Image processing

Project Report

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TABLE OF CONTENTS

ABSTRACT

Image enhancement is used to improve the digital quality of image. It is used to improve the poor quality of image that is too used to improve bad quality of picture into good picture or image. This paper suggests a combination of local and global method for contrast image enhancement. Global contrast image enhancement improves low contrast of image in a global way. This type of global enhancement avoids noise and other ringing artefacts of a digital image. In global contrast image enhancement when high contrast occurs it causes under exposure on some part of image and over exposure on some other part of an image.

Global contrast image enhancement has much advantage but it lacks in local enhancement of image means it lacks the local detail of an image. When we use local detail of an image, the local detail of an image can be defined in better way.

Local contrast image enhancement increases noise of an image when high contrast gain occurs. When we use global contrast image enhancement or local contrast image enhancement single handedly it is not beneficial but when we use combination of local and global method it gives us better results for certain images. In this paper we will be going to use global contrast stretching method for global contrast image enhancement. In local contrast image enhancement method, we are using unsharp masking technique to enhance the local detail of an image.

The main aim of using this combination of local and global method is to preserve the brightness of an image when contrast image enhancement is done.

INTRODUCTION

Image enhancement techniques have been widely used in many applications of image processing where the subjective quality of images is important for human interpretation. Contrast is an important factor in any subjective evaluation of image quality. Contrast is created by the difference in luminance reflected from two adjacent surfaces. In other words, contrast is the difference in visual properties that makes an object distinguishable from other objects and the background.

In visual perception, contrast is determined by the difference in the colour and brightness of the object with other objects. Our visual system is more sensitive to contrast than absolute luminance; therefore, we can perceive the world similarly regardless of the considerable changes in illumination conditions.

Image is a discrete space made up of small elements called pixel. Each pixel represents intensity value at each position. A digital image can be captured with different devices such as a camera, an MRI machine and also with sensors that consume light intensity. There are two types of an image grey scale image and colour.

Contrast enhancement is acquiring clear image through brightness intensity value redistribution. Contrast factor is one of the factors of low or good quality images.

Contrast stretching is one of the image enhancement technique. It attempts to improve the contrast in an image by stretching the range of the intensity values it contains to span a desired range of values.

The "unsharp" of the name derives from the fact that the technique uses a blurred, or "unsharp", negative image to create a mask of the original image. The unsharped mask is then combined with the positive (original) image, creating an image that is less blurry than the original. The resulting image, although clearer, may be a less accurate representation of the image's subject.

LITERATURE REVIEW

An Analysis of Contrast Enhancement using Activation function: This paper studies various contrast image enhancement technique. This various technique will going improve the contrast of an image so that image will look good. There are so many contrast image enhancement technique that we will going to study in this paper they are Convolution Mask ,Linear Contrast Stretching , Histogram equalization, Adaptive Histogram Equalization and Enhancement by Point Processing. The main aim of this paper is preserving input mean brightness of an image when contrast image enhancement procedure is done on that image.

Review of various Contrast Image Enhancement Technique: This paper studies global and local method for Contrast image Enhancement .This paper study this two method in which researcher found that this two are not sufficient to enhance an image when image has some contrast area and it is not possible to perform any type of transformation on it. This paper proposed and study a novel method to remove the divided by zero condition that arises due to local standard deviation of that contrast area to enhance the image in more suitable way.

A Comprehensive method for Contrast Image Enhancement based on Local and Global Contrast and Local standard Deviation: This paper studies global and local method for Contrast image Enhancement. This paper study this two method in which researcher found that this two are not sufficient to enhance an image when image has some contrast area and it is not possible to perform any type of transformation on it. This paper proposed and study a novel method to remove the divided by zero condition that arises due to local standard deviation of that contrast area to enhance the image in more suitable way.

Blurred Image Enhancement using Contrast Stretching, Local Edge Detection and blind deconvolution: This paper is research work to avoid the problem which will occur in blurred image. Blurred image is a common problem observed in the situation when object is in motion or when we will be going to shoot a video. Three method are presented here in this paper to avoid the problem of blurred image. Contrast stretching process is used to deblurred image. Local edge detection method is applied on original as well as blurred image. Both the image edges are fused to obtain sharp edges of an image as an output. Fused image distortion is unknown so blind deconvolution technique is applied to obtain final output

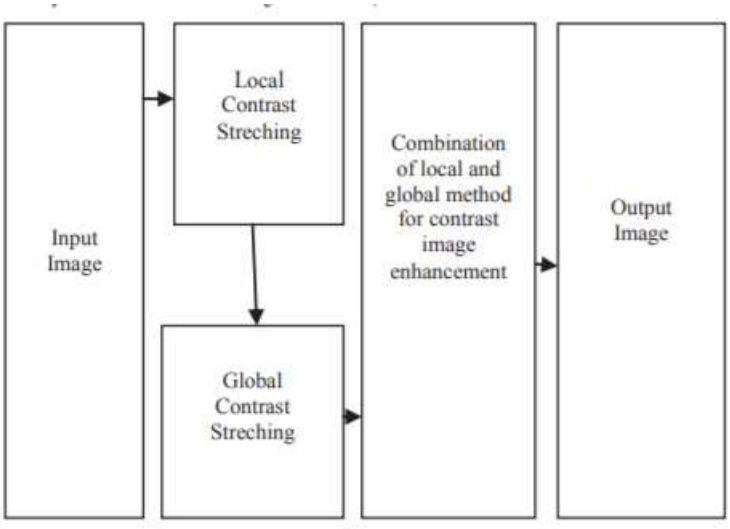
PROPOSED MODEL

The combination of local and global method is used on 2D histogram.2D histogram consist of two or more than that channel.2D histogram is made up of RGB values. The pixel intensity as well as statistics of colour has to maintain when we work on combination of local and global method. In this work we combine local as well as global method for contrast image enhancement to preserve the brightness. The fact is that when contrast occurs image lose its brightness to avoid this we are trying to develop new method.

We are using local Contrast Stretching method for local feature enhancement of an image. Local contrast stretching is used to sharpen the edges. It is used to enhance the local details of an image. In local contrast Stretching we will be going to use unsharp masking technique.

We use global contrast stretching for global contrast image enhancement of an image. These two methods are combined by using combination of local and global method.

- First on input image local contrast stretching process is applied.
- The output which we obtained from local contrast stretching is applied as input to global contrast stretching method.
- The output which we obtained from global contrast stretching is final output.
- The objective analysis is done on the whole system by calculating the brightness factor on every stage. The brightness factor of input image and output image is enhanced from that we conclude that system work properly. The aim of our work is fulfilled that when contrast increase image will not be going to lose its brightness it will be preserved and it will increase not decrease.



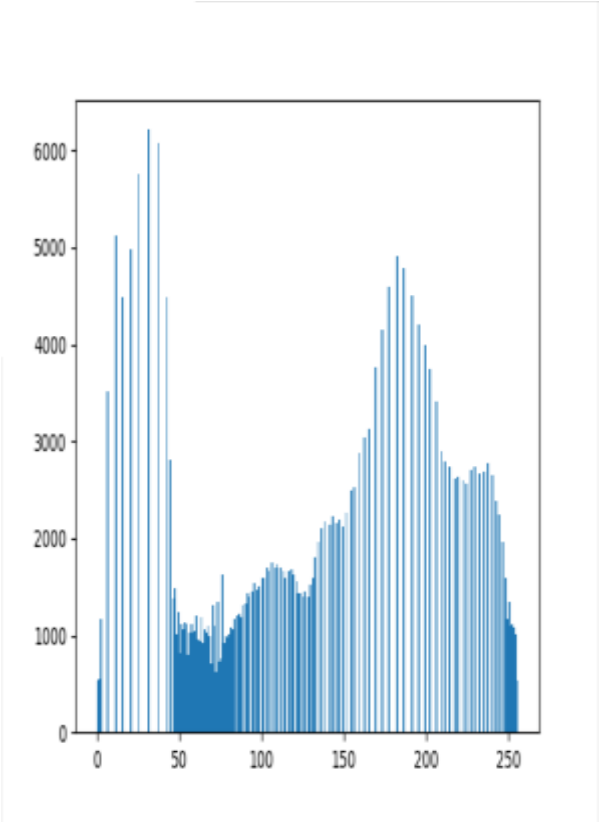
Global Contrast Image Enhancement:

To perform global contrast image enhancement method, we are using global contrast stretching method. Global Contrast stretching is a simple image enhancement technique that changes the range of pixel intensity values. This method enhances the pixel intensity into desired range.

For global contrast stretching a new upper and lower pixel value is needed to be predicted so that image got normalized. The concept of maximum and minimum value is to be deciding the maximum pixel intensity value and minimum pixel intensity value that we will going to use while executing process.

The 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.

Histogram Equalized Image



Histogram

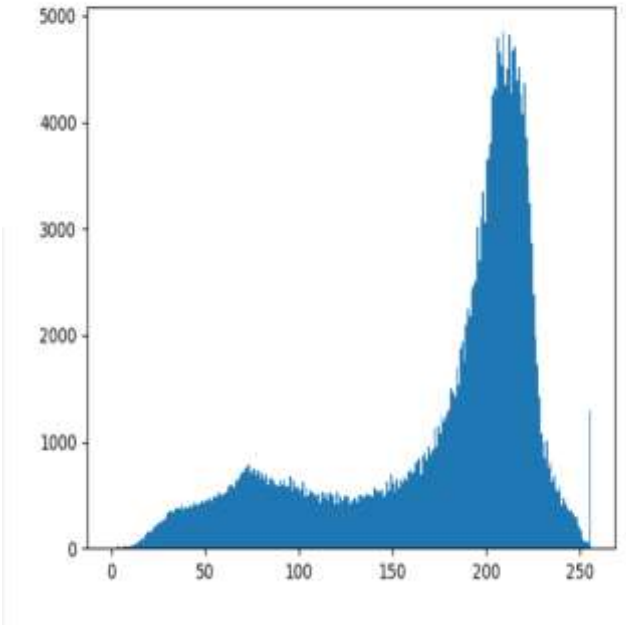
Local Contrast Image Enhancement:

For Local contrast image enhancement, we will be going to use local contrast stretching method. In local contrast stretching method we will going to target on local feature of an image. For this type of a local contrast stretching method we will going to focus on particular area of an image where we want to perform local contrast image enhancement.

For Local contrast image enhancement method, we will be going to use unsharp masking technique. In unsharp masking, image is separated into two components, the low-frequency unsharp mask obtained by low-pass filtering of the image, and the high-frequency component obtained by subtracting the unsharp mask from the original image itself. The high frequency component is then amplified and added back to the unsharp mask to form an enhanced image.

Local enhancement-based algorithms only make level of pixels in the fixed region, but effectively reduce the impact of other regions, and greatly enhance the local details.

Input and Output of local Contrast Image Enhancement method:



REGION OF INTEREST:

Implementation

Global Contrast Image Enhancement Using CLAHE:

To perform global contrast image enhancement method, we are using Contrast Limited Adaptive Histogram Equalization Method.

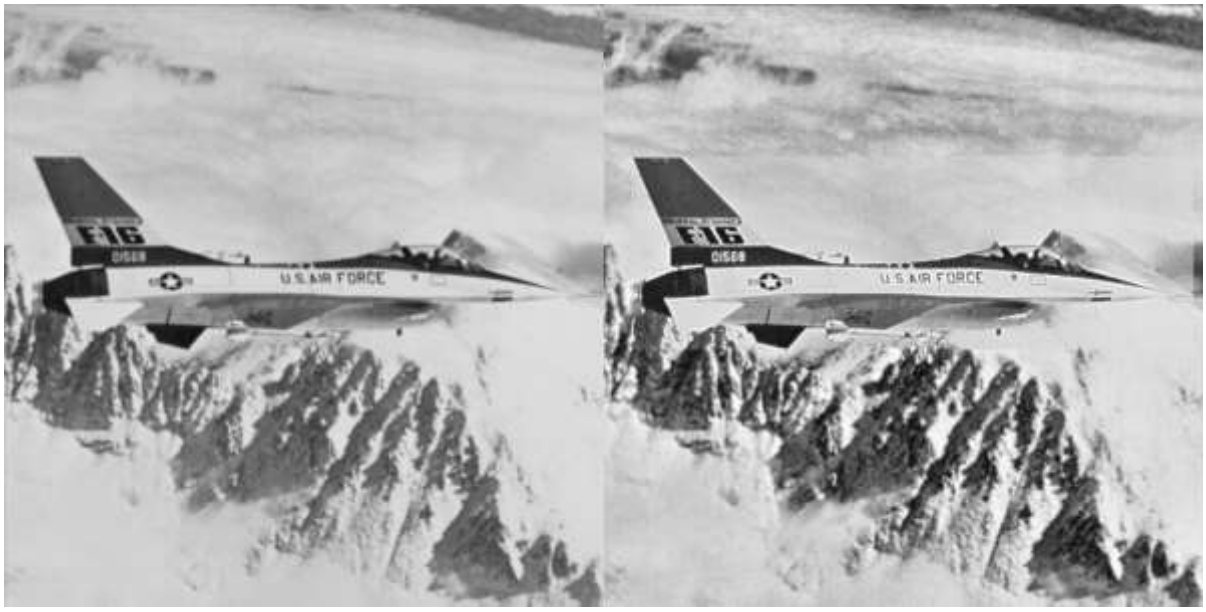
The adaptive Histogram Equalization method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast and enhancing the definitions of edges in each region of an image.

Ordinary AHE tends to overamplify the contrast in near-constant regions of the image, since the histogram in such regions is highly concentrated. As a result, AHE may cause noise to be amplified in near-constant regions. Contrast Limited AHE (CLAHE) is a variant of adaptive histogram equalization in which the contrast amplification is limited, so as to reduce this problem of noise amplification.

In CLAHE, the contrast amplification in the vicinity of a given pixel value is given by the slope of the transformation function. This is proportional to the slope of the neighbourhood cumulative distribution function (CDF) and therefore to the value of the histogram at that pixel value.

CLAHE limits the amplification by clipping the histogram at a predefined value before computing the CDF. This limits the slope of the CDF and therefore of the transformation function. The value at which the histogram is clipped, the so-called clip limit, depends on the normalization of the histogram and thereby on the size of the neighbourhood region.

It is advantageous not to discard the part of the histogram that exceeds the clip limit but to redistribute it equally among all histogram bins.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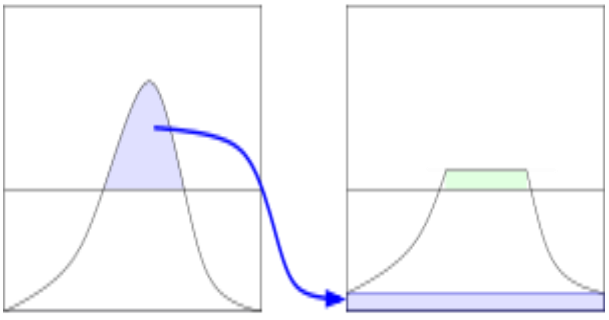

QUANTITY METRICS

Test Image

NAME	PSNR	MSE
JUST CLAHE	28.19217439396659	98.59682304526748
JUST UNSHARP	37.831195776484854	10.714225514403292
WITHOUT ROI:	28.117174444219568	100.31431604938271
WITH ROI:	30.782535691197452	54.303371193415636
USING HISTOGRAM EQUALISATION INSTEAD OF CLAHE:	27.92471243785965	104.85982222222222

Code:

```
import cv2
import math
import numpy as np

def psnr(img1, img2):
   mse = MSE(img1, img2)
   if mse == 0:
      return 100
   PIXEL_MAX = 255.0
   return 20 * math.log10(PIXEL_MAX / math.sqrt(mse))

def MSE(img1, img2):
   squared_diff = (img1 - img2) ** 2
   summed = np.sum(squared_diff)
   num_pix = img1.shape[0] * img1.shape[1]
   err = summed / num_pix
   return err

img = "C:\\Users\\Adithya\\Pictures\\img\\tomato.tif"
img_inp = cv2.imread(img, 0)
copy_img= img_inp.copy()

kernel = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]])


r = cv2.selectROI(img_inp)
imCrop = img_inp[int(r[1]):int(r[1]+r[3]), int(r[0]):int(r[0]+r[2])]
gaussian = cv2.GaussianBlur(imCrop, (9,9), 10.0)
output= cv2.addWeighted(imCrop, 1.5, gaussian, -0.5, 0, imCrop)
clahe = cv2.createCLAHE(clipLimit=2.0, tileGridSize=(8,8))
img_inp=cv2.equalizeHist(img_inp,img_inp)
img_inp[int(r[1]):int(r[1]+r[3]), int(r[0]):int(r[0]+r[2])]=output

stack = np.hstack((copy_img, img_inp))

cv2.imshow('output', stack)

cv2.waitKey(0)
cv2.destroyAllWindows()

d=psnr(copy_img,img_inp)
print(d)
d=MSE(copy_img,img_inp)
print(d)
```

Conclusion:

Thus, by analysing the quality metrics of the given model, we can observe that a combination of local and global enhancement successfully enhances the image. The ROI method ensures that the noise imparted to the image due to applying the unsharp mask is reduced significantly as the sharpening is limited to the region of interest.

The global enhancement is then done to the rest of the image, thus reducing the MSE, preventing unnatural deviation from the original image.

The result output image is thus, successfully enhanced to the desired parameters.

REFERENCES

Contrast Enhancement and Brightness Preservation using Global-Local Image Enhancement Techniques- (BASE PAPER)

A Combined Effect of Local and Global Method for Contrast Image Enhancement-2015 IEEE International Conference on Engineering and Technology (ICETECH), 20th March 2015, Coimbatore, TN, India.

A Combination of Local and Global Method for Contrast Image Enhancement - A Review Approach-IJCSN - International Journal of Computer Science and Network, Volume 3, Issue 6, December 2014 ISSN (Online): 2277-5420 www.IJCSN.org Impact Factor: 0.274

APPENDICE:

OpenCV:

OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel). The library is cross-platform and free for use under the open-source BSD license.

Numpy:

NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays.