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# Hybridization of Image Enhancement Techniques: BBHE with DSIHE and Classical He Algorithms

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**ABSTRACT:** Image editing encompasses the processes of altering images, they can be digital photographs, traditional analog photographs, or illustrations. Traditional analog image editing (TAIE) is known as photo retouching, using tools such as an airbrush to modify photographs, or editing illustrations with any traditional art medium. The no. of techniques are available till now to enhance images like contrast enhancement, Intensity, hue, and saturation transformations, Density slicing, Edge enhancement, Making digital mosaics, Producing synthetic stereo images, BBHE, Local HE etc. In this research paper we have took three techniques called Local HE, BBHE and our proposed technique. From results we have found that our proposed technique is giving best results from all. The Mean Square Error 61.9421 which is very less from other two techniques, Bit error Rate is also low than other techniques i.e. 0.033101. The value of peak Signal to Noise ratio is increases as compare to other techniques Local HE & BBHE i.e. 30.2109.

**KEYWORDS:** Image Enhancement, BBHE, Local HE, Bit error Rate, Noise ratio

## I. INTRODUCTION

Human beings are predominantly visual creatures. We heavily rely on our vision to make sense of the world around us. We not only look at things to identify and classify them, but we can scan for divergences, and obtain an overall rough feeling for a scene with a quick glance. We can identify a face in an instant; we can differentiate colors; we can process a large amount of visual information very quickly.

An image is a single picture which represents something. It may be a picture of a person, of people or animals, or of an outdoor scene, or a microphotograph of an electronic component, or the result of medical imaging. Even if the picture is not immediately recognizable, it will not be just a random blur. It involves the modification of digital data for improving the image qualities with the aid of computer. The processing helps in maximizing clarity, sharpness and details of features of interest towards information extraction and further analysis [21]. This form of remote sensing actually began in 1960s with a limited number of researchers analyzing airborne multispectral scanner data and digitized aerial photographs. However, it was not until the launch of Landsat-1 in 1972, that digital image data became widely available for land remote sensing applications.

Raster images are stored in a computer in the form of a grid of picture elements, or pixels. These pixels contain the image's color and brightness information. Image editors can change the pixels to enhance the image in many ways. The pixels can be changed as a group, or individually, by the sophisticated algorithms within the image editors such as Spatial Domain Methods, Frequency Domain Methods.

**The Digital Image Enhancement Process Includes:**

- Remove Artifacts
- Advanced Color Correction
- Filter Adding and Reduction
- Image Replacement, Augmentation and Creation

Subjective parameters for image enhancement are visual quality and computation time and objective parameters are Peak signal to noise ratio (PSNR), Mean squared error (MSE), Normalized Absolute Error (NAE), Normalized

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Correlation, Error Color an Composite Peak Signal to Noise Ratio (CPSNR). In this research paper, we apply this fact effectively to design a contrast enhancement method for images that improves the local image contrast by controlling the local image gradient. Unlike previous methods, we achieve this without segmenting the image either in the spatial (multi-scale) or frequency (multi-resolution) domain. At that time not only the theory and practice of digital image processing was in its infancy but cost of digital computers was very high and their computational efficiency was far below by present standards.

The remaining paper in order as: Section 2 review many image enhancement techniques available in the literature. Section 3 presents the problem definition after discussing literature survey and proposed methodology for our research. It also includes hardware and software used to carry research. Section 4 discusses the work done including brief description on dataset collection, pre-processing steps and image enhancement techniques. The results are discussed and comparison is drawn to validate the robust algorithm for image enhancement in section 5. Section 6 discusses the conclusion of the research accomplished and section 7 describes the sthe future scope means the way by which this work can be further extended.

## II. LITERATURE SURVEY

In [1] **a**uthor provides an overview of underlying concepts, along with algorithms commonly used for image enhancement. The paper focuses on spatial domain techniques for image enhancement, with particular reference to point processing methods and histogram processing. In [2] author presents HE **(**Histogram equalization**).** Histogram equalization is one of the well known image enhancement technique. Although these methods preserve the input brightness on the output image with a significant contrast enhancement, they may produce images with do not look as natural as the input ones. The basic idea of HE method is to re-map the gray levels of an image. HE tends to introduce some annoying artifacts and unnatural enhancement.

In [3] the purpose of image enhancement methods is to increase image visibility and details. Enhanced image provide clear image to eyes or assist feature extraction processing in computer vision system. Numerous enhancement methods have been proposed but the enhancement efficiency, computational requirements, noise amplification, user intervention, and application suitability are the common factors to be considered when choosing from these different methods for specific image processing application.

In [4] proposed a novel adaptive direct fuzzy contrast enhancement method based on the fuzzy entropy principle and fuzzy set theory. We have conducted experiments on many images. The experimental results demonstrate that the proposed algorithm is very selective in contrast enhancement as well as in preventing over-enhancement.

In [5] author defines that Fuzzy logic can be used to process human knowledge in the form of fuzzy if-then rules. which is divided into 3 phases: Image fuzzification, membership values modification, and image de-fuzzification. In this paper an image enhancement technique based on fuzzy logic is discussed and then implemented in MATLAB 7.14.0 (R2012a). In [6] available histogram equalization based methods are reviewed and compared with image quality measurement (IQM) tools such as Absolute Mean Brightness Error (AMBE) to assess brightness preserving and Peak Signal-to-Noise Ratio (PSNR) to evaluate contrast enhancement. In [7] the paper mainly deals with processing an image as well as enhancing it. To achieve the before said target we grab the pixel information from the input image, convert that information into RGB model, then using that model we process and/or enhance it based on the algorithms. We analyze the enhancement of the image by comparing the enhanced image with the initial image using their respective histograms. The coding part of the project uses JAVA language on PC platform with Linux/Windows operating system.

In [8] the multi-peak generalized histogram equalization (multi-peak GHE) is proposed. In this method, the global histogram equalization is improved by using multi-peak histogram equalization combined with local information. Experimental results demonstrate that the proposed method can enhance the images effectively.

In [9] presented a review of new forms of histogram for image contrast enhancement. The major difference among the methods in this family is the criteria used to divide the input histogram. Brightness preserving Bi- Histogram Equalization (BBHE) and Quantized Bi Histogram Equalization (QBHE) use the average intensity value as their separating point. Dual Sub-Image Histogram Equalization (DSIHE) uses the median intensity value as the separating point. Minimum Mean Brightness Error Bi-HE (MMBEBHE) uses the separating point that produces the smallest Absolute Mean Brightness Error (AMBE). Recursive Mean-Separate Histogram Equalization (RMSHE) is another improvement of BBHE. The Brightness preserving dynamic histogram equalization (BPDHE) method is actually an

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extension to both MPHEBP and DHE. Weighting mean-separated sub-histogram equalization (WMSHE) method is to perform the effective contrast enhancement of the digital image. In [10] a new method for image contrast enhancement is developed. The novelty of the proposed method is that the weighted average of the histogram equalized, gamma corrected and the original image are combined to obtained the enhanced processed image .The proposed algorithm not only achieve contrast enhancement but also preserves the brightness level. Experimental results show that the proposed algorithm has good performance on enhancing contrast and visibility for a majority of images. In [11] review of different popular histogram equalization techniques and experimental study based on the absolute mean brightness error (AMBE), peak signal to noise ratio (PSNR), Structure similarity index (SSI) and Entropy.) In [12] introduces a new automatic image enhancement technique based on real-coded Genetic Algorithms (GAs). The task of the GA is to adapt the parameters of a novel extension to a local enhancement technique similar to statistical scaling, as to enhance the contrast and detail in the image according to an objective fitness criterion. It compared proposed method with other automatic enhancement techniques, like contrast stretching and histogram equalization methods. Results obtained, both in terms of subjective and objective evaluation, show the superiority of proposed method. In [13] a brief overview of the canonical genetic algorithm and it also reviews the tasks of image pre-processing. The GAs were adopted to achieve better results, faster processing times and more specialized applications. This paper introduces various approaches based on genetic algorithm to get image with good and natural contrast.

In [14] the feasibility of the proposed method is demonstrated and compared with Genetic Algorithms (GAs) based image enhancement technique. The obtained results indicate that the proposed PSO yields better results in terms of both the maximization of the number of pixels in the edge and the adopted objective evaluation. Computational time is also relatively small in the PSO case compared to the GA case. In [17] a method is developed to enhance the quality of the given image. The proposed technique uses DWT and SVD. The HF components are interpolated using conventional interpolation techniques. Then we use IDWT to combine the interpolated high frequency and low frequency components.. The experimental results show that proposed technique gives good results over conventional methods. In [18] author discussed that Satellite images are used in many applications such as geosciences studies, astronomy, and geographical information systems. This paper proposed a technique for new satellite image resolution enhancement based on the interpolation of the high-frequency sub bands obtained by discrete wavelet transform (DWT) and tested on satellite benchmark images. The quantitative (peak signal-to-noise ratio and root mean square error) and visual results show the superiority of the proposed technique over the conventional and state-of-art image resolution enhancement techniques.

From the literature survey we have found that earlier there are many techniques to enhance an image like Local HE, BBHE etc. but to improve the quality of image means to enhance the image more we have proposed a technique which is hybridization of BBHE technique with the mixture of two old techniques.

## III. PROPOSED METHODOLOGY

Proposed methodology is divided into four sub processes named as (i) Image Dataset (ii) Preprocessing (iii) Image Enhancement (iv) Result. To acquire an image, it is stored digitally by clicking in Camera or taken from internet. Preprocessing applying on it improves the quality of acquired image. The block diagram for the HCR is shown in Fig 1.1.

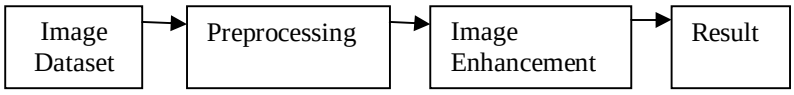


Fig. 1.1 Block diagram of Image Enhancement

In this thesis the procedure is as follow:

- In first step user will select the image from the pc to whom user want to enhance.
- Next step is to convert the selected image to the single layer image.
- After the conversion to the image next to it is the pre-processing so that the enhancement process will be more efficient and resulted image will be better.

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- After performing the pre-processing process select the related techniques as in this thesis there is analysis of proposed work with classical techniques.
- Firstly the basic techniques as LHE, BBHE are implement to get the results on the images.
- In proposed work there is hybridization of BBHE with the DSIHE and Local HE algorithms to get the efficient image enhancement.
- Finally there is comparison of classical image enhancement techniques with the proposed hybrid approach and analysis over the parameters.

## IV. WORK DONE

To enhance the image, we have collected 100 images and do experimentation on it. Using Matlab 2009b we start our work by making GUI. First of all we browse a file see in fig. 1.2 i.e. image in any format or extension. After an image is selected from open a file, than it will shown on axes as shown in fig. 1.2. We show that image in axes because we want to show each image by comparing with output image. Next option is to select the technique for enhancement of an image. There are three techniques we have included in our thesis. These are (1) Local HE (2) BBHE (3) Proposed HE as shown in fig.

Select any technique from these three techniques. In these techniques two techniques are the old techniques for an image enhancement and last one is the technique is proposed by us. If we select local HE technique then the result of that technique will be shown on axes2 as shown in fig.

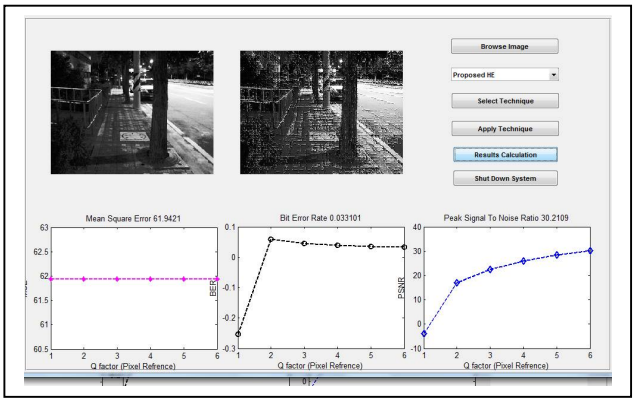


Fig. 1.2 image enhancement

## V. EXPERIMENTAL RESULTS

To show result of all three techniques we have used three parameters

- Mean Square Error
- Bit Error Rate
- Peak Signal to Noise Ratio

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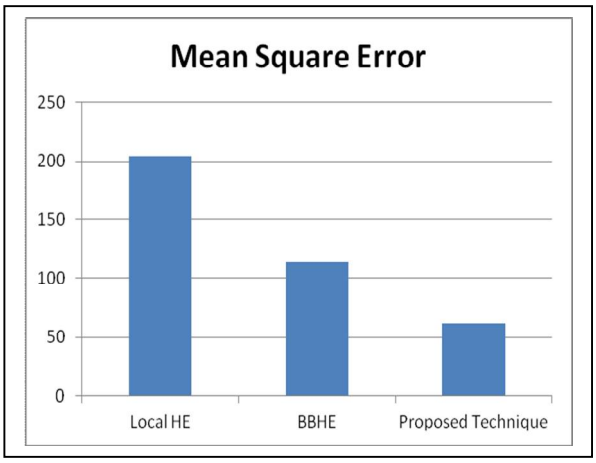


Fig 1.3 Performance Comparison in terms of Mean square errors

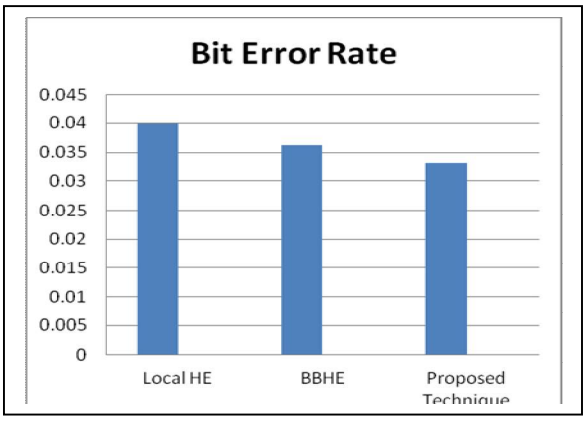


Fig. 1.4 Performance Comparison in terms of bit error rate

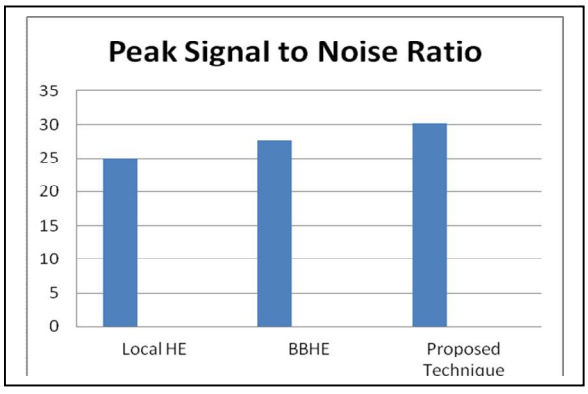


Fig. 1.5Performance Comparison in terms of peak signal to noise ratio

From the above figures, i.e. fig. 1.3-1.5, we have found that the three parameters gives result according to technique applied. If we see at Local HE technique, we found that Bit rate error is 0.03996; Mean Square error is 204.4601 and Peak Signal to Noise Ratio is 25.0247.

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Now let's talk about Bi-Histogram equalization (BBHE) technique, the value of Bit Error rate is 0.036254 which is little less than Local HE technique, that means it remove more error in image and do more enhance t image than Local HE. Mean Square Error is also less as compare to Local HE technique i.e. 113.4487. And the Peak Signal to Noise Ratio increase in this technique i.e. 27.5828. This value shows that this technique is much better than local HE.

Thus the results shown by our proposed technique is very good from other two techniques. The Mean Square Error 61.9421 which is very less from other two techniques, Bit error Rate is also low than other techniques i.e. 0.033101. The value of peak Signal to Noise ratio is increases as compare to other techniques Local HE & BBHE i.e. 30.2109.

## VI. CONCLUSION & FUTURE WORK

Image Enhancement (IE) is the improvement of digital image quality (wanted e.g. for visual inspection or for machine analysis), without knowledge about the source of degradation. There is no. of techniques available till now to enhance images like contrast enhancement, Intensity, hue, and saturation transformations, Density slicing, Edge enhancement, making digital mosaics, producing synthetic stereo images, BBHE, Local HE etc. From results analysis as shown in fig. 1.3-1.5, we have found that our proposed technique is giving best results from all. The Mean Square Error 61.9421 which is very less from other two techniques, Bit error Rate is also low than other techniques i.e. 0.033101. The value of peak Signal to Noise ratio is increases as compare to other techniques Local HE & BBHE i.e. 30.2109.

The proposed technique used may be further extended in future as we may use different pair of image enhancement technique and do comparison between them or selected dataset may comprise of samples of different type of images and can check the accuracy of proposed technique with different type of image samples.

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