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A Novel Algorithm for Low Light Video Enhancement Using Image Processing Techniques

Mohammad Shaffi[1], Pujitha Padala[2], Shyam Kumar Pokala[3]

[1]Assistant Professor, Department of Electronics and Communications Engineering, Wellfare Institute of science Technlogy &Management Pinagadi Village, Near Pendurthi, Andhra Pradesh, India

[2]Student, Department of Electronics and Communications Engineering, Wellfare Institute of science Technlogy &Management Pinagadi Village, Near Pendurthi, Andhra Pradesh, India

[3]Student, Department of Electronics and Communications Engineering, Wellfare Institute of science Technlogy &Management Pinagadi Village, Near Pendurthi, Andhra Pradesh, India

Abstract: ***Today, we are in a society where almost all the people are familiar with the word "VIDEO". With this increased utilityresearches have been carried out over several decades and there have been notable capability improvements in Digital cameras including resolution and sensitivity. Despite these improvements, however, modern digital cameras are still limited in capturing high dynamic range images in low-light conditions. Many approaches are developed for enhancing low light video; however most of them consider video from moderately dark conditions. This project provides an most effective way to capture evidentiary colour detail in extreme low light environments by using image processing techniques.***

Keywords: Video Enhancement, Contrast, Noise, Image Adjustment, Matlab.

1. Introduction

Videos are the integral part of our life. It seems to be simple to capture a video at any time, any place now ever days but this is not apt for all conditions. Capturing a video in low light intensity places i.e in dark conditions is still being a drawback. From past few years, there have been notable capability improvements in digital cameras including resolution and sensitivity. Modern digital cameras are still limited in capturing high dynamic range images in low-light conditions. These cameras often rely on automatic exposure control to capture image of high dynamic range, but the longer exposure time often results motion blur.

Videos are used in many sectors such as schools, hospitals, companies, airports etc.For education, enjoyment, security in many such manners.Modern digital cameras have a limited dynamic range of thousands in magnitude this causes poor visibility due to over exposure in bright regions & under exposure in dark regions of a captured video.Noise in video frames creates the serious poverty of image quality.Colour of the objects with similar background, low intensity of light and the unknown level of darkness while capturing a video, make it more complicate. Video enhancement of low light video is really a tedious job.Video enhancement may be defined as to give an input of low light and collect the high quality video as output. Here we use appropriate noise removal filter techniques and enhancement techniques to enhance the low light video.In this project, we propose an effective framework approach to enhance video from low light environments using appropriate noise removal filter technique and enhancement techniques using matlab code which will maintain image quality.This approach helps identify objects of interest more successfully in challenging Lighting situations, such as restaurants, bars, hotels, parking lots, and traffic areas.

2. Literature Survey

Ms. Pallavi H. Yawalkar, Mr. P. N. Pusdekar presented a review for video enhancement which gives the scope for enhancement process. It is only a thought of how to enhance the video. Here no techniques are being implemented.

Henrik Malm Magnus Oskarson Eric Warrant presented a methodology for adaptive enhancement and noise reduction for very dark image sequences with very low dynamic range. The approach is very general and adapts to the spatiotemporal intensity structure in order to prevent motion blur and smoothing across important structural edges. The method also includes a sharpening feature which prevents the most important object contours from being over-smoothed. Most parameters can be set generally for a very large group of input sequences. These parameters include: the clip-limit in the contrast-limited histogram equalization, the maximum and minimum widths of the filtering kernels and the width of the isotropic smoothing of the structure tensor and in the gradient calculations. However, the scaling parameter for the width function has to be adjusted to the noise level in the current sequence. The best approach when applying the method to colour images has been discussed, which includes demosaicing from the Bayer pattern in raw input colour data simultaneously to the noise reduction. They implemented the method using a GPU and achieved interactive performance.

Minjae Kim1, Student Member, IEEE, Dubok Park1, David K. Han2, and Hanseok Ko1 proposed a novel framework for enhancement of very low-light video. For noise reduction, motion adaptive temporal filtering based on the Kalman structured updating is presented. Dynamic range of denoised video is increased by adaptive adjustment of RGB histograms. Finally, remaining noise is removed using Non-local means (NLM) denoising. The proposed method exploits color filter array (CFA) raw data for achieving low

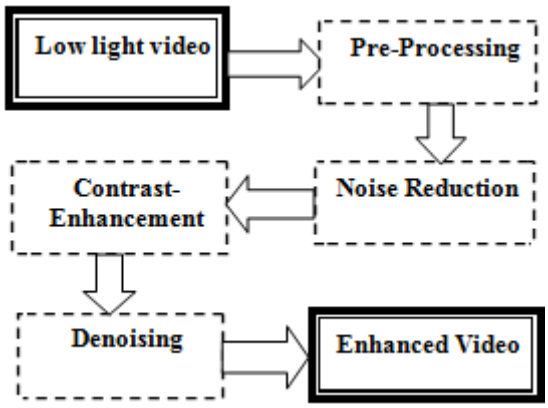
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memory consumption. Histogram adjustment using the gamma transform and the adaptive clipping threshold is also presented to increase the dynamic range of the low-light video. The experimental results indicate that this method is highly promising for real time applications to consumer digital cameras, especially CCTV and the surveillance video system.

3. Problem Definition

The main problem is that, while capturing a video in very low light it is difficult to obtain the area of interest due to poor visibility this is because of low intensity of light and limited dynamic range. Even with high resolution digital cameras capturing a video at very low light is being no possible. Our aim is to sort out this problem to some extent.

4. Block diagram of Video Enhancement



5. Methodology

The video enhancement is still an active area of research by many experts. There are still many problems of video enhancement, such as false background problem, colour shift problem etc. Video enhancement is one of the most important and difficult component of video security surveillance system. The increasing use of night operations requires more details and integrated information from the enhanced image. However, low quality video of most surveillance cameras is not satisfied and difficult to understand because they lack surrounding scene context due to poor illumination. Here we are implementing image processing techniques to enhance the video.

5.1 Pre-Processing

The low light video is applied to the first step which is pre-processing. Image pre-processing is the name for operations on images at the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing. It does not increase image information content. Its methods use the considerable redundancy in images. Neighbouring pixels corresponding to one object in real images have the same or similar brightness value and if a distorted pixel can be picked out from the image, it can be restored as an average value of neighbouring pixels. Four categories of image pre-processing methods according to the size of the pixel neighborhood that is used for the calculation of a new pixel brightness:

Pixel brightness transformations, geometric transformations, pre-processing methods that use a local neighborhood of the processed pixel, and image restoration that requires knowledge about the entire image.

5.2 Noise Reduction

Noise is the result of errors in the image acquisition process that result in pixel values that do not reflect the true intensities of the real scene. We have a variety of noises like salt n pepper noise,Gaussian noise etc… and even we have a different types of noise reduction techniques which are mainly classified into two domains they are spatial domain and frequency domains.Here we are reducing noise by implementing a special spatial domain filter. A special pre-defined 2D Gaussian filter is created using “fspecial” which is implemented using “imfilter” function. This function is used for N-D filtering of multidimensional images. This filter uses it parameter like fspecial filter and convolution for reducing noise in the video. Here we are representing the results by the screenshots taken during video runtime.

Input Low Light Video

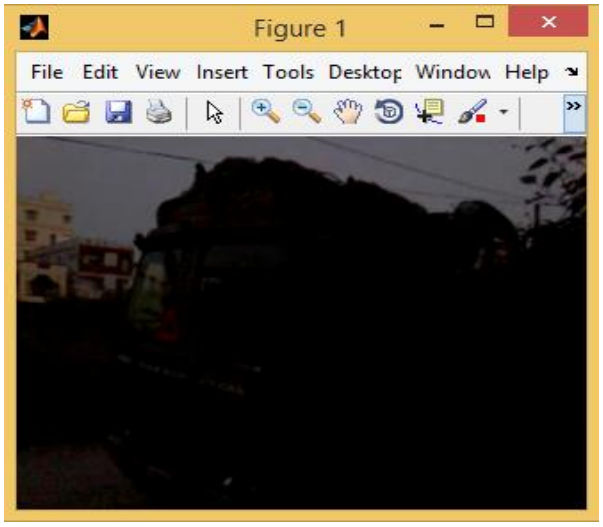


Figure 5.1: Low Light Video

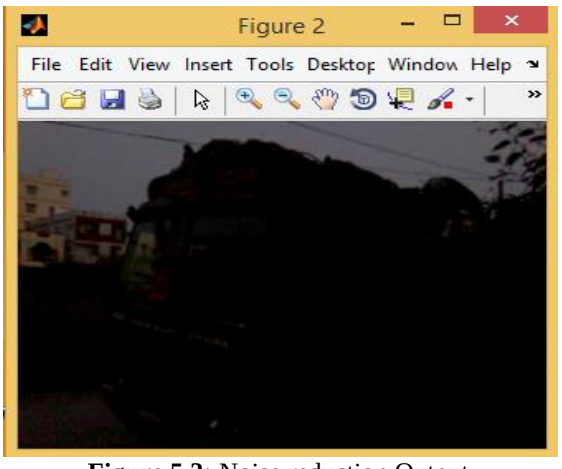


Figure 5.2: Noise reduction Output

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5.3 Contrast Enhancement

Contrast is defined as the separation between the darkest and brightest areas of the image. Increase contrast and you increase the separation between dark and bright, making shadows darker and highlights brighter. Adding contrast usually adds "pop" and makes an image look more vibrant while decreasing contrast can make an image look duller or Contrast of an image is a measure of its dynamic range, or the "spread" of its histogram. The dynamic range of an image is defined to be the entire range of intensity values contained within an image, or put a simpler way, the maximum pixel value minus the minimum pixel value. Contrast enhancements improve the perceptibility of objects in the scene by enhancing the brightness difference between objects and their backgrounds. Three functions are particularly suitable for contrast enhancement: imadjust,histeq and adapthisteq these functions are used for enhancing grayscale and truecolor images. As we are enhancing a colour video imadjust is only applicable for contrast enhancement, it adjusts image intensity values or colormap. **imadjust** increases the contrast of the image by mapping the values of the input intensity image to new values such that, by default, 1% of the data is saturated at low and high intensities of the input data.It also uses "strecthlim"function which finds limits to the contrast stretch image. Image enhancement is the process of adjusting images so that the results are more suitable for display or further image analysis. After the noise reduction, we have to amplify the intensity of the low light video. This stage is used to enhance the contrast of low light video. Contrast enhancement processes adjust the relative brightness and darkness of objects in the scene to improve their visibility.

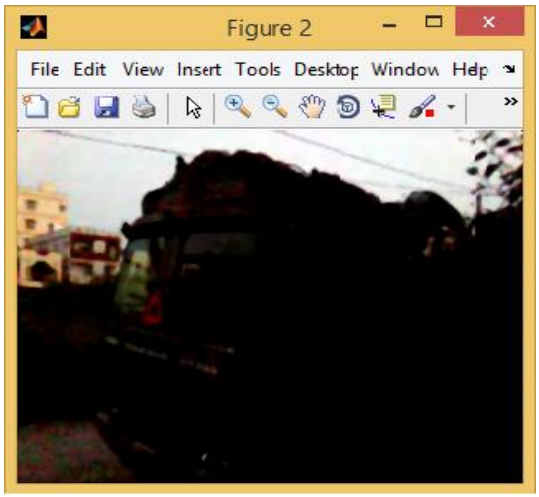


Figure 5.3: Contrast-enhancement Output

5.4 Denoising Method

For the final step of low light video enhancement we have to apply filtering for smoothing the remaining noise. Even though most of the noise is removed by the noise reduction, the noise is introduced by contrast enhancement step. The denoising is done by using median filter. The R, G, B channels are separated and for each channel "medfilt2" is applied and at last concatenation of the R, G, B channels is done to get an final enhanced video.

Enhanced Video Output

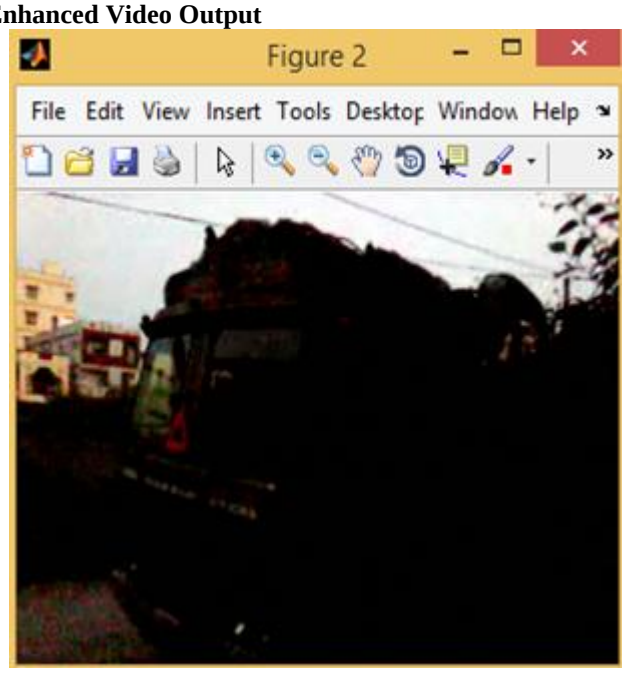


Figure 5.4: Denoising Output

6. Conclusion

This is a novel algorithm, for low light video enhancement. By using the image processing techniques we have done this. A good result as show in the figures above are obtained by using the basic techniques. By implementing this in cameras we can capture videos in low intensity light such as restaurants, parking's, clubs etc… It is mainly useful for video surveillance purpose for public protection where observing area of interest is a difficult task in low light.

7. Future Scope

In this algorithm only some of the basic techniques have been implemented in further studying we can implement histogram equalization and many such techniques. Video enhancement seems difficult as there are no video processing toolbox is in built in Matlab. As matlab is for multipurpose i.e for implementing many signal processing and image processing and many such features by using this there will be reduced amount of software bugs. We have implemented it for a video of size 8Mb in future working on this can increase the size of video.

References

[1] Rafael C. Gonzalez, Richard E. Woods, Steven L.Eddins "Digital Image Processing using MATLAB" 2nd edition.
[2] "A Review on Low Light Video Enhancement Using Image Processing Techniques" by Ms. Pallavi, H.Yawalkar, Mr. P. N. Pusdekar2.
[3] Anup Date and P.V. Ingole "Low Light Video Enhancement: A Survey" National Conference on Recent Trends in Computer Science and Engineering.
[4] Minjae Kim, Dubok Park, David K. Han and Hanseok Ko, "A Novel Framework for Extremely Low-light

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Video Enhancement," IEEE International Conference on Consumer Electronics (ICCE), 2014.
[5] Zhengying Chen, Tingting Jiang and Yonghong Tain, "Quality Assessment for Comparing Image Enhancement Algorithms," IEEE, Computer Vision Foundation, CVPR, 2014
[6] Er. Mandeep Kaur, Er. Kiran Jain and Er Virender Lather, "Study of Image Enhancement Techniques: A Review," International Journal of Advanced Research in Volume 3, Issue 4, April 2013, ISSN: 2277 128X.

Author Profile



Mohammad Shaffi completed his M.Tech in Instrumentation and control system engineering in JNTU Kakinada from 2012. Presently he is working as Assistant professor (ECE) Wellfare Institute of science Technology & Management Pinagadi Village, Near Pendurthi, Andhra Pradesh. He has 6years Teaching Experience. His area of interests is Image Processing, Optical Character Recognition, VLSI. He also published to journals till date.



Pujitha Padala pursuing B.Tech (ECE) in Wellfare Institute of science Technology & Management Pinagadi Village, Near Pendurthi, Andhra Pradesh.



Shyam Kumar Pokala pursuing B.Tech (ECE) in Wellfare Institute of science Technology & Management Pinagadi Village, Near Pendurthi, Andhra Pradesh.

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