LOW LIGHT ENHANCEMENT USING DCE-NET AIDED BY PACK AND UNPACK OPERATIONS

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ABSTRACT

The main objective of Low Light Image enhancement is to process an image so that the result is more suitable for practical application. Images captured in dark circumstances have very low contrast, due to this people can't clearly identify the objects, which increases the difficulty of applied computer vision tasks considerably.Generally, this enhancement is done using image processing techniques like Histogram Equalization and its variants (CLAHE). But recent advances in deep learning enabled us to restore dark images which were hard to enhance with normal techniques. But often these techniques are limited by speed and hardware. Here, we combine the DCE-net, Pack and UnPack algorithms to improve the performance of low light image enhancement, which aim to reduce the runtime.

1. INTRODUCTION

We implemented novel Pack and UnPack operations to do novel downsampling and up sampling with less color misrepresentation. The DCE-Net used to improve the low light image into an enhanced light image. For this it takes a low- quality image as input and produces a pixel wise parameter map as its output which is combined with the input image to produce an enhanced image. We can also use this method in face detector application by lighting up the face in the very dark regions and conserve luminous Taking photos is one of the most popular and convenient ways to record memorable moments of our life. Images taken in low-light conditions are usually very dim. This makes us difficult to recognize the scene or object. However, often it is inevitable to take photos in low-light conditions. To obtain high- visibility images in the low-light conditions, we can adopt three solutions. 1) To use flash: It is a direct way to solve the problem. However, it is not allowed in some public areas, such as the museum, cinema, and exhibition hall. 2) To increase the ISO (sensitivity of the sensor): This method could increase the visibility of dark areas, but higher ISO will also bring more noise to the image, and the normal-light area will easily face the overexposure problem. 3) To take a photo with longer exposure time: Capturing an image with longer exposures allows more light that enlightens the dark area. Nevertheless, long-time exposure may blur the image if there is camera shake or fast-moving objects.A large number of conventional approaches have been proposed to mitigate the degradation caused by low-light conditions. Histogram Equalization (HE) counts the frequency of the pixel values[9].By rearranging the pixels to obey uniform distribution, it improves the dynamic range (i.e., better visibility) of the low-light image. Retinex-based methods regard one image as a combination of illumination and reflectance, where the reflectance is an inherent attribute of the scene that is unchangeable in different lighting conditions, and the illumination maps store the differences between the low- and normal-light images. The Retinex-based methods enhance the illumination map of the lowlight image to estimate the corresponding normal-light image. Other methods adopt dehazing theory that decomposes the low- light image to ambient light, refraction, and scene information. Refining the refraction map can also enhance the visibility of low-light images. Convolutional Neural Networks (CNNs) have achieved impressive results in many tasks, such as image classification, semantic segmentation ,super-resolution, and object detection .Compared with conventional approaches, the CNNs have better feature representation that benefits from the large dataset and powerful computational ability. For CNNs, the information extracted from the shallow layers has detailed local information (like edge, texture), while deep layers have large receptive fields that can obtain more global features (like complex texture and shape). The CNNs tend to have more convolutional layers and

complex structures to obtain more powerful learning abilities. The low-light enhancement can be regarded as an image restoration task. Image Super-Resolution (SR) is one of the similar topics, which reconstructs a high- resolution (HR) image from a low-solution (LR) image of different scales.

2. LITERATURE SURVREY

Areas of the image are enhanced and saturated, resulting in the loss of relevant details. To reduce Out of all the five senses, human sight seems to be the most important. Much of the information acquired by humans comes from vision and images are the primary source of visual information . Therefore, retrieving useful information from images remains an essential task in computer vision. However, images captured in low light conditions are often not visually pleasing because most of the information is masked in the low visibility region, resulting in a significant reduction in image quality. As most of the computer vision algorithms require high-quality inputs (medical imaging, tracing, navigation, etc.) , the performance is significantly reduced by the low-quality images. Therefore, it is necessary to improve the low light images before it continues to further processing. The main goal of the low-light image enhancement algorithm is to create visually pleasing images and provide more information than input images that are suitable for computer vision applications . Existing methods focus primarily on the contrast enhancement, while others focus on naturalness preservation. Since there is no specific definition of naturalness preservation, it depends on personal preferences. In practice, this naturalness depends on things such as inconsistency of lighting, preservation of colour and fidelity details .Low light images may have slight lightness irregularities, and reversing these irregularities may result in abnormal results. Proper low-light image enhancement techniques should be able to maintain lighting in different locations while collecting data masked in dark areas. Linearly amplifying the pixel intensity values probably is the simplest way to improve the low-light images. This type of operation captures information masked in dark areas. However, the bright saturation, several improvement algorithms have been proposed. These image enhancement techniques attempt to preserve the bright image information while collecting information buried in darker areas. [8]

A threshold selection method from gray-level histograms

Image thresholding is essentially a pixel classification problem. Its basic objective is to classify the pixels of a given image into two classes: those pertaining to an object and those pertaining to the background. While one includes pixels with gray values that are below or equal to a certain threshold, the other includes those with gray values above the threshold. Thresholding is a popular tool for image segmentation. It is widely used in halftone repro-duction automatic target recognition , design of visual navigation system for autonomous land vehicles , industrial applications of computer vision , and biomedi-cal image analysis . Over the years many thresh-old selection techniques have been proposed. For a survey off threshold selection techniques, readers may refer to .In general, threshold selection techniques can be broadly di-vided into two groups, namely, global and local thresholding. A global technique may be point-dependent or region-dependent. [9]. The thresholding method is point-dependent if the threshold value is determined solely from the pixel gray tone as represented by gray-level histogram and is independent of the gray tone of the neighborhood of a pixel. On the other hand, a method is called region-dependent if the threshold value is determined from the local property within a neighborhood of a pixel[8].The logarithmic image processing model (LIP) is a robust mathematical frame work which, among other benefits, behaves invariantly to illumination changes.

Digital image processing An image may be defined as a two-dimensional function, f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x,
y) is called the intensity or gray level of the image at that point .When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image .The field of digital image processing refers to processing digital images by means of a digital computer. Note that a digital image is composed of a finite number of elements ,each of which has a particular location[10].X-ray Imaging X-rays are among the oldest sources of EM radiation used for imaging. The best known use of X-rays is

medical diagnostics, but they also are used extensively in industry and other areas, like astronomy. X-rays for medical and industrial imaging are generated using an X-ray tube, which is a vacuum tube with a cathode and anode .The cathode is heated, causing free electrons to be released. These electrons flow at high speed to the positively charged anode. When the electrons strike a nucleus ,energy is released in the form of X-ray radiation. The energy (penetrating power) of the X-rays is controlled by a voltage applied across the anode , and the number of X-rays is controlled by a current applied to the filament in the cathode. shows a familiar chest X-ray generated simply by placing the patient between an X- ray source and a film sensitive to X-ray energy .The intensity of the X-rays is modified by absorption as they pass through the patient ,and the resulting energy falling on the film develops it, much in the same way that light develops photographic film. In digital radiography, digital images are obtained by one of two methods: (by digitizing X-ray films;or by having the X-rays that pass through the patient fall directly onto devices (such as a phosphor screen) that convert X-rays to light. The light signal in turn is captured by a light-sensitive digitizing system .No-Reference contrast assessment by image histogram

Digital Image Processing means transforming images into new images treating every pixel independently. It actually refers to the graphical representation of the brightness /colour distribution in an image. The most important task in pre- processing an image is enhancing the contrast and brightness of images. Histogram equalization is one of the most popular methods used for improving the contrast in images. A histogram is an estimate of the probability distribution of a continuous variable and was first introduced by Karl Pearson. Histogram is a graph that shows

3. PROPOSED METHOD

Our proposed method uses pipelines the LLPackNet [12] where RDN is replaced with DCE-net [8]. This provides us with a lighter CNN, with fewer parameters, which make it easier to train and run.

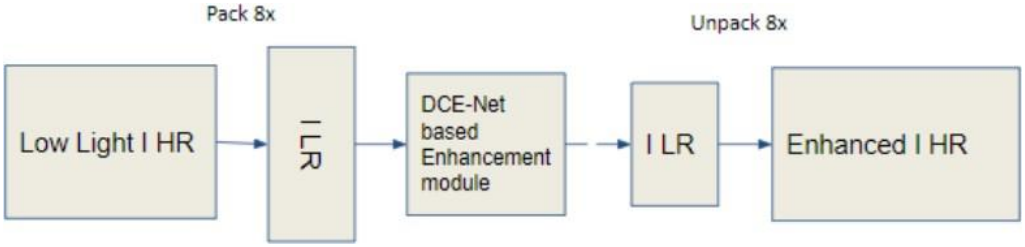


Figure 1 Architectural Diagram of our proposed system

The most operations are performed in LR space for that we down sampled the image without losing any information. To down sample an image we use pack algorithm which is proposed in [12]. In this algorithm, first we perform the Pack8X operation on red, green and blue color components of the amplified image. By doing this the dimensions of the input image are reduced by a factor of 8 and the number of channels is increased. The result is given to DCE-Net: Deep Curve Estimation Network proposed in [8]. The DCE based enhancement module is not a single pass module, DCE net only provides parameter map for image input, but this parameter map is be combined with the image to produce an enhanced image. However, it's not single pass and this is repeated several times. Finally, the output of the DCE-net is unsampled. To perform this, we use UnPack 8X operation, which is the inverse of Pack 8X.

4. RESULTS

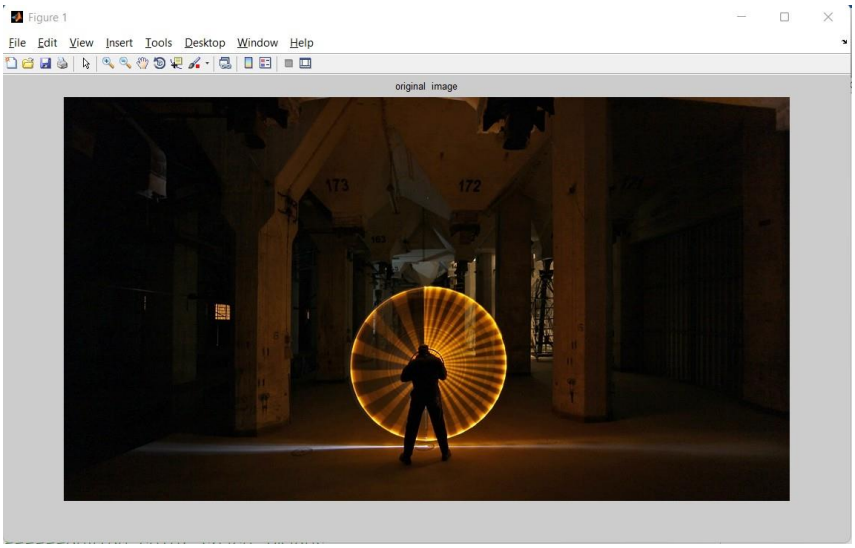


Figure.1 Original image

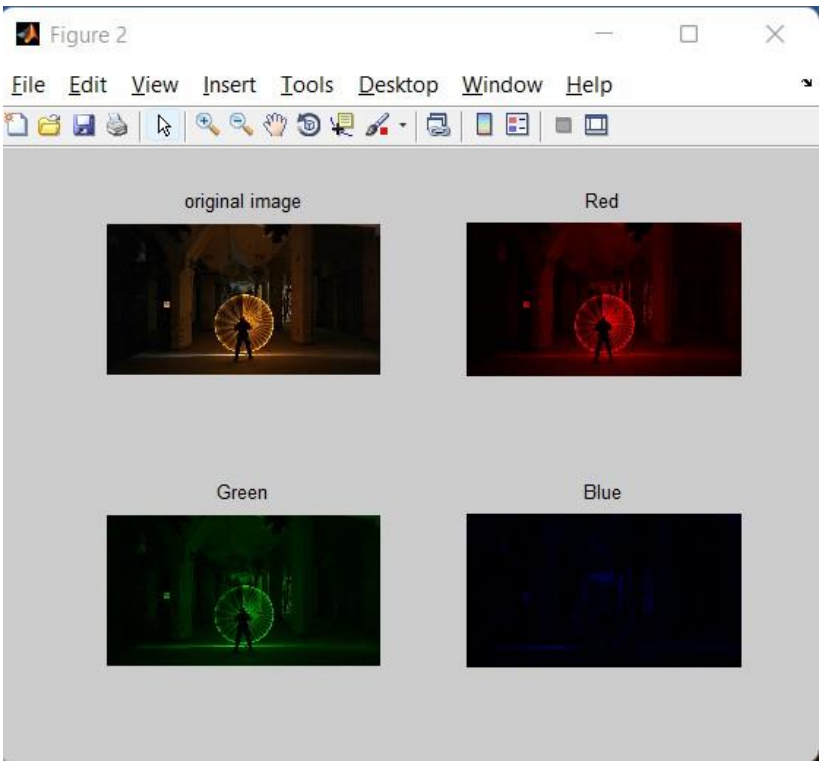
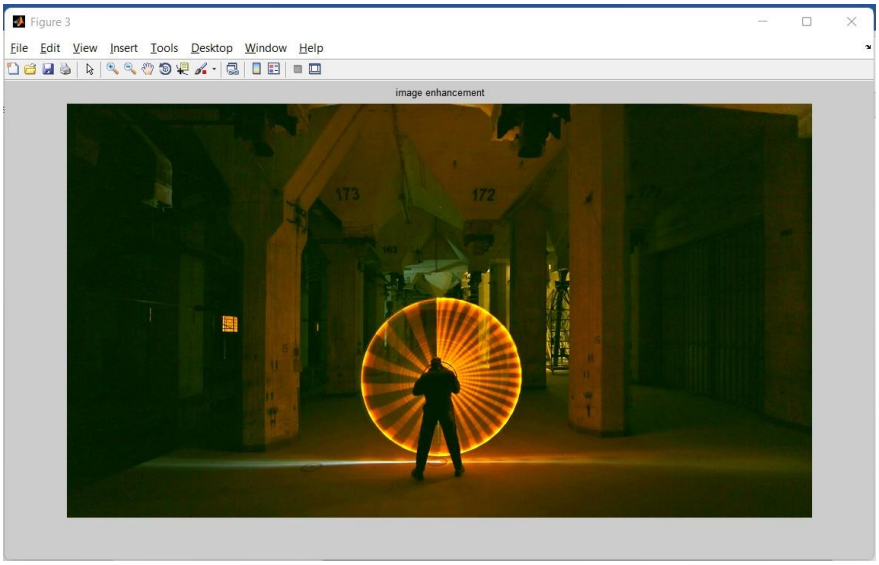
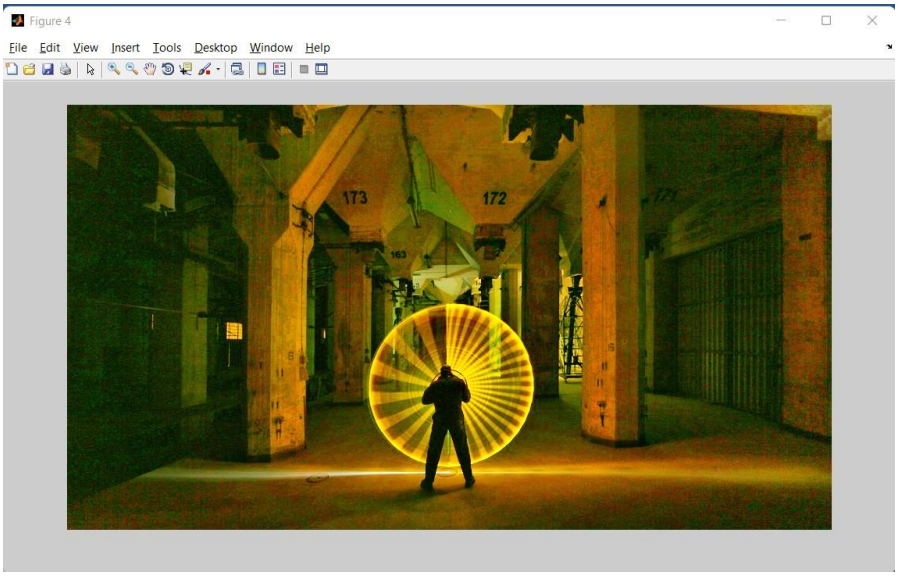


Figure. 2 Image processing



a) Original image



b) Enhanced image

5. CONCLUSION

We developed a technique to enhance low light images using Pack, Unpack and DCE-Net methodologies, the proposed method is very fast and is suitable for running on low power devices, and we believe that its enhancement qualities can certainly be improved using deeper networks.There are many approaches to solve this problem, some are designed to run on hardware specific platforms like GPUs while others have less constraints and can be run on CPUs. The performance also differs based on the type of input (such as color model low light environment). Here, we implanted low light image enhancement using DCE-net and Pack and UnPack algorithms which is simpler than state-of-the-art

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