output of all the above mentioned techniques is compared on the basis of their corresponding PSNR, MSE and SSIM values and following figures and table show the output.

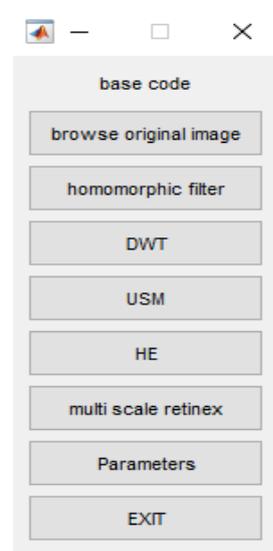


Fig.2. First, We ‘Run’ our code and then obtain this type of menu bar.

This menu bar there are 6 steps.

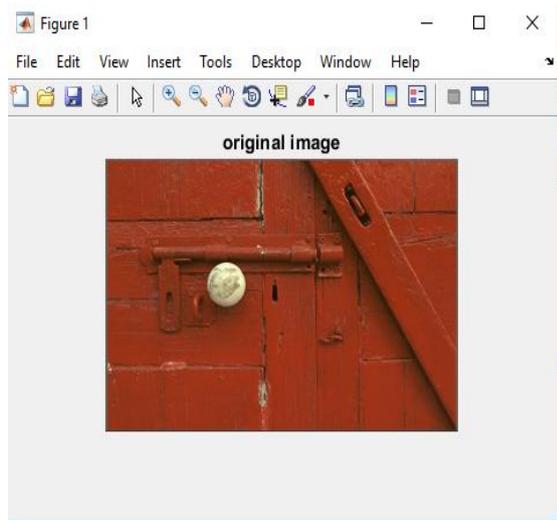


Fig.3.First we browse image from dataset.

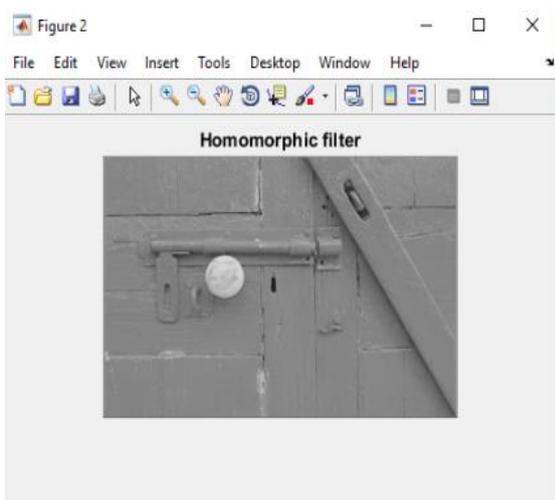


Fig. 4.Homomorphic filter.

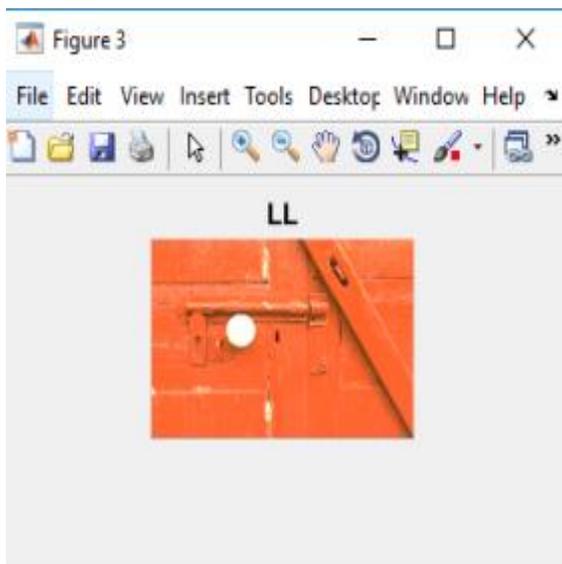


Fig. 5 Apply DWT that decomposes image signal into four sub bands with smaller bandwidth named as LL, LH, HL and HH sub band in first level of decomposition.

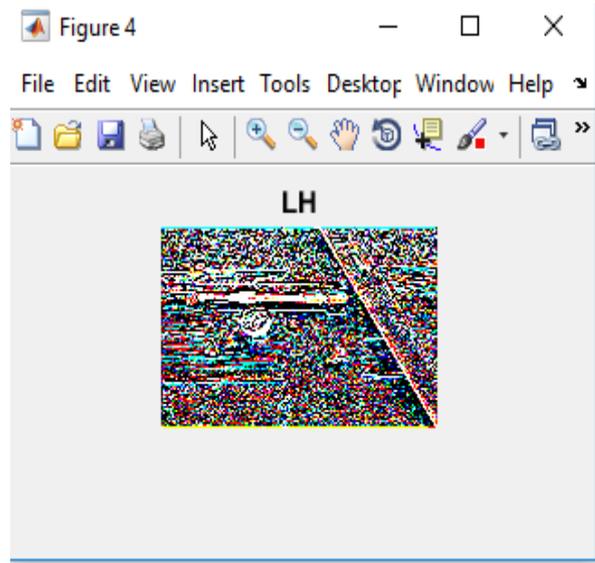


Fig. 6.Apply LH band.

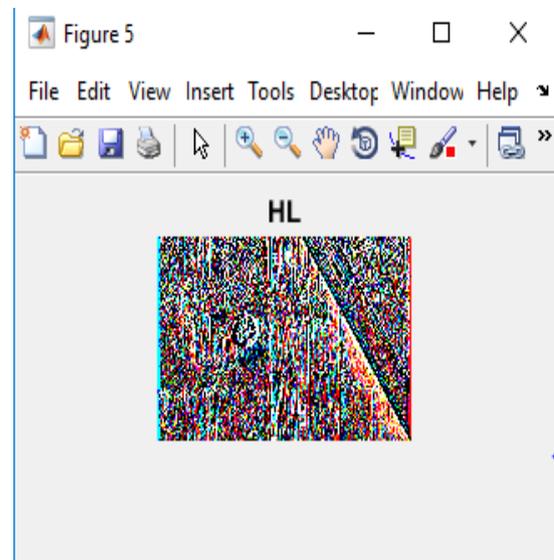


Fig. 7.Apply HL band

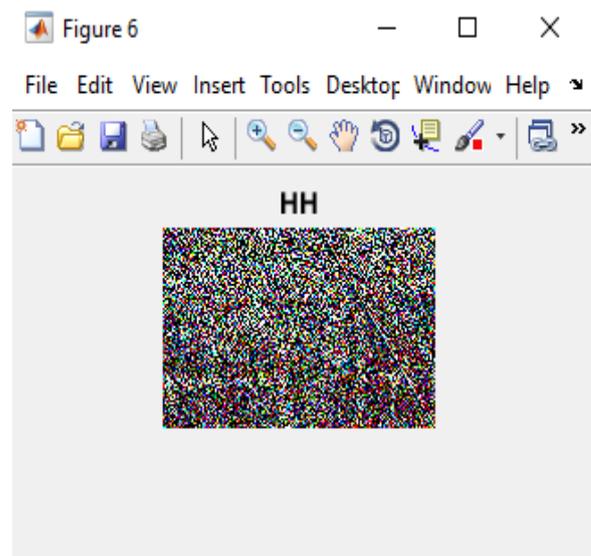


Fig. 8.Apply HH band

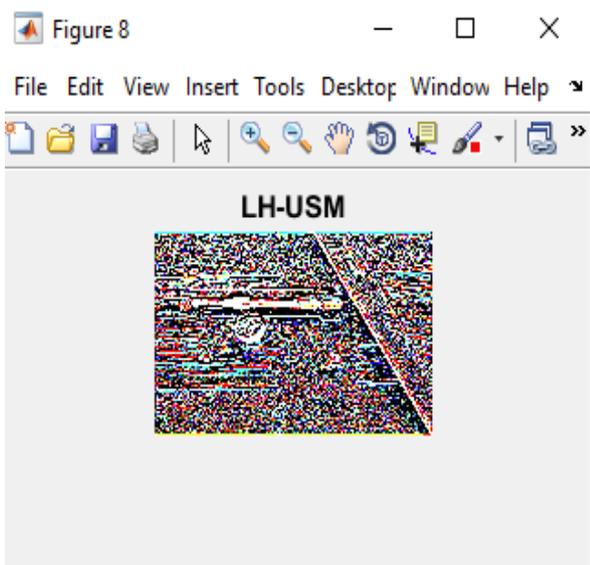


Fig. 9. Apply LH-USM

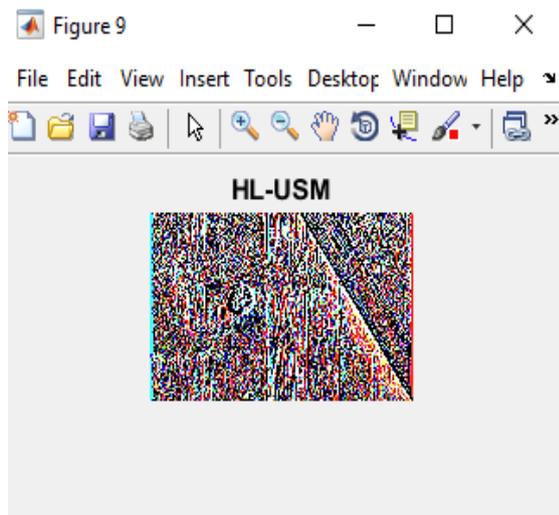


Fig. 10. Apply Unsharp masking (USM) technique used for image manipulation (mainly sharpening).

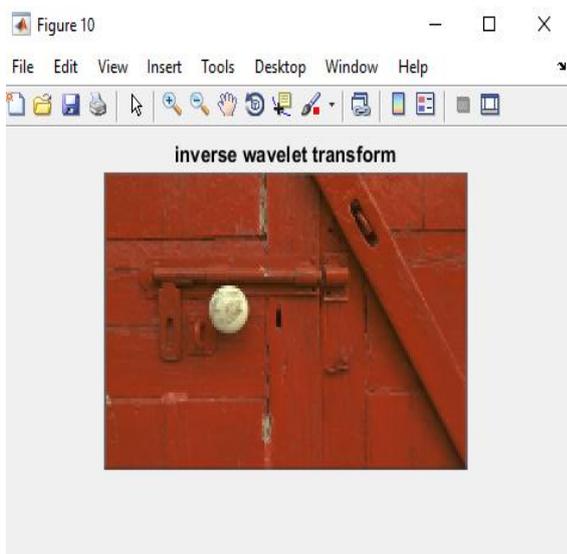


Fig. 11. inverse wavelet transform

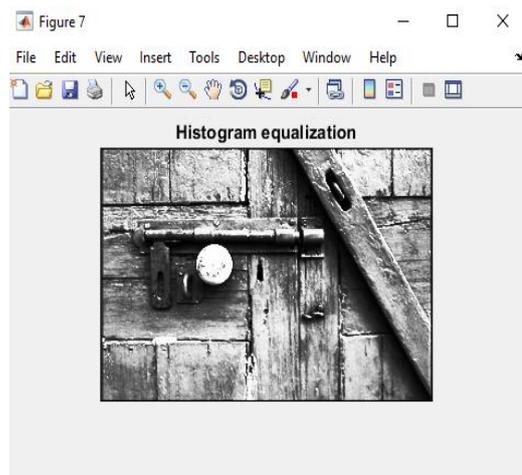


Fig. 12 Apply Histogram equalization.



Fig. 13. Apply naturalness preserved enhance algorithm (NPEA)

Table.1.comparison Base PSNR, and Propose PSNR

Image name	Base PSNR	Propose PSNR
Kodime02	47.1501	54.4718
Image gallery	47.2764	54.5530
Image gallery1	45.6366	55.2583

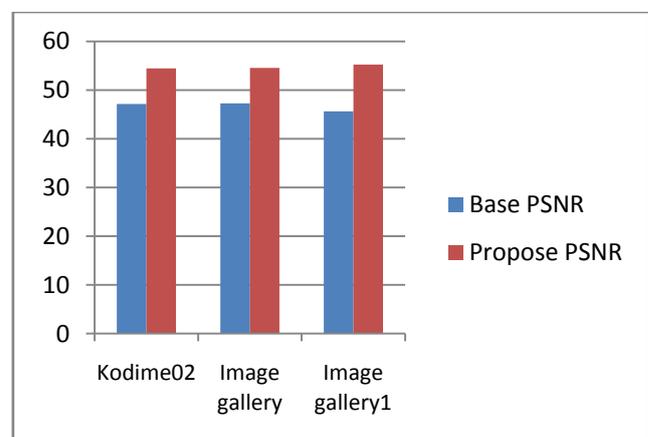


Fig.12. Graph 1.Comparison Base PSNR, and Propose PSNR

Table 2. Comparison Base MSE, and Propose MSE

Image name	Base MSE	Propose MSE
Kodime02	1.1557	1.3670
Image gallery	1.1607	1.3055
Image gallery1	1.1603	1.2059

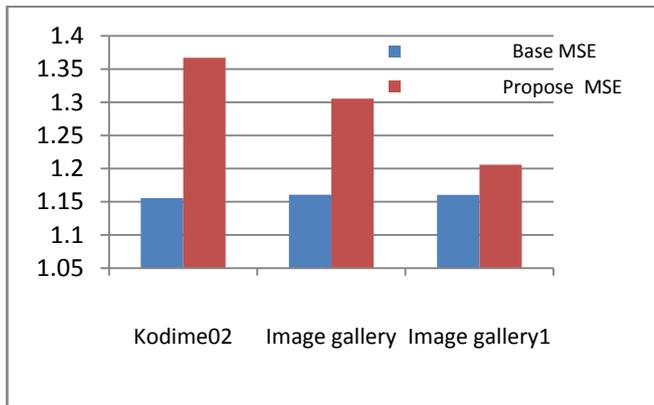


Fig. 13. Graph 2. Comparison Base MSE, and Propose MSE

Table 3. Comparison Base SSIM, and Propose SSIM

Image name	Base SSIM	Propose SSIM
Kodime02	0.0468	0.8341
Image gallery	0.1717	0.8450
Image gallery1	0.2019	0.9236

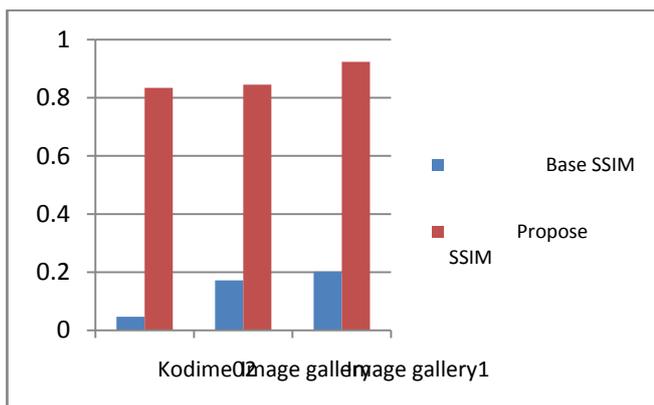


Fig. 14 Graph 3. Comparison Base SSIM, and Propose SSIM

VIII. CONCLUSION

The Image enhancement plays important role in image processing. In Propose Work, naturalness preserved enhance algorithm (NPEA) enhancement method is proposed. Our algorithm is very effective in the manner of above problem. These strategies can be characterized into two vital gatherings – spatial domain based and change

space based techniques. The algorithm is planned on MATLABR17 using IP toolbox. Output of all the above mentioned techniques is compared on the basis of their corresponding PSNR, MSE and SSIM values. Since As parameters, PSNR has been increment and we register the notable structural similarity (SSIM) file that looks at neighborhood examples of pixel powers and MSE has been decrease.

In future, other enhancement methods and learning techniques can be used to improve the processing effect of proposed technique.

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