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Comparitive analysis for Pre-Processing of Images and videos using Histogram Equalization methodology and Gamma correction method

Pratiksha M. Patel[1], Dr. Sanjay M. Shah[2]

[1] *Research Scholar, KSV, Gandhinagar, India*
[2] *Guide, Director of Computer Science Department, SKPIMCS, Gandhinagar, India*

Abstract - *Pre-processing is an action performed on poor quality of images, degraded video files and also to find finer details of an image and video. Brightness and contrast enhancement are two major factors which play important role in improving visual artifacts and patterns of an image. Conservative HE results in unnecessary contrast enchantment which in turn gives processed image and aberrant look and also creates visual artifacts. In this paper diverse essences of deprived quality of images and videos with law lightning conditions and foggy or videos with noisy environment are taken. In this paper HE based algorithm, Advanced HE algorithm CLAHE and CLAHE-RGB are applied on various images and videos and they have been analyzed using both subjective and objective fidelity criteria. The research work is also spotlight on applying gamma correction method on the mentioned images and video file. This paper compares and analyzes performance of gamma correction and CLAHE technique based on PSNR value as a measuring parameter. The proposed work of comparative analysis tried to find out which histogram equalization method accomplishes higher accuracy, and which method is effective.*

Key Words: **Contrast Limited Adaptive Histogram Equalization, Image Enhancement, Gamma Correction, PSNR, GHE**

1. INTRODUCTION

In day to day digital life, ratio of smart devices and transaction with smart device are increase. In terms of banking, credit card, billing, government organization, medical science, forensic science, or in crime investigation department there is a need to improve the quality of images for further analysis, or to improve the quality of some law lightning illumination condition videos, or to enhance the degradation of video file capture from CCTV camera, or video taken from any external sources. Sometimes, during the capturing of video there may be heavy rain, or environment becomes cloudy, or foggy, there is snowfall then the result of captured video file is also degrade. To solve such crisis of image and video file, different image enhancement techniques are implemented. Image enhancement is only the method which performed on an image to improve its quality or visual appearance [1]. Video file also require enhancement techniques to improve its quality, this can be achieved via contrast procedure. From the observation it is clear that contrast is determined by the difference in the color and brightness of an object with other objects [2]. Contrast enhancement of any image is measured with contrast index factor. The higher CI value signifies better contrast improvement in the output image [3]. Brightness of an image depends on type of image, whether it is a monochrome image or color. Three pillars of histogram equalizations such as Bi, Multi, and Clipping Histogram are applied and to measure the quality PSNR, AMBE, Entropy, MSE, SNR are used [1]. It has been observed that images and video system are sometimes homogenous, heterogeneous, in such a situation to achieve superior feature consequence CLAHE is used which basically work on shape of Hist., and it used the concept of distribution constraint [4]. Image contrast is directly evaluated by contrast ratio equation then it refers as enhancement done directly [5]. Vikram Mutneja el al proposed PSNR value for achieving measurement, and extracting information for video sequence [5]. Gamma correction is also used to enhance the contrast of multiple frames in the video sequence [5]. The subsequent themes express detail view of methodology.

1.1 Contrast Enhancement Using Histogram Equalization

Proposed work applied with poor quality of image as well as foggy, blurry video sequence. This section discuss the method of basic HE for contrast enhancement. Process of HE are mentioned below.

- ✓ Acquisition of an image or video file
- ✓ Key Frame Extraction in case of video file
- ✓ Conversion of RGB to Grey
- ✓ Histogram Generation
- ✓ Histogram Equalization

1.2 Contrast Enhancement using CLAHE

The CLAHE (Contrast Limited Adaptive HE) is better-quality edition of algorithm which has adaptive characteristics [8]. Local histogram enhancement enhances the local details of an image, which apply on local neighborhood of the pixel. The main problem with local enhancement is that it is a tedious task to do the manipulation, more computations are compulsory. To solve the above problem the system used adaptive contrast enhancement. Adaptive filter worked globally on entire image of un-even contrast with an effective manner. It is worked on local characteristics of mean and variance. Workflow of CLAHE is shown in subsequent figure1.

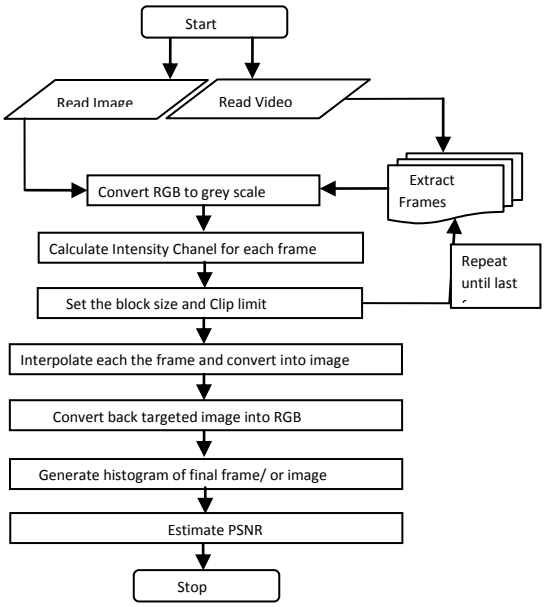

Figure 1: CLAHE Algorithm

1.3 Implementation of Gamma Correction Method

Various researchers discussed varied flavors of image enhancement techniques [1][2][3]for an image and some of them are discussed varied techniques on enhancement of poor quality video for instance fog degradation, poor lightning conditions[4][5][6]. But the gaps suggest that to improve contrast enhancement in an image or video, use some basic Grey Level Transformations techniques before enhancement applied, grey level transformation functions are simple and easy to implement for enhancement. Algorithmic steps are as follows.

Input: Image or Video

Output: Generation of Gamma corrected image with histogram

Step 1: Read the video/ image

Step 2: Extract each frame

Step 3: Convert RGB to grey

Step 4: Apply Gamma Correction on greylevel image to improve the noise

Step 5: Generate Histogram of gamma corrected image or frame

Step 6: Calculate PSNR

Step 7: Compare it with original HE

The extracted histogram of images and poor quality of video files are compared with HE, CLAHE, and gamma correction with HE. The comparative study proves that which technique is best for image as well as different type's video file based on PSNR value. The practical implementation and experimental results are discussed in following section, which include comparative tables and graphs.

2. Experimental Results

Contrast enhancement of poor quality video file or image using HE, CLAHE, and gamma correction methods which was tested using emgucv-windows-universal 3.0.0.2157 with c# as a software tool. This system is tested with 10 different types of images and 10 varied types of videos; out of them a few are display below. The targeted images formed by mentioned methods are statistically shows with PSNR (Peak Signal to Noise Ratio) .The PSNR values for output images and videos are stored in tabular form and Shown in subsequent Tables and the graphical illustration of PSNR are shown by Figure respectively.

Table 1 shows different PSNR value for normal pre-processing including RGB to grey conversion, Histogram equalization of an image, CLAHE, and finally conversion from CLAHE grey to RGB to achieve quality of original image again. It also displays value for 10 different images with different dimensions and having different format. The value written in red color indicates higher PSNR value of mentioned technique. Table 2 shows PSNR value for 10 different images using HE, CLAHE, gamma correction methods. The value written in red color indicates higher PSNR value and it is up to the mark.

Video is a process of continuous frame running at a single shot or single glance, it is specified that the frame of video size is selected as 640 X 360 and 960 X 540. Video used for practical implementation use different criteria. Among 10 video 5 videos frame rate is 29 frames/ second, 3 videos frame rate is 25 frames/ second, 1 video frame rate is 23 frames/ second, and remaining video also having frame rate of 30 frames/ second. Implementation result of video is

tested with histogram equalization method and CLAHE and Gamma correction method shown in Table 3.

Table 1: PSNR values for static images using HE, CLAHE, CLAHE_RGB

Image	Grey Conversion	HE	CLAHE	CLAHE_RGB
Tire	74.823135	18.035897	18.617591	22.967649
Cameraman	361.20199	19.072920	19.300983	12.573542
Face	17.127225	12.647498	13.986621	10.774499
Lena	17.868341	12.974201	13.938925	15.336492
Hurricane Andrew	30.314857	19.521672	14.932527	13.414176
Random matches	35.269357	6.0011012	12.040845	22.282529
Cygnus loop	28.282844	6.8734821	10.278123	18.970536
Crab pulsar radio	21.003479	8.1118209	14.413110	18.696397
Bottom_Left (beans)	361.20199	7.533428	13.442106	22.655151
Rice	361.20199	12.481749	33.730153	23.524081

Chart 1 proved that CLAHE_RGB is the essential method for different dimensions and different types of images.

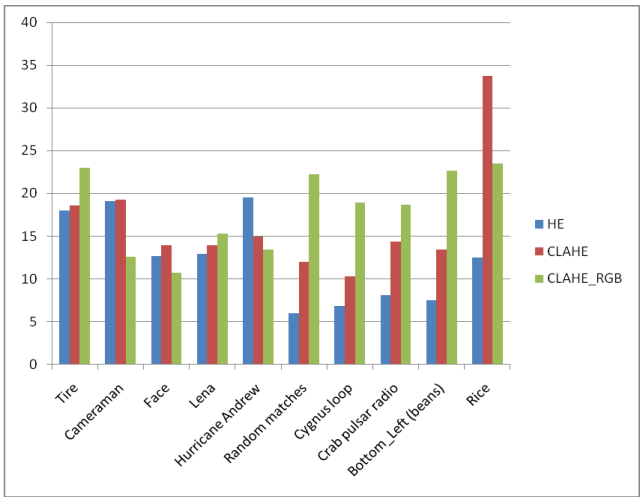

Chart -1: Comparative chart of varied images with HE techniques

The proposed Table 2 displays PSNR of targeted image after applying gamma correction method. From experimental result it is confirmed that for better grey level enhancement it is a very efficient method for pre-processing on an image.

Table 2 Comparison table for static images using HE, CLAHE-RGB, Gamma

Image	HE	CLAHE	CLAHE_RGB	Gamma
Tire	18.035897	18.617591	22.967649	29.39581
Cameraman	19.072920	19.300983	12.573542	25.393626
Face	12.647498	13.986621	10.774499	15.992922
Lena	12.974201	13.938925	15.336492	17.071886
Hurricane Andrew	19.521672	14.932527	13.414176	22.719994
Random matches	6.0011012	12.040845	22.282529	30.102464
Cygnus loop	6.8734821	10.278123	18.970536	24.289442
Crab pulsar radio	8.1118209	14.413110	18.696397	21.450496
Bottom_Left (beans)	7.533428	13.442106	22.655151	26.244559
Rice	12.481749	33.730153	23.524081	36.303978

Chart 2 proved that Gamma correction is up to the mark pre-processing methods for different flavors of images.

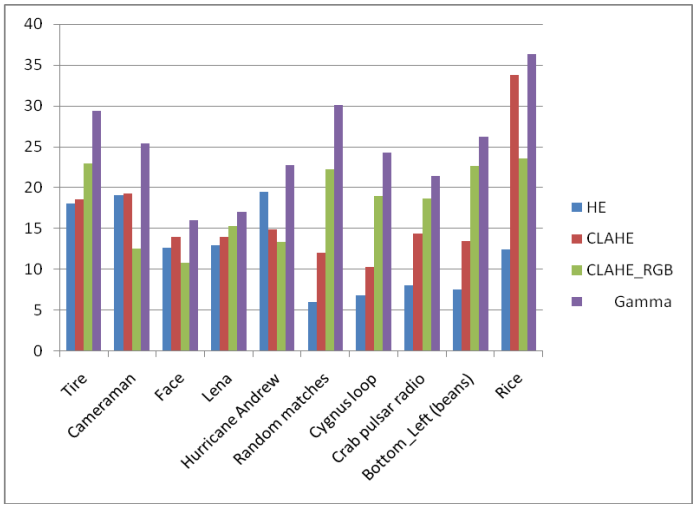

Chart -2: Comparative chart of varied images with HE techniques, gamma correction

Table 3 shows comparison of varied pre-processing techniques for effective last frame of video-quality.

Table 3 : PSNR value for video file using different pre-processing techniques

Video	HE	CLAHE	CLAHE_RGB	Gamma
Simple	9.371095	16.23958	9.5401253	24.48523
Lake_1	11.98895	15.72640	18.66261	26.06742
Lake_2	13.33258	19.05307	17.95406	28.52813
Mist	19.95238	14.69283	13.40044	25.40510
Ocean	13.38362	18.39174	10.81132	21.86923
Rush_hour	19.85590	16.04474	11.90557	21.48534
Snow	24.981487	16.809983	12.83182	23.82112
Snowfall	10.19004	14.617166	8.3044725	27.16425
Street	18.534571	15.30914	9.80656	26.12038
Tree	14.47888	13.35891	9.787354	15.41554

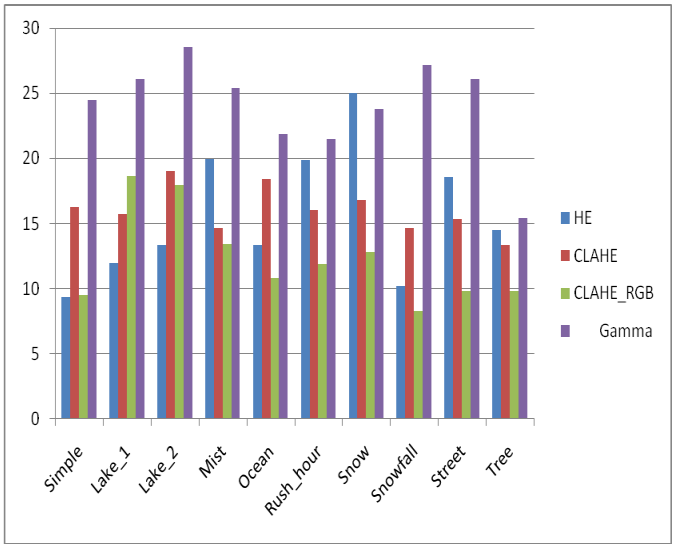

Chart -3: Comparative chart of varied video of last frame with HE techniques, gamma correction

From Highlighted Red color marked PSNR and from chart 3, it is observed that for real life video file or video with poor lightning conditions, mist, fog, street traffic, snowfall etc. , one must apply pre-processing of gamma correction, and then apply contrast stretching techniques of CLAHE to improve as well enhance brightness and contrast in video file of each key frame to achieve betterment of video file.

3. CONCLUSIONS

To accomplish contrast effect on an image or video file here the histogram equalization methods are applied and comparative analysis are done based on parameter of image file and video file. Out of 10 images, 6 images which are either grey scale or color achieve higher quality of image after contrast enhancement by using CLAHE RGB that is contrast limited adaptive histogram equalization; 3 images achieved high PSNR value using CLAHE, and remaining image achieved high contrast enhancement using simple HE. The paper shows various PSNR value for different frame of different videos. It use total 10 video files, out of which 5 video's frame and its PSNR is shown with two techniques HE and CLAHE. It is proved that for video file of simple, lake-2, ocean, and snowfall improved efficient quality in a key frame of video sequences only by applying CLAHE of histogram equalization method. From all results it is proved that CLAHE pre-processing is up to the mark for varied static images and Gamma correction is suitable for foggy, blurry video files. In future use combination of varied HE techniques to improve contrast enhancement and brightness ratio of an image and video file.

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REFERENCES

[1] Saritha K R., "A Study on Image Enhancement Techniques and Performance Measuring Metrics." International Journal of Innovative Research in Computer and Communication Engineering 4.4 ,2016

[2] Enhancement and Lacuna Texture Synthesis," Computer Journal of IEEE Transactions Image Processing,

[3] Raju, A., "A comparative analysis of histogram equalization based techniques for contrast enhancement and brightness preserving.",2013.

[4] Yadav, Garima, Saurabh Maheshwari, and Anjali Agarwal.,"Contrast limited adaptive histogram equalization based enhancement for real time video system." Advances in Computing, Communications and Informatics (ICACCI, 2014 International Conference on. IEEE, 2014.

[5] Mutneja, Vikram, and Deepak Kumar Behera. "Contrast enhancement analysis of video sequence in the temporal-based (TB) method."

[6] Ramya, C., and Dr S. Subha Rani. "Contrast Enhancement for Fog Degraded Video Sequences Using BPDFHE." International Journal of computer sciences & information techniques vol3 (2) ,2012.

[7] Y. T. Kim, "Contrast Enhancement Using Brightness Preserving Bi -Histogram Equation", IEEE Transactions on Consumer Electronics, vol. 43,1997 .February , pp. 1-8 .

[8] Das, Sourav, Tarun Gulati, and Vikas Mittal. "Histogram equalization techniques for contrast enhancement: a review." International Journal of Computer Applications 114.10 ,2015.

[9] Bhagya H.K, Keshaveni N. "Review on video enhancement techniques." International Journal of Engineering Science Invention Research & Development.3.2 ,2016.

[10] Sahu, Niraj Kumar, and Sampada Satav. "A Study paper on Development of Robust Video Contrast Enhancement Technique using intra-frame Techniques."

[11] S. Srinivasan, N. Balram, "Adaptive Contrast Enhancement Using Local Region Stretching." 8.12 oct

[12] Wang, Dongsheng, Xin Niu, and Yong Dou. "A piecewise-based contrast enhancement framework for low lighting video." Security, Pattern Analysis, and Cybernetics (SPAC), 2014 International Conference on. IEEE, 2014.

[13] Pratiksha M. Patel, "Contrast Enhancement of Images and videos using Histogram Equalization", November 16 Volume 4 Issue 11 , International Journal on Recent and Innovation Trends in Computing and Communication (IJRITCC), ISSN: 2321-8169, PP: 267 - 270