LOW ILLUMINATION VIDEO-IMAGE ENHANCEMENT

Munaf S, Harshavardan K, Aravind S, Maanashaswaruban M

Department of Electronics & Communication Engineering, Sri Ramakrishna Institute of Technology, Pachapalayam, Coimbatore, India.

---***---

Abstract - *Due to their low visibility, low-light images are not suited to human observation or computer vision algorithms. Despite the fact that several image enhancement approaches have been developed to address this issue, present methods invariably introduce contrast under- and over augmentation. Low brightness, low contrast, a narrow grey range, and color distortion, as well as significant noise, are common characteristics of images captured under poor lighting conditions, all of which have a significant impact on the subjective visual effect on human eyes and severely limit the performance of various machine vision systems. The goal of low-light image enhancement is to improve the visual effect of such photos so that they may be processed more efficiently. A deep learning-based approach for low-light image enhancement is presented. The difficulties in handling multiple parameters concurrently, including as brightness, contrast, artefacts, and noise, makes this task tough. The main concept is to extract rich features at various levels so that we can apply enhancement via many subnets and then construct the output image via multi-branch fusion. In this way, image quality is increased in a variety of ways.*

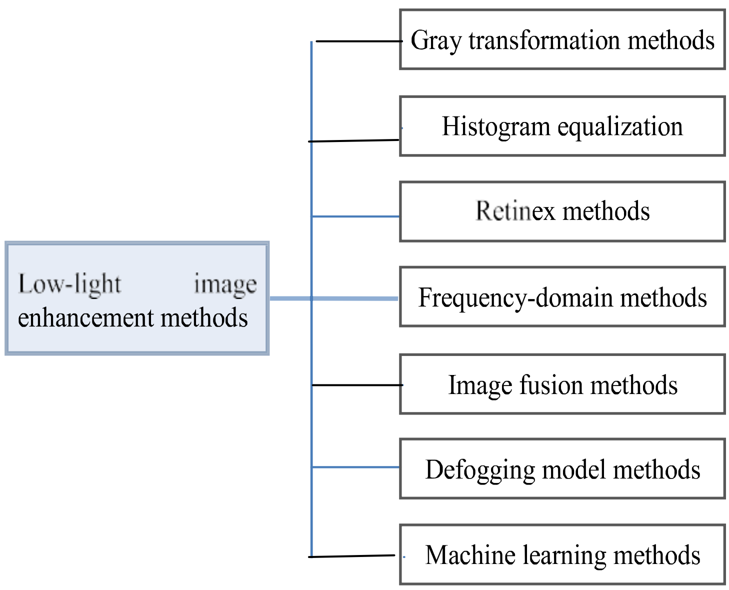
Key Words: Convolution Neural Network (CNN), Deep Learning.

1. INTRODUCTION

Many tasks need the usage of high-quality photos and videos. Images are captured in a range of lighting circumstances, thus not all of them are excellent quality. The image quality degrades when an image is captured in low-light situations because the pixel values have a low dynamic range. It's difficult to detect objects or textures because the entire image appears dark. As a result, improving the quality of low-light photographs is crucial. A number of image acquisition systems may now easily acquire images. Images and videos convey a wealth of information about actual events. Intelligent systems can be developed for various tasks such as object detection, classification, segmentation, recognition, scene understanding, and 3D reconstruction by capturing and processing image and video data, and then used in a variety of real-world applications such as automated driving, video surveillance, and virtual/augmented reality. The light reflected from the object surface may be weak under poor illumination conditions, such as indoors, at night, or on cloudy days; as a result, the image quality of such a low-light image may be substantially deteriorated due to colour distortions and noise. The quality of this type of low-light image is significantly diminished after image processing, storage, transmission, and other procedures.

1.1 Existing System:

Intelligent systems can be developed for various tasks such as object detection, classification, segmentation, recognition, scene understanding, and 3D reconstruction by capturing and processing image and video data, and then used in a variety of real-world applications such as automated driving, video surveillance, and virtual/augmented reality. The light reflected from the object surface may be weak under poor illumination conditions, such as indoors, at night, or on cloudy days; as a result, the image quality of such a low-light image may be substantially deteriorated due to colour distortions and noise. The quality of this type of low-light image is significantly diminished after image processing, storage, transmission, and other procedures.



1.2 Disadvantage of Existing Model:

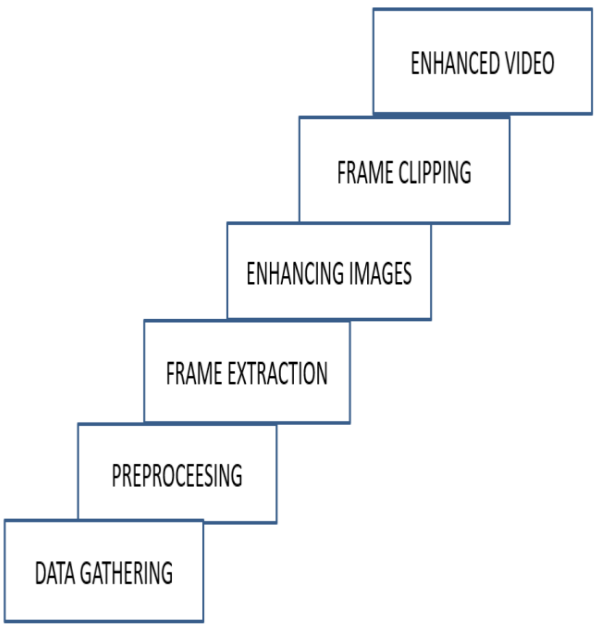
The major shortcoming of the above mentioned method is,

1. It takes longer to enhance a video.
2. It is not possible to enhance a video that is longer video.

2. Problem Statement:

The lack of vision is the biggest problem with videos shot in extremely low light. Low dynamic range and a lot of noise are two characteristics of the barriers. Quantization noise, read out noise, thermal noise, and photon shot noise are all examples of noise sources in low light video. Stretching the dynamic range of a low-light video immediately results in undesired effects as noise amplification, intensity saturation, and resolution degradation. Before stretching the dynamic range, a suitable denoising technique, such as tone mapping, must be used. Even though a significant quantity of noise is eliminated before to the tone mapping stage, the noise amplified during the tone mapping step requires effective denoising.

3. Block Diagram:



4. Advantages:

1.It is useful in public security surveillance

2.The main advantage of the technique is that it can reduce the noise variance in smooth areas and at the same time retains the sharpness of edges in object boundaries.

3.It is very much useful for low light conditions such as nighttime videos, foggy situations, rainy and so on, which are very difficult for human observation.

4.The objective of video enhancement is to improve the visual appearance of the video.

5. Proposed System:

This section introduces the proposed method in depth. Due to the complexity of image material, achieving good quality image augmentation using a basic network is often difficult. As a result, the MBLLEN has multiple branches. It divides the image enhancement problem into sub-problems based on multiple feature levels, each of which can be addressed separately to obtain the final output via multi-branch fusion. The MBLLEN takes a low-light colour image as input and produces an improved clean image of the same size. Figure depicts the total network architecture and data flow. The three modules, FEM, EM, and FM, are detailed in depth later.

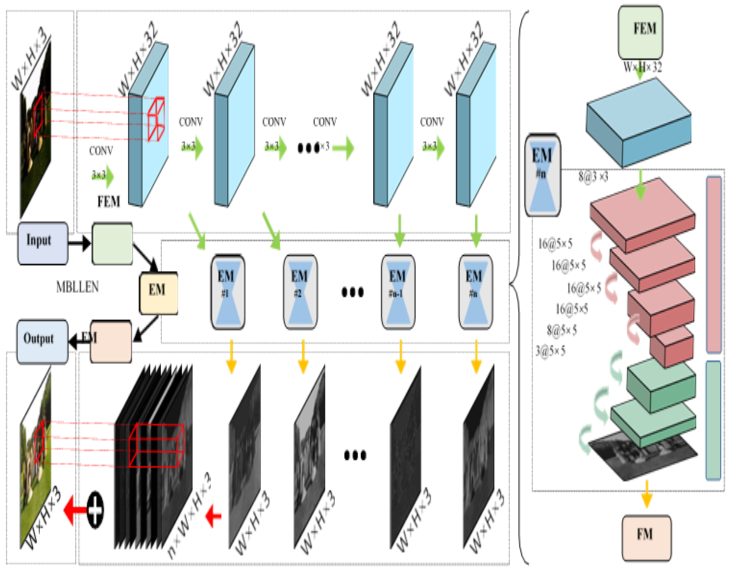


Figure : The proposed network has three modules: feature extraction, augmentation, and fusion (FM). Feature fusion is used to create the final image.

5.1 Real-world Image:

Besides the above synthetic dataset, our method also performs well on the natural low-light images and outperforms existing ones. Due to page limit, comparison on one representative example is shown in figure, along with additional low-light image enhancement results by our method. More results and comparisons, including those for previous sections, are in- clued in the supplementary files, which fully demonstrate the effectiveness of our method.

Input Dong AMSR NPE LIME Ying BIMEF Ours

6. Comparison:

Existing techniques typically process videos frame by frame. Our improved technique, on the other hand, uses 3D convolution to handle low-light videos more effectively.

	LIME	Ying	BIMEF	MBLLE	MBLLV
PSNR	14.26	22.36	19.80	19.71	24.98
SSIM	0.59	0.78	0.76	0.88	0.83
AB(Var)	0.015	0.025	0.044	0.010	0.006

Table: Quantitative evaluation on low-light video enhancements.

Table shows a comparison of our MBLLEN, its video version (MBLLVEN), and three other approaches. We also present the AB(var) metric, which measures the difference between the enhanced video and the ground truth in terms of average brightness variance. This score indicates whether the video has unexpected brightness changes or flickers, and the suggested MBLLVEN has the best inter-frame consistency performance. For easy comparison, the improved videos are included in the additional files..

7. SYSTEM SPECIFICATION:

HARDWARE REQUIREMENTS

- Processor : core I3 Processor
- Hard Disk : 500GB
- RAM : 4GB (minimum)
- Keyboard : 110 keys enhanced

SOFTWARE REQUIREMENT

- PYTHON 3.6
- TENSORFLOW GUI
- SYSTEM TESTING PROCESS
- SYSTEM STUDY

8. CONCLUSIONS:

This research presents a revolutionary CNN-based low-light improvement approach. Existing approaches frequently make assumptions and overlook additional aspects like image noise. To address these issues, we plan to train a robust and adaptable network to better handle this task. Our network is made up of three modules: FEM, EM, and FM. It's made to extract rich characteristics from different layers in FEM and enhance them in EM using various sub-nets. It delivers high-quality results and outperforms the state-of-the-arts by a wide margin by fusing the multi-branch outputs via FM. The network can also be tweaked to operate well with low-light videos.

9. REFERENCES:

[1] Abdullah-Al-Wadud, M, et al. "A Dynamic Histogram Equalization for Image Contrast Enhancement," IEEE Transactions on Consumer Electronics, vol. 53, pp. 593-600, 2007.

[2] Pisano E D, Zong S, Hemminger B M, et al. "Contrast Limited Adaptive Histogram Equalization image processing to improve the detection of simulated spiculations in dense mammograms," Journal of Digital Imaging, vol. 11, no. 4, pp. 193-200, Nov. 1998.

[3] D. J. Jobson, Z. Rahman, and G. A. Woodell, "Properties and performance of a center/surround retinex," IEEE Transactions on Image Processing, vol. 6, no. 3, pp. 451–462, Mar. 1996.

[4] Rahman, Z., D. J. Jobson, and G. A. Woodell, "Multi-scale retinex for color image enhancement," In Image Processing, 1996. Proceedings., International Conference, 1996, vol. 3, pp. 1003-1006.

[5] Jobson, D. J., Z. Rahman, and G. A. Woodell. "A multiscale retinex for bridging the gap between color images and the human observation of scenes," IEEE Transactions on Image processing, vol. 6, no. 7, pp. 965- 976, 1997.

[6] Fu X, Zeng D, Huang Y, et al. "A weighted variational model for simultaneous reflectance and illumination estimation," IEEE Conference on Computer Vision and Pattern Recognition. 2016, pp. 2782-2790.

[7] Guo X, Li Y, Ling H. "LIME: Low-Light Image Enhancement via Illumination Map Estimation," IEEE Transactions on Image Processing, vol. 26, no.2, pp. 982-993, 2017.

[8] Li, Lin, et al. "A low-light image enhancement method for both denoising and contrast enlarging," IEEE International Conference on Image Processing IEEE (ICIP), 2015, pp. 3730-3734.

[9] Jiwon Kim, Jung Kwon Lee and Kyoung Mu Lee, "Accurate Image Super-Resolution Using Very Deep Convolutional Networks," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016, pp. 1646-1654.

[10] Zhang K, Zuo W, Chen Y, et al. "Beyond a Gaussian denoiser: Residual learning of deep CNN for image denoising", IEEE Transactions on Image Processing, 2017.