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An Efficient System for Video Enhancement by Reduction of Noise

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Abstract : Image processing typically refers to digital image processing, but analog and optical image processing also are possible, a novel approach for noise reduction and enhancement of extremely low-light video is proposed. For noise removal, a motion adaptive temporal filtering based on a Kalman structured updating is presented. Dynamic range of denoised video is increased by adjustment of RGB histograms using Gamma correction with adaptive clipping thresholds. Finally, residual noise is removed using a nonlocal means (NLM) denoising filter. The proposed method works directly on the colour filter array (CFA) raw video for achieving low memory consumption. In our proposed method we are going to implement video enhancement process based on the following methods-Image pre-processing, Noise reduction, Contrast enhancement, Temporal denoising.

Keywords : Noise, Illumination, Contrast, Frame.

1. INTRODUCTION

Nowadays, quality of image plays a vital role in day to day life. Quality is needed to visualize the image clearly. This image cannot be visualized clearly when there are at low lights, due this image are blurred and some portion goes dark. To maintain the quality of image, the image has to be enhanced more than the original image. Hence we are moving to the concept of image enhancement. Image enhancement is the process of improving the quality of image more than original image.

To [1] enhance the quality the discrete wavelet frames is used to segment images into frames with their textured properties by low pass filter and the high pass filter. Then the colour is added to each texture. [2] the noise has to be removed by four operation-segmentation of bright pixels, noise detection algorithm, filtering median of SHF,SDTF for FCN detection and filtering.

The images can also be filtered [3] by the trick called add and eliminate the noise but they works only on lesser noised images. Filtering is possible for noised images. At last contrast enhancement has to be done. The segmented image is adjusted based on the pixel size which gives clear image more than the original image.

2. RELATED WORKS

Distortion may occur at the time of acquisition, processing, compressing, storing, transmitting and receiving the digital image. The correct method to quantify the quality of image is through Subjective Evaluation. But, it is costly, time consumption. So, Objective image quality assessment is used. It will automatically predict perceived image quality. Image processing application has variety of roles such as dynamically monitor and adjust the image quality (it will see the quality of video transmitter and allocate

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resources), Optimize the algorithm and the parameter setting, Benchmark the image processing system and algorithm. This is been discussed in [1].Here, in this approach we use the concept of full reference (complete reference image is known). It is done by the Mean Squared Error (MSE) computed by averaging the square of intensity distortion, reference image pixel and Peak Signal- to- Noise Ratio (PSNR).Image quality Assessment is based on two method.

Error Sensitivity mainly decomposes the image signal using linear transformation. It is done by the concept of framework. The framework concept is done by pre-processing, CSF

Filtering (Contrast Sensitivity Function), Channel Decomposition, Error Normalization, Error Pooling. Structural Similarity mainly focus on removing the strong dependency. Here, the image signal is highly structured by pixel exhibit strong dependency, spatial proximate. Dependencies carry important information about the structure of object in visual scene.

Reducing the noise and enhancing the video which is very low- light video. Here, the noise removal and video enhancement plays a critical role. Video taken under very poor light is more challenging as it has poor dynamic range and high noise level. Low- light video are taken and processed by Non- Local Means (NLM) and its extension, along with the tone mapping. There are three staged processing schemes are used here Spatial and Temporal Filtering-In this filtering, we use the filter which is an image operation by which we can change the pixel value by a function of intensities of pixel in a neighbourhood by that pixel, Tone Mapping-It will enlarge the dynamic range of dark image and keep the other areas slightly affected. It is done by the luminance. [2]. It will set the value of maximum luminance to 255, Filtering in the YCrCb Space-However the first two stages will help in reducing the noise, some noise will be left after the spatial and temporal filtering which is raise by the tone mapping .The visual colour appearance is done by YCrCb. It is also called as YUV standards. It is mainly done on analogue video.

Nowadays, patch processing is used for image restoration algorithm. The ideas is to breakdown the source image into fully overlapped patches and recovers each separately and combine results by plain averaging. This concept is highly effective but has an drawbacks that it gives results only based on the intermediate path results and not on the final outcome. [3]In these paper we will find the minimum mean squared error and we will find the non-overlapping or average overlapping patches .Here we will denoised patches independently, then we will carry out the patches on final result not on the intermediate results. Then we will compare with original image to show the clear improvements across all tasks.

The major problem that is found on the existing paper is removing the noise by calculating the median value. So the false value is removed either by intensity value or the pixel value , but these doesn’t work on very low level lights.[4]In another paper they have used adaptive weighted averaging filter. Here the mean value is calculated by motion sequence. Even though in these algorithms, many noises is left unaffected by the heavy noise. The heavy noise is removed by Tone mapping, Noise reduction, Intensity Stretching Even though the image is processed by adaptive smoothing, the image will be dark as in unprocessed input data. For these tone mapping is used to amplify the intensity transformation such that the dynamic range of darkness is removed.

In these paper, we are going to use image decomposition for image denoising. We should compute the local geometry of a moving frame and compute the image components to be processed. In these existing paper they use three methods for image denoising-a local variation method, a patch based method, method combining a path. These process leads to complex state and makes delay. To overcome these, we will combine all the single valued vector function together and we will perform denoising function or giving the denoising to them individually. The major drawbacks in [5] is there will different geometry components in a frame but we will use only one denoising technique, how can it denoise all the components.

According to [6] the consumers, noise reduction is the most important feature in the cameras. The noise is easily interfered with the signal in low light surroundings. Many techniques is been used for noise reduction, but it reduces the performance seriously. In olden technique, we will improve the computation by omitting the brighter region. Thus the noise is reduced, but these makes very complex. Thus in our paper

works on Noise Adaptive Spatio-Temporal for removing noise in low light surroundings. Two algorithm is proposed for removing noise Statistical domain temporal filter-used for filtering the motion full area, Spatial hybrid filter-used for filtering the motionless area. The NAST uses four operation for removing noise in low light images by Segmentation of bright pixels-In these operation, we use only pixel intensity and contrast for segmentation for calculating the dark and brighter region, Noise Detection Algorithm- In these process, we will only focus on noisy images and we will detect whether any mixture is available. We will get the absolute difference between two frames to remove the noise and blur images.

The image denoising is mainly based on three algorithm-Compute and analyze the noise by Denoising algorithm, a new algorithm known as Non- Level Means based on a Non- Level average of all pixel in the image, some experiments are used to compare the NL- Means Consistency algorithm and local smoothing filter. This method should denoise only the noised image. It should not alter the other non- noisy image. Some good quality image will have a small amount of noise in it. If we denoise that image, the image will be blurred. So, We use the technique called "Add and then remove it".[7] There are four types of filtering done Gaussian Filtering-Here, the isotropic linear filter boils down the convolution of the image bilinear symmetric kernel, Anisotropic Filtering-It attempts to avoid the blur effects present in the Gaussian by convolution the image at orthogonal direction. It was introduced by Perona and Maik, Total Variation Minimization-It was introduced by Rudin, Osher, Fatemi. Here, noisy image is given and the original image is recovered using a solution of minimization problem, Neighbourhood Filtering-It is a kind of filter which can restore a pixel by taking an average value of neighbouring pixel with similar grey level value.

In the existing paper [8], the drawbacks come when we process the image at poor illumination conditions. For these purpose we create an algorithm Content Aware which will enhance dark images rather than the brighter images and also sharpen the edges. This algorithm produces the max enhancement by adopting mapping function for every images characteristics. It also performs image transformation. We will perform the image contrast at the textured region and the boundary and collect data with common characteristics. By these we can obtain the transformation functions. Then the clear image is produced by mixing it with human vision. The proposed system is tough, since it avoid image error by transforming function to content of the image. The quality of image is increased by mixing different region channels. Thus the Content Aware algorithm produces a wide range of images and omits the artifacts and produces a great quality in images.

3. PROPOSED WORK

In our proposed system, we will work on very low light images and our main aim is to focus on motion blur and poor contrast images.

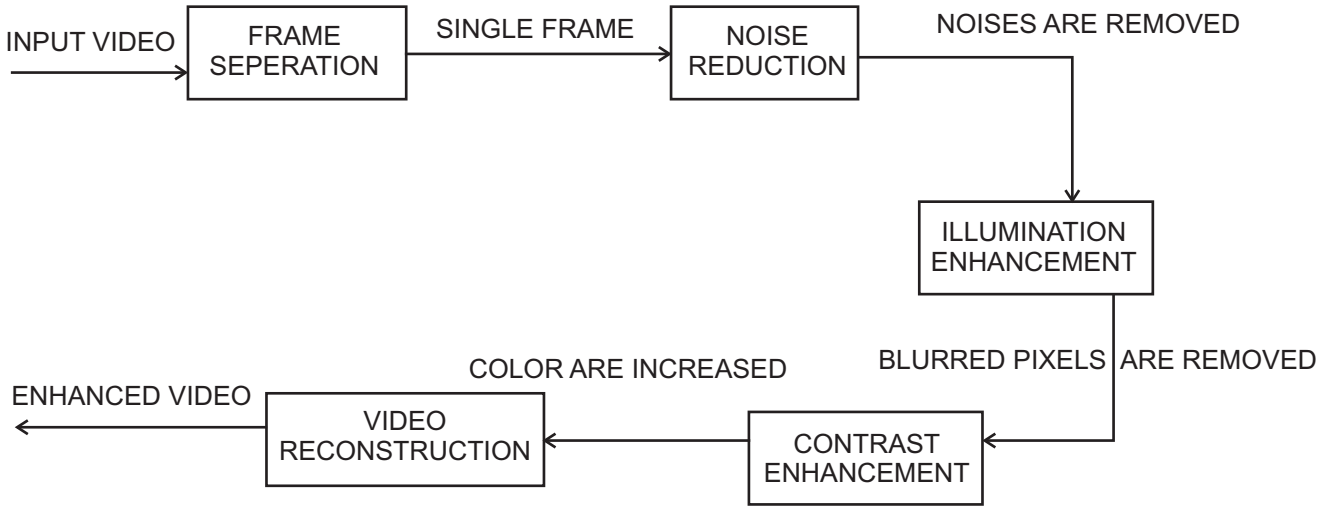

Figure 1: Process Flow Architecture

To enhance the video quality we will focus on pre-processing of image. From figure 1 Process Flow Architecture, we take low light videos has an input, then we will separate the videos into frames. Then the noise reduction is done for initial noisy frames. Some of the initial frames are Salt and pepper noise, Gaussian noise, Shot noise, Quantization noise, Film noise, anisotropic noise. In these we will mainly focus on the Salt and pepper noise which denoised by Median filter. Illumination Enhancement is used to remove the blur in the frames and make the frames to appear more clearly. Then Contrast enhancement is performed for the initial denoised frame. It is achieved by two methods-Image adjustment is used to adjust the pixel position of framed image by comparing with the neighbouring image, Histogram equalization which is used to adjusting image intensities to enhance contrast. Again denoising is performed to remove the blurred image. Finally the absolute frames are reconstructed to produce the original video.

A. Frame Separation

In frame separation the input video is separated into many frames. The frame separation is done by pre-processing algorithm. Pre-processing is done to remove the unwanted distortion of image. Pre-processing is done by pixel brightness transformation, geometric transformation and image restoration.

B. Noise Reduction

In noise reduction we will remove the noises using the two types of filters. Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. Median filter is used to remove salt and pepper noise and spatio noise. Gaussian filter is used to the gaussian noises.

C. Illumination Enhancement

The illumination enhancement is used for the placement of the light sources can make a considerable difference in the type of message that is being presented. Multiple light sources can wash out any wrinkles in a person's face, for instance, and give a more youthful appearance. In contrast, a single light source, such as harsh daylight, can serve to highlight any texture or interesting features.

D. Contrast Enhancement

Contrast enhancement is performed for the initial denoised frame. It is achieved by two methods-Image adjustment and Histogram Equation. Image adjustment is used to adjust the pixel position of framed image by comparing with the neighbouring image, Histogram equalization which is used to adjusting image intensities to enhance contrast.

E. Video Reconstruction

Video reconstruction is used to reconstruct all the frames that are enhanced according to pixel intensity and the frames positions. The output of the video reconstruction gives an enhanced video more than the original video.

4. PERFORMANCE EVALUTION

We have done our performance evaluation for our project based on each stage output. We have compared the previous stage output with the current stage output. The performance evaluation is based on the intensity and the pixel clarity in our frames of images. A graph is generated for the input frame, then the first process for the enhanced image.

At the second stage, we generate a graph Figure 3 Filtered image on comparing the two processes in the first stage. The enhanced image from the input image.

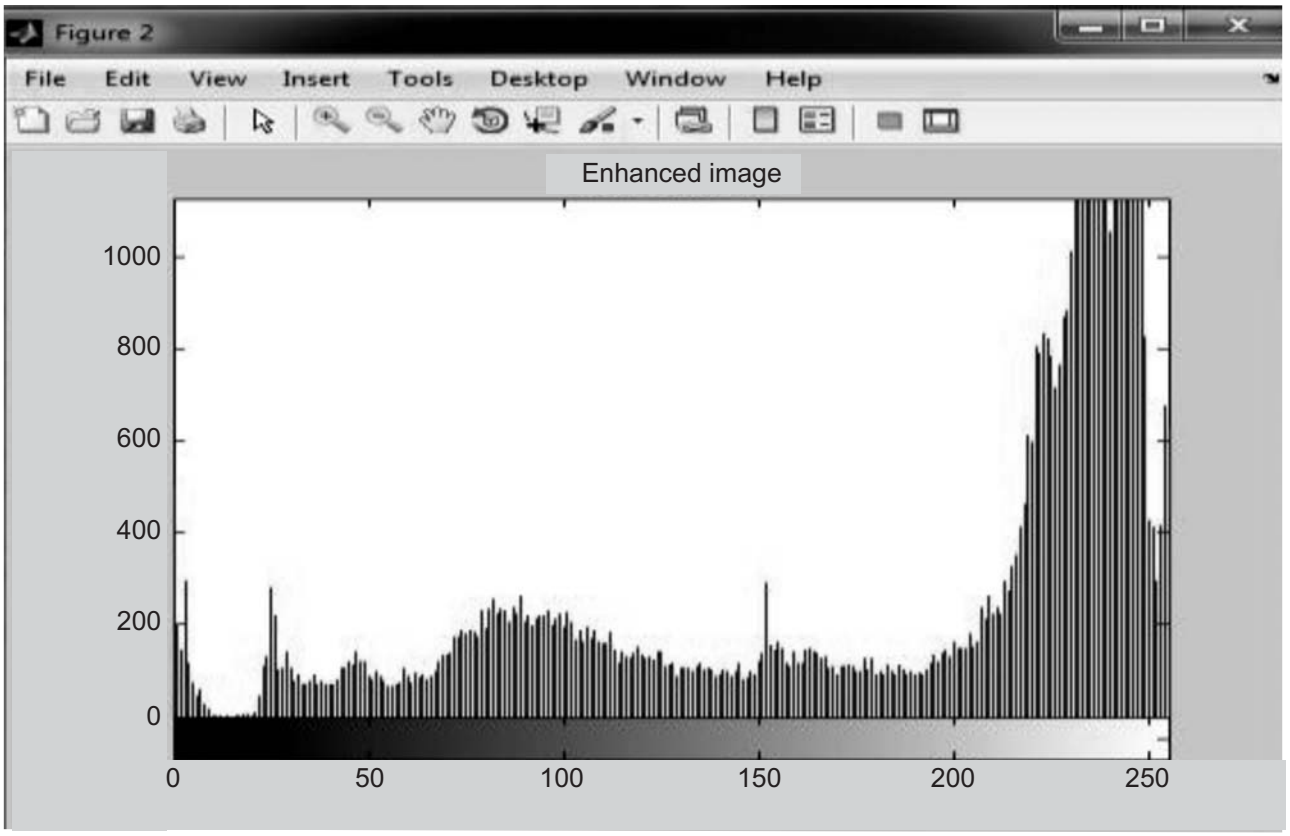

Figure 2: Enhanced image

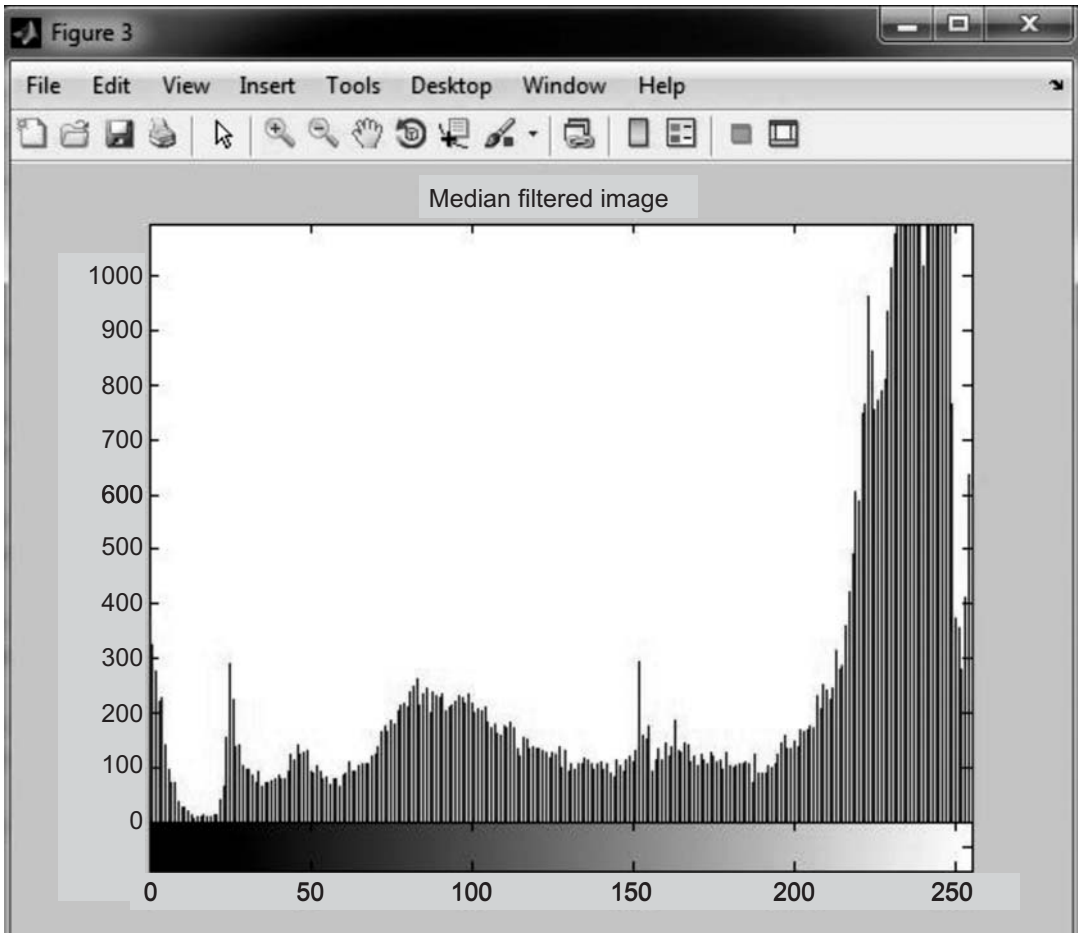

Figure 3: Filtered image

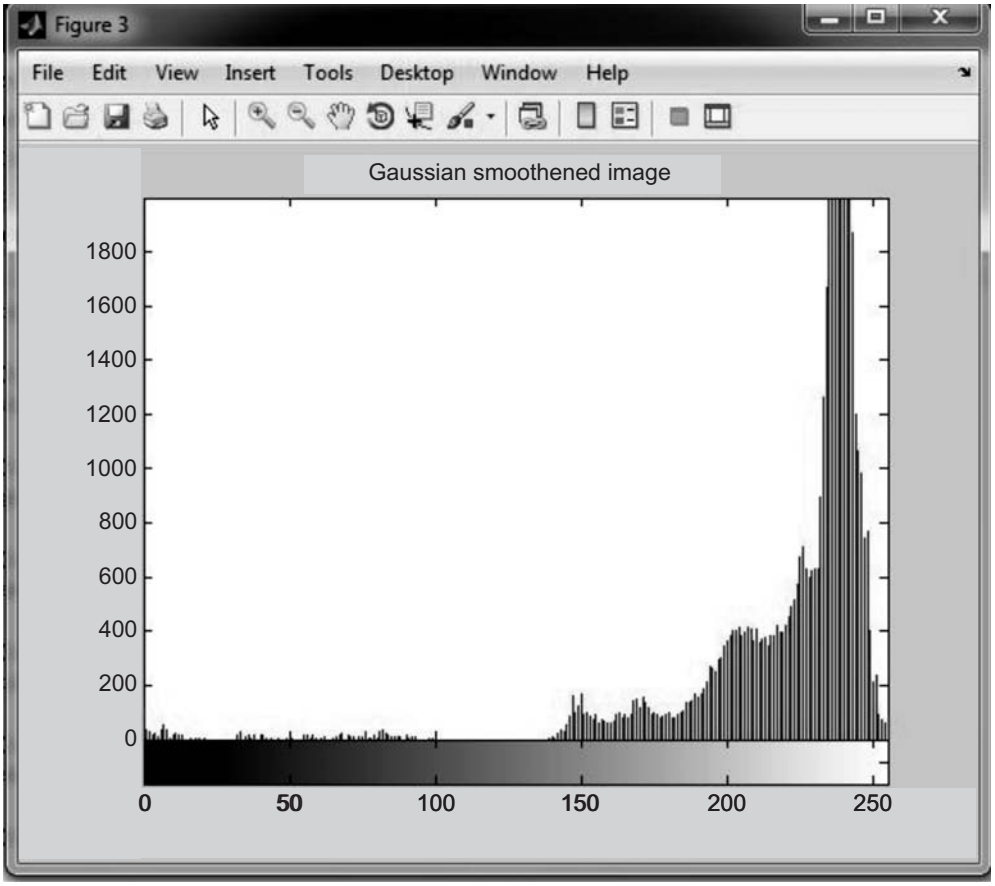

Figure 4: Smoothened image

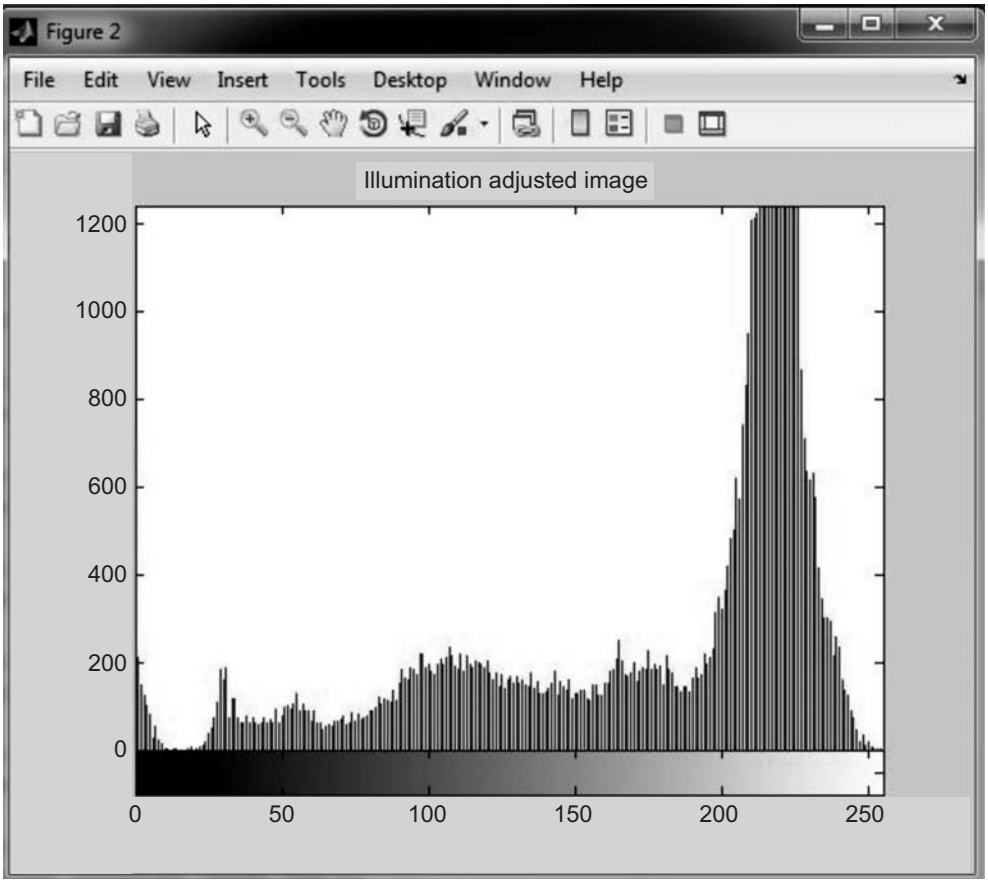

Figure 5: Illumination adjusted image

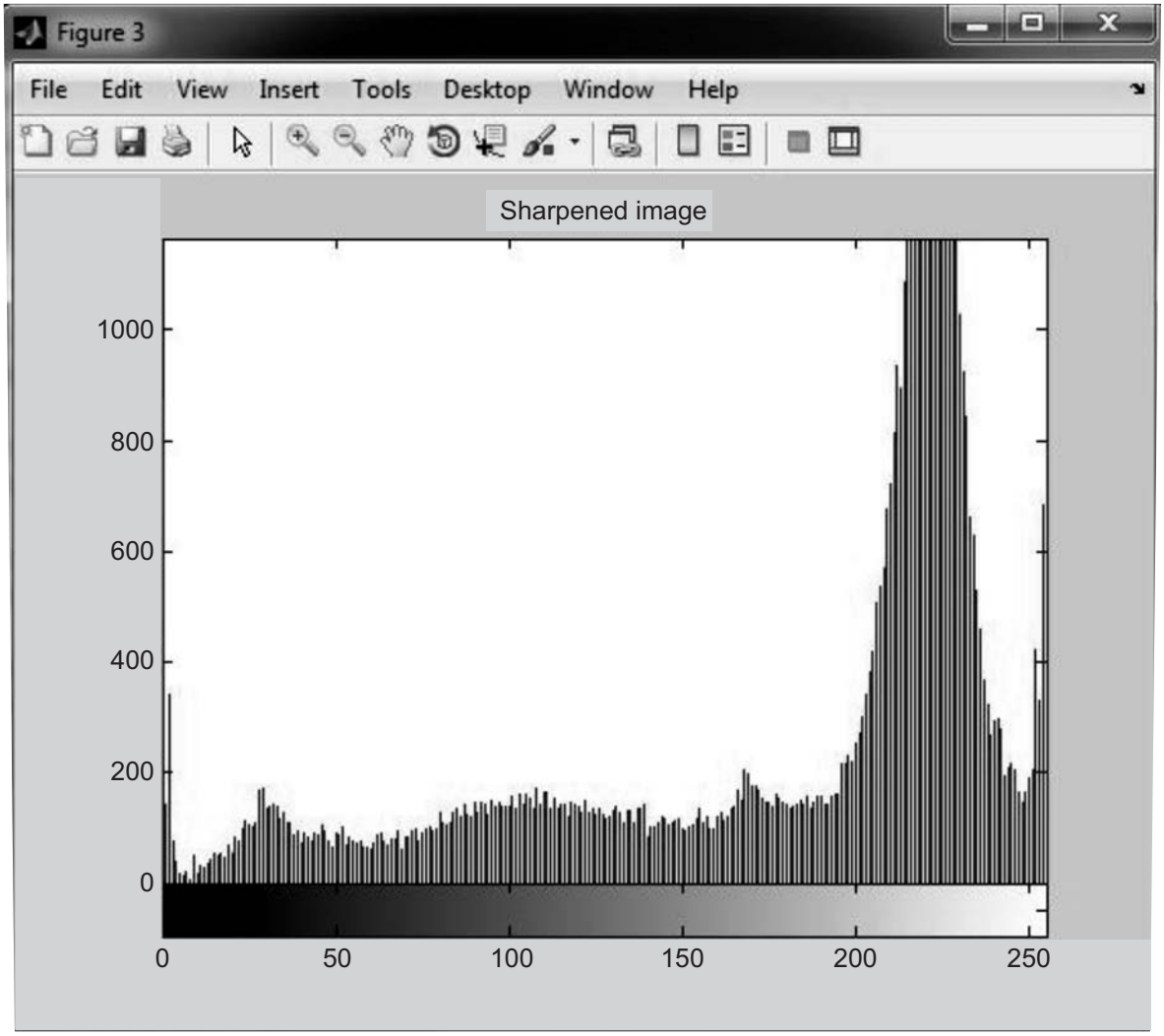

Figure 6: Sharpened image

Figure 3 shows the image after filtering the noise by taking the input image(figure 3). Figure 4 Smoothened image shows the image which is smoothened from the filtered image. Figure 5 Illumination adjusted image shows the image after reducing the illumination from the smoothened image.Finally the Figure 6 Sharpened image gives the sharpened image from figure 5.

5. CONCLUSION

Here, by we conclude that we have done our project on the approach on noise reduction and enhancement for extremely low-light video is proposed. We have done frame separation. Then, we processed the noise reduction by removing the initial noise and the illumination module has been done completely by removing the blurred pixels in each and every frames of image. Later the contrast enhancement is been processed by applying various filters to enhance the frames of images. Finally, we reconstruct the entire frames of image again into the enhanced video.

6. REFERENCES

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