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LOCAL AND GLOBAL ENHANCEMENT METHODS FOR EFFECTIVE IMAGE ENHANCEMENT OF DARK IMAGES

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Abstract: Images in actual settings often show a range of degradations, including noise, poor contrast, and colour distortion, as a result of issues with low light and inappropriate viewpoints. These deteriorations impact computer vision tasks as well as visual impacts. The integration of conventional techniques with machine learning algorithms for picture enhancement is the main topic of this study. Three categories are used to explain the classic approaches, together with their advances and guiding principles: grey level transformation, histogram equalisation, and Retinex methods. In addition to being separated into end-to-end and unpaired learning, machine learning-based algorithms may also be further classified into decomposition-based and fusion-based learning depending on the image processing techniques used. Lastly, a variety of picture quality evaluation techniques, such as mean square error, natural image quality evaluator, structural similarity, peak signal to noise ratio, etc., are used to thoroughly evaluate the approaches involved.

Keywords: Deep learning, image processing, low-light photos, and image enhancement.

1. INTRODUCTION

Deep learning and computer vision technologies are becoming more and more common in a variety of industries, including object identification [4], automated driving [2], face recognition [3], and medical image processing [1]. However, pictures often suffer from a variety of degradations, including but not limited to poor visibility, low contrast, backlight, shadow, and darkness, owing to physical restrictions including inadequate lighting, limited exposure time, and inappropriate camera angles. Images of this kind are shown in Figs. 1(a) through to 1(d).1(d). Information about the picture is masked or lost properly due to non-uniform lighting and poor contrast, which limits its applicability for real-world applications like lane recognition [6], remote sensing images [5], etc.

Figure 1

Degradations of images.

One of the primary goals of image processing is image enhancement, which includes adding information or using certain techniques to convert data into original pictures in order to make images fit the visual response characteristics and

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emphasise specific elements of interest. Expanding the contrast between the features of various objects in an image, suppressing uninteresting features, enhancing the quality of the image, adding more information, fortifying the image's interpretation and recognition effect, and satisfying specific analysis requirements are the primary goals of image enhancement.

This work aims to provide an extensive survey of the literature on picture enhancement from an algorithmic standpoint. Numerous evaluations on image enhancement already exist. Wencheng et al. [7] provide an overview of the primary methods for enhancing low-light images that have been developed in recent decades. Retinex-based low-light enhancement techniques are reviewed by Rasheed et al. [8] along with a comparison with other cutting-edge low-light enhancement techniques. Deep learning-based techniques for improving images and videos in low light are presented by Chongyi et al. [9]. A overview of the use of image enhancement in object identification and classification tasks is provided by Sobbahi et al. [10]. But these publications are either just linear introductions to image improvement, or they ignore the links between the techniques and the derivation of image digital theory, concentrating exclusively on the structures and applications of the approaches. This essay begins by providing a thorough analysis of conventional teaching strategies. This research creatively summarises decompression-based and fusion-based algorithms that are strongly integrated with conventional algorithms in addition to categorising the algorithms into end-to-end learning and unpaired learning categories in the machine learning-based techniques part.

The contrast of a picture may have a significant impact on how the human eye perceives it. The difference between a given pixel's intensity value and that of its nearby pixels is known as contrast. The contrast of the picture is greater if there is a greater difference in intensity. Greater contrast improves the sharpness of a picture by bringing out more minute details. When analysing and extracting information from a picture for medical or scientific purposes, the specifics in the local information play a crucial role in accurately identifying illnesses based on the image of a cell. So, as science and technology progress, particularly in the area of signal processing, the quality of a picture may be improved to provide precise and comprehensive information about the image.Over the years, several ways have been presented to address different parts of a picture, and there are numerous methods for improving the quality of an image. One of the several methods for improving images is contrast stretching. There are two distinct categories of contrast stretching techniques: global and local techniques. The global method of contrast stretching is a widely used technique in image enhancement. It produces images of a sufficiently high quality for viewing purposes, but it lacks the local details of the image because it focusses primarily on the global details, or the image's overall information, and ignores the local details. The image's local features are improved by the local approach, which addresses the

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image's tiny variations and yields the image's minute details. It is deficient in terms of the overall picture pixel enhancement information. One method addresses the disparity of another in this combination algorithm. The local approach addresses the smallest features in the picture that the global method does not. Numerous researchers have created methods for improving images. It is very usual and efficient to equalise an image's histogram in order to improve it. In order to maintain brightness, contrast enhancement methods based on histogram equalisation were introduced. Every every peak in the histogram is equalised independently in. It is an image's spatial domain method. Processing a picture directly on its pixels, as opposed to on another modified domain, is referred to as spatial domain processing. It is not possible to employ a single approach as a general technique that works with all kinds of photos. For a certain kind of picture, one approach could provide excellent results, but not for another kind.

2. EXISTING SYSTEM

Various contrast stretching methods have been proposed to enhance the image of leukemia, a medical image in . When a dark stretch is performed, the bright portions of the image or the bright pixels are more brightened. A better way to address such problem is to enhance the dark regions by keeping the bright regions untouched , these have shown the effects of various contrast stretching techniques like global stretching, local contrast stretching, partial contrast stretching etc. The problems of a blurred image, which is caused by the motion of the object while taking the image, and how to avoid is presented in . It also used local edge detection to deblur the original image. In , the effect of application of both global and local contrast enhancement is studied on gray scale image and only the brightness parameter of the image has been observed. This method is being used in this paper on the dark color image and image enhancement parameters like mean and measure of enhancement factor is calculated and the output image is compared with the existing image enhancement techniques.

Disadvantages System

- Accuracy is Low.
- blurred image.
- More time taking process and cost is also high.

3. PROPOSED SYSTEM

In this method first an image is taken and converted from the red green and blue (RGB) color space to the HSV color space. From the HSV colour space, the V component or the luminance component is taken to apply the algorithm. In order to enhance the local gradients or the local details, an existing local enhancement method has been used. Here the unsharp masking is used as local details enhancement method. As the name suggests it uses the blurred image to make the mask and enhances the local details in the form of edge sharpening. The sharpened image is used as the input to the global enhancement method. The global enhancement method uses one of the global contrast stretching methods. At first a color image to be

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enhanced is taken and it is converted to the HSV color space. From that color space the luminance portion is taken. The enhancement in the hue and saturation is not done. The image enhancement is performed only in the luminance plane of the image. The local details of an image can be accessed or addressed through the luminance only. There is effect of hue and saturation also in the contrast but the effect is less compared to luminance of an image. The luminance portion is responsible for the local radiance of the image. The luminance is enhanced by applying the proposed algorithm and it is combined with the chrominance and converted back to color image. Generally the global method is very fast in processing.

Advantages System

- Accuracy is Very high.
- Less time taking process and cost is also low.
- Their results gave high success rate.
- Clear image

4. SYSTEM ARCHITECTURE

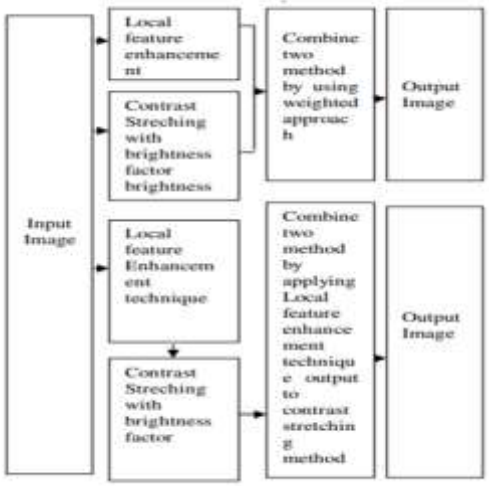

Fig. 1 System Architecture

5. ALGORITHM

CNN

Convolution Neural Network technique (CNN)

The **"convolution neural network (CNN)"** is a specific type of deep learning-based algorithm. This algorithm has been taken as an appropriate input image, an important attribute that is learnable weights with respect to the proper biasing system to the different types of objects. For this purpose, this particular system is very much effective to show the actual difference in the working process in each case. The actual requirement and necessity of preprocessing within the ConvNet are very much lower than the other classifier algorithms (Haytom *et al.*, 2019). The proper learning strategies and designing components and respective hierarchies of various factors should be done through "convolution neural network (CNN)" with various building structures like pooling layers, convolution layers and entire connected layers. The **"convolution neural network (CNN)"** has been recently

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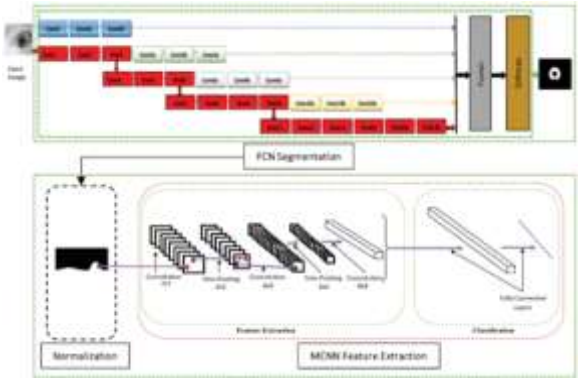
provided various types of tasks like the object recognition, object detection, image captioning anf image segmentation. The **"convolution neural network (CNN)"** is the particular types of category that is mainly designed various types of models and methods for completing the entire process such as the respective videos and images that will be very much necessary for completing the entire finger based iris recognition process. This particular network technique is image classification, signal processing and image segmentation. The iris recognition system has been regarded with respect to the "reliable biometric recognition" process during the extraordinary and stable variation within the appropriate texture (Hernández-García *et al.*, 2019). This entire research note has explored the efficient technology and modern techniques which has been mainly used for feature extraction and feature classification. This recognition system is mainly used for enhancing the respective recognition efficiency.



Convolution Neural Network technique (CNN) for Iris recognition system

6. MODULES

Global Enhancement of the Image

The global enhancement of the image is used to increase the contrast of the image. In this process each pixel of the image is adjusted so that it gives a better visualization of the image. In spatial contrast enhancement, the operation is performed directly on the pixel. The pixels are arranged in such a way that it is distributed throughout the range of desired intensity level. Global contrast stretching method is used as global method of enhancing the image. There are many global techniques like histogram equalization (HE), contrast limited adaptive histogram equalization and many other transformation methods like discrete cosine transform (DCT), discrete shearlet transform (DST).

Fig. 1 shows the proposed method to be incorporated in order to get a good quality image by combining both local enhancement and global enhancement of a color image. It mainly consists of the following four steps.

Step 1: Get the color image and convert it into hue, saturation and value (HSV) color space and take the luminance of that image.

Step 2: Apply the local enhancement method to enhance the local details of image.

Step 3: The local output is again given as global input and perform global image enhancement.

Step 4: Recombine the components and reconvert it back to color image.

In this method first an image is taken and converted from the red green and blue (RGB) color space to the HSV color space. From the HSV colour space, the V component or the luminance component is taken to apply the algorithm. In order to

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To see the effect of the combination of local and global enhancement methods of an image, the above mentioned algorithm is applied. The color image or digital color image to be enhanced is taken and converted to the HSV color space in order to apply the algorithm. The image plane slicing is performed and the image is divided into three different planes each of hue, saturation and value. The hue and saturation is the chrominance of the image and the value is the luminance. The luminance is mainly responsible for the radiance and brightness of the image. So the value image plane which is the third plane is taken for the enhancement and the other two planes of the image is kept as it is without altering the pixel intensities.

In order to enhance the edges which are considered as the local features of an image, the local contrast stretching process is applied. This is the first step in enhancement method. At the end of this step, a locally enhanced image is obtained. It gives a clear picture of the local information of the image but deficient in the overall brightness of the image. In order to address this discrepancy of local enhancement the global enhancement method is applied to the output of the first step. The global enhancement method employed here is histogram equalization explained above.

7. SCREEN SHOTS

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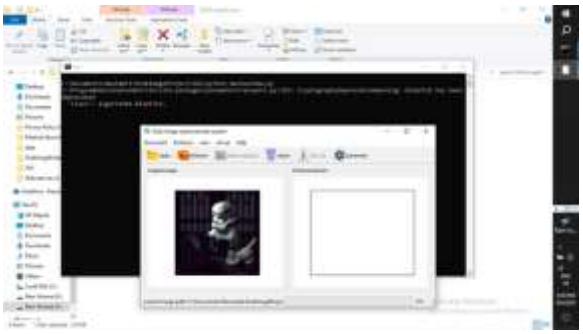

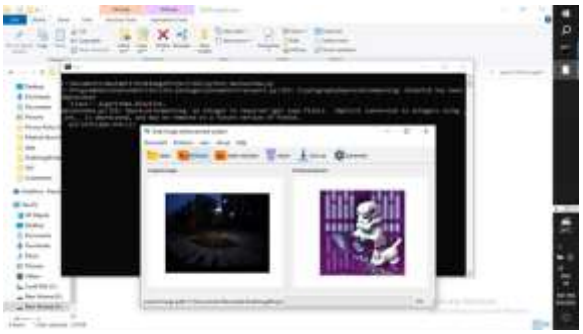

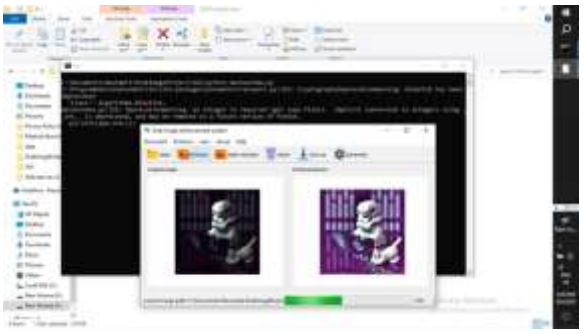

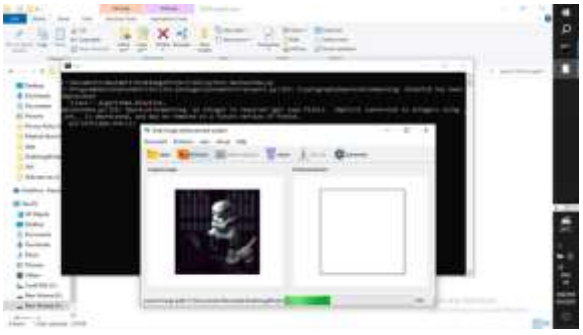

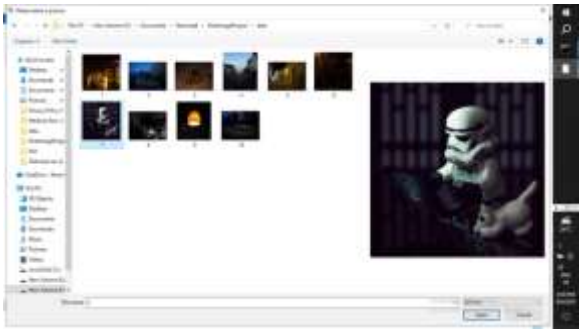

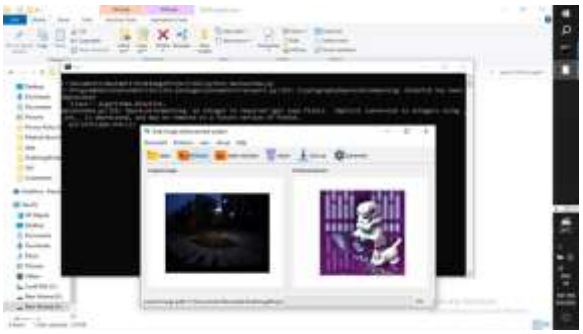

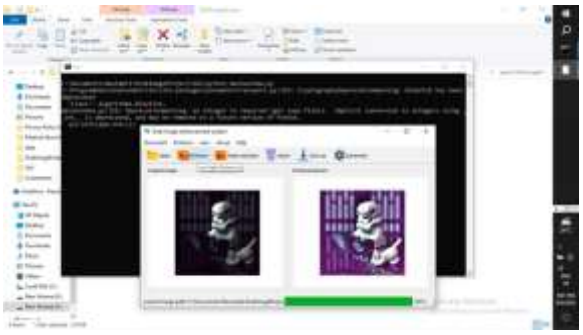

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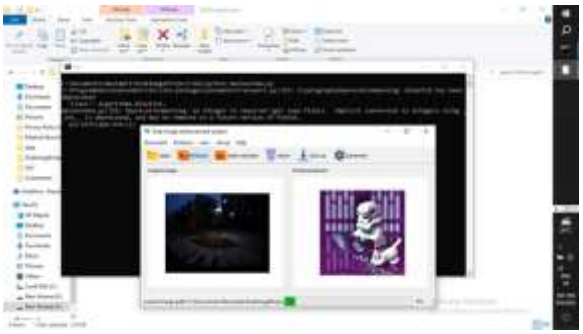

8. CONCLUSION

For low-light photos, the goal of the image enhancement method is to boost the contrast between the characteristics of various objects in the picture, reduce the distracting aspects, enhance the information in the image, and improve image quality. This article provides a detailed discussion of the concept, goal, implementation process, benefits, and drawbacks of picture enhancement from the perspectives of both machine learning-based algorithms and conventional approaches. With the goal of examining machine learning-based image enhancement algorithms from the perspective of digital image theory, we creatively categorise them based on model approach as well as conventional techniques coupled with the algorithm. We replicate several algorithms and objectively analyse their performance in picture quality assessment techniques to compare other algorithms.

Feature Enhancement

For picture content analysis, poor-quality photos with inconsistent intensity and low contrast are not useful. To increase picture quality, a unique global–local image enhancement (GLIE) technique was presented in this article. Weighted least squares (WLS) were used in the GLIE technique to split a picture into the base layer and the detail layer. Next, an adaptive gamma correction based on the cumulative histogram was presented and used to improve the base layer, while an enhancement operator was used to improve the weak structure.

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Vol 18, Issue 4, 2024

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