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ENHANCEMENT OF CONTRAST OF IMAGE USING DAYTIME AND NIGHTTIME IMAGE

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ABSTRACT

In night image enhancement fusion technique plays an very important role. In recent years, varieties of image fusion algorithms have been developed. Road traffic cab is monitored using video observation system. This system is limited by many objective factors because video may not be seen clearly.

In this paper, we have proposed a new hybrid technique which focused especially on the night vision application. This technique is based upon extraction of moving object in which daytime and nighttime captured image fused. First weighted sum histogram equalization technique is applied on nighttime image for enhancement. Further night enhanced image and daytime captured were fused using adaptive threshold based fusion technique and PSNR and MSE were calculated based upon the presence of noise from 0 to 120%. The observed results were compared with Weigner Distribution Technique which earlier reported technique for night image enhancement. It is observed that maximum value of PSNR is 65.9dB and MSE is 0.128 at 0% noise using fusion based technique which is very high as compared to reported technique. The results of this algorithm are very effective and presented for the human evaluation.

KEYWORDS: Image Enhancement, Image Fusion, Night Vision

INTRODUCTION

Nightvision cameras are broadly used for military and law enforcement applications which are related to surveillance, reconnaissance, intelligence gathering, and security. Untill recently a grey or greenscale representation of nightvision imagery has been standard. The interest in colour display of nightvision imagery has been growing because of increasing the availability of fused and multiband infrared and visual nightvision systems [1, 2, 3, 4, and 5]. The aim of image enhancement is to improve the perception in images for human viewers or the image quality evaluated under different application purposes. An image taken form a real scene can be divided into several regions according to the need for enhancement. Most images taken from scenes with non-uniform distributed illumination show the problem of being too contrasty. The images then can be divided into several different regions according to their need for enhancement. Some regions need to be enhanced as contrast compression, some regions need to be enhanced as contrast stretch and some regions need no enhancement at all. The goal to achieve is to improve the overall perception or quality which can hardly be achieved by one single enhancement [6]. Nowadays, many techniques for image enhancement are discussed, such as contrast stretching, slicing, histogram equalization etc. The enhancement results of the traditional algorithm are not ideal for the nighttime video; these algorithms may cause excessive exposure or amplify noise. Therefore, enhancement algorithms combined with daytime image have attracted attention of many researchers [7, 8, and 9]. To extract additional detail from image data, a sequence of video frames containing object or scene movement must be utilized, or a set of displaced cameras can be used to acquire slightly different viewpoints of the same scene. In essence, super-resolution enhancement exploits either the temporal correlations present among under sampled video frames or the displacements among several cameras to improve spatial resolution. Potentially, substantial additional detail can be extracted, provided that there is a great deal of sub pixel overlap from picture to picture. Increasing resolution through the integration of multiple pictures generally involves two steps, namely the estimation of sub pixel-resolution motion vectors and the numerical optimization of an objective function [l0, 11, 12, 13, 14, 15].

In this paper, we have proposed an enhancement method of nighttime images for a surveillance camera. In this we are using both moving target extraction technology and fusion method. The objective of our method guarantees that most of the important contexts in the scene are synthesized to create a much clearer video for observers. We present a novel technique for night image enhancement technique which overcomes very low intensity images to a good intensity image, in order to give better visibility to the inspectors inspecting the highways. In this proposed work, night image enhancement technique is based on hybrid model of day and night images for the same area of that highway which is under surveillance. This technique applies the hybrid image to increase the contrast of local part of the image which is stable (not moving objects) in the night images to that of non-stable (moving objects) on the highway [17]. Further PSNR and MSE were calculated and compared with the earlier reported method.

PROPOSED METHOD

The objective of our method guarantees that most of the important contexts of the nighttime images are synthesized to create a much clearer video for observers and increase the situational awareness. The proposed algorithm consists of four parts:

- Initialize the camera.
- Extraction of Stationary Objects from Daytime Image.
- Extraction of Non-Stationary Objects from Nighttime Image.
- Remove the noise and Fusion Process.

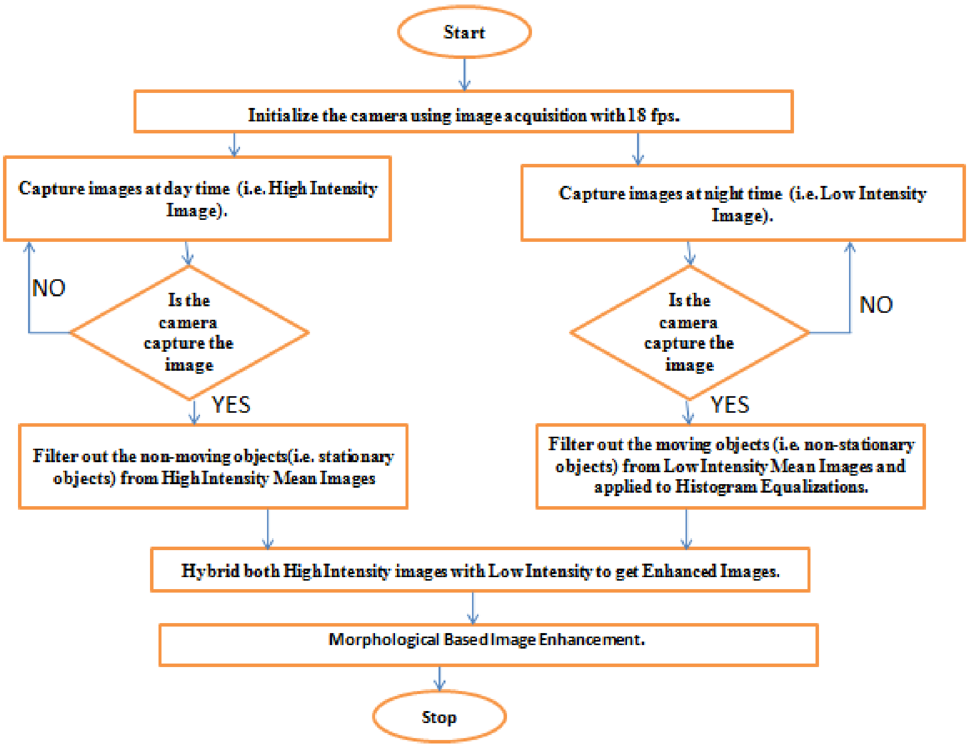

Figure 1: Flow Chart of Methodology

Algorithm

- **Initialize the Camera:** Initialize the camera and Frame/image captured from digital camera with fps more than 18.

- **Extraction of Stationary Objects from Daytime Images.**

For using the hybrid model for night image enhancement technique, it is important to capture at least one hundred images of local area at day time (i.e. high intensity image) and same for the night time (i.e. low intensity image).

Here we have variables with name

P= Number of pixels of an image (size of every image),

Num= number of images in data base

Storing the day time images in one single matrix

DTM=day time matrix (4D matrix to store images in one matrix)

$$DTM(p, num) = \sum_{num=1}^{num=500} [[DTMimg](1:p,1)]$$

Now after storing the images for day time in one matrix DTM. We have to take a mean image so that non-moving objects (i.e. stationary objects) extracted in one image DM.

$$DM = \sum_{num=1}^{num=500} DTM(:, num)$$

Extraction of Non-Stationary Objects from Nighttime Images

Storing the night time images in one single matrix.

NTM=Night time matrix (4D matrix to store images in one matrix)

$$NTM(p, num) = \sum_{num=1}^{num=500} [NTMimg(1:p,1)]$$

Now after storing the images for night time in one matrix NTM. We have to take a mean image so that moving objects (non-stationary objects) extracted in one image NM.

$$NM = \sum_{num=1}^{num=500} NTM(:, num)$$

Taking live images with the variable name img where ‘n’ is the nth number of image form the starting and subtracting from the night mean image to extract non-stable objects in night.

$$DIFF_{P_r} = NM_r - img_r$$

$$DIFF_{P_g} = NM_g - img_g$$

$$DIFF_{P_b} = NM_b - img_b$$

Remove the Noise and Fusion Process

Removing the noise from DIFF image below 9 threshold value. Storing the dimensions as row and Column of image in Row and Column variables and replacing rest all with day time mean image (DM).

$$[Rowcol] = \int_{\downarrow}(\alpha = 1)^{\uparrow}(\alpha = P)\,\square(DIFF_{\downarrow}P_{\downarrow}r\,\square > 9) + \int_{\downarrow}(\alpha = 1)^{\uparrow}(\alpha = P)\,\square(DIFF_{\downarrow}P_{\downarrow}g\,\square > 9) + \int_{\downarrow}(\alpha = 1)^{\uparrow}(\alpha = P)\,\square(DIFF_{\downarrow}P_{\downarrow}b\,\square > 9$$

In the next part, have done the fusion of both images i.e. high intensity image with low intensity image to get the enhancement of image.

Calculation of night image enhancement algorithm with threshold variable ‘α’.

RESULTS

In this work of night image enhancement, we take the image of the size 320x240. We consider two metrics with the variation of noise from 0 % to 120% (0%, 5%, 10%, 20%, 30%, 50%, 80%, 100% and 120%). The number of 100 frames are taken for this work.

Figure 2 represents that image is captured at day time. In this image two corks are used as stationary objects.

Figure 2: Day Time Image

Figure 3 represents that image is captured at night time. In this image two corks are used as stationary objects and car is as moving object and no noise is added in this image (or 0% noise).

Figure 4 represents that image is enhanced with the use of fusion technique. In this image, the car is taken from night image and background image which have two corks as stationary objects taken from day time image. Both of these images are fused to get the enhanced image.

Figure 3: Night Time Image with 0% Noise

Figure 4: Enhanced Image Using Fusion Technique

The figure 5 shows that the resultant enhanced image has PSNR is 65.9 dB and MSE is 0.128 with the use of 0% noise in the original night image.

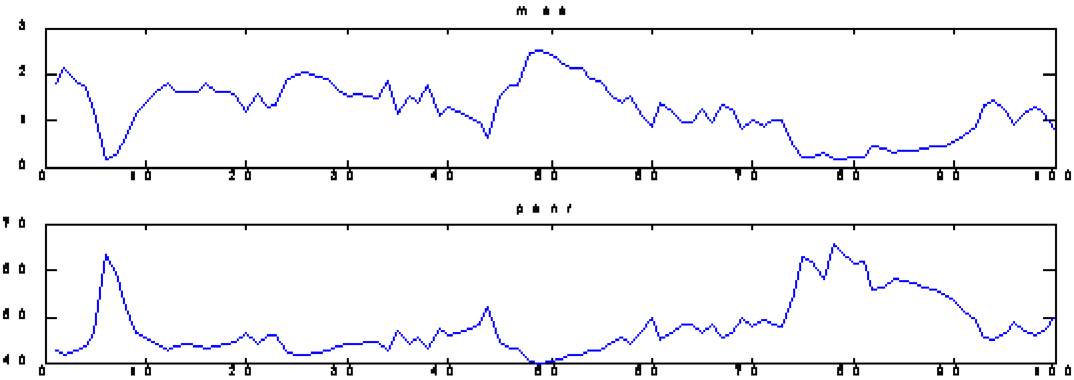

Figure 5: PSNR (65.93 dB) and MSE (0.128) after Applying Fusion Technique

Table 1: Comparative Analysis between Proposed Method (Fusion Technique) and Earlier Reported (Wigner Technique) in Terms of Presence of Noise in Night Image, PSNR and MSE

% Noise of p-p Image	PSNR In dB of Wigner Image	PSNR In dB of Proposed Technique	Improvement Factor in % of SNR	MSE of Wigner Image	MSE of Proposed Technique
0%	-	65.9	-	-	0.128
5 %	26	62.5	68%	0.190	0.191
10 %	20	62.1	67.79%	0.174	0.199
20 %	14	61.5	77.23%	0.175	0.213
30 %	10	59.9	83.30%	0.170	0.255
50 %	6	58.2	89.69%	0.211	0.311
80 %	2	47.4	95.78%	0.442	1.084
100 %	0	38.4	100%	0.528	3.058
120 %	-1.58	31.3	105.04%	0.643	6.910

From Table 1, it observed that as noise is increased from 0% to 120% the PSNR values decreases and MSE values increases for both techniques. But if we compare the fusion technique with the Wigner technique it was found that the PSNR values were higher as varies the percentage of noise from 0% to 120%.

It also depicts that when the percentage of noise was increased above 100 than MSE increased but still PSNR is 38.4 dB in case of Fusion Technique whereas 0 dB in case of Weigner Distribution Technique.

CONCLUSIONS

Night image enhancement techniques are widely applicable to different fields. The proposed method has given good results in terms of MSE and PSNR. This algorithm can be used even in darkness. By changing the threshold values different views and different objects can be seen for same image by the users. The noise has also been properly removed from the images. The resultant enhanced image closely resembles the day image by using this algorithm.

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