INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal , Hyderabad-500 043

Project Based Learning
(Prototype / Design Building)

External Evaluation Report

Title of your Idea : **IMAGE ENHANCEMENT**
Thrust Area / Sector : **IMAGE PROCESSING**
Branch : **ECE**
Year / Semester : **3rd year / 5th semester**

S. No	Name of the Student	Roll Number	Mobile Number	Signature
1	K.SAI TEJA	19951A04D3	8121947959	Saiteja

1. Background of the Idea:

Image enhancement is one of the primary aspects in computer vision. Image enhancement techniques have become widely available to provide a better transform representation for the most popular image processing systems. Image enhancement is one of the key issues in high quality pictures such as digital cameras. The main purpose of image enhancement is to bring out detail that is hidden in an image. This is the main reason that image enhancement is used in a huge number of applications with important challenges such as noise reduction, degradations, blurring etc. A number of image enhancement techniques have been defined from which researcher can get an idea for a modified efficient technique.

Keywords: Digital image processing; Image enhancement; Image restoration; Spatial and Frequency Domain.

Image enhancement is basically improving the Interpretability or perception of information in images for human viewers and providing better input for other automated image processing techniques. There exist many techniques that can enhance a digital image without spoiling it. The enhancement methods can broadly be divided in to the following two categories:

1. Spatial Domain Methods
2. Frequency Domain Methods

In spatial domain techniques, we directly deal with the image pixels. The pixel values are manipulated to achieve desired enhancement. In frequency domain methods, the image is first transferred in to frequency domain.

It means that, the Fourier Transform of the image is computed first. All the enhancement operations are performed on the Fourier

transform of the image and then the Inverse Fourier transform is performed to get the resultant image. Image enhancement is applied in every field where images are ought to be understood and analyzed. For example, medical image analysis, analysis of images from satellites etc. In this section we briefly describe the various image enhancement techniques.

Image enhancement is applied in every field where images are ought to be understood and analyzed. For example, medical image analysis, analysis of images from satellites etc. Image enhancement simply means, transforming an image f into image g using T. (Where T is the transformation. The values of pixels in images f and g are denoted by r and s, respectively. As said, the pixel values r and s are related by the expression,

$$s = T(r) \quad (1)$$

Where T is a transformation that maps a pixel value r into a pixel value s. The results of this transformation are mapped into the grey scale range as we are dealing here only with grey scale digital images.

So, the results are mapped back into the range [0, L-1], where L=2k, k being the number of bits in the image being considered. So, for instance, for an 8-bit image the range of pixel values will be [0, 255].

This paper presents a literature review on some of the image Enhancement techniques like, Contrast Stretching, Histogram Equalization and its improvement versions, Homomorphic Filtering, Retinex, and Wavelet Multiscale Transform, Stochastic resonance, Fuzzy Gray Scale Enhancement Technique.

2.Problem Statement:

In general, to enhance contrast from image, image enhancement techniques are used. Which is a bit complex and time taking and high knowledge is required regarding MATLAB.

Image enhancement using background brightness preserving the Histogram equalisation technique that is widely used to enhance the image contrast but it tends to over-enhance the image background brightness. The brightness preserving bi-histogram equalisation (BBHE) was proposed to preserve the image brightness by decomposing the image into two based on the input mean. The sub-images are then independently equalised and combined into the output image.

An image enhancement algorithm of video analysis and the CI value is used as the evaluation function in this system, which can provide a reference to the degree of enhancement. The video image enhancement algorithm based on the point analysis method of multi-dimensional biomimetic informatics and it work well based on the point analysis method of multi-dimensional biomimetic informatics algorithm.

3.Proposed Solution:

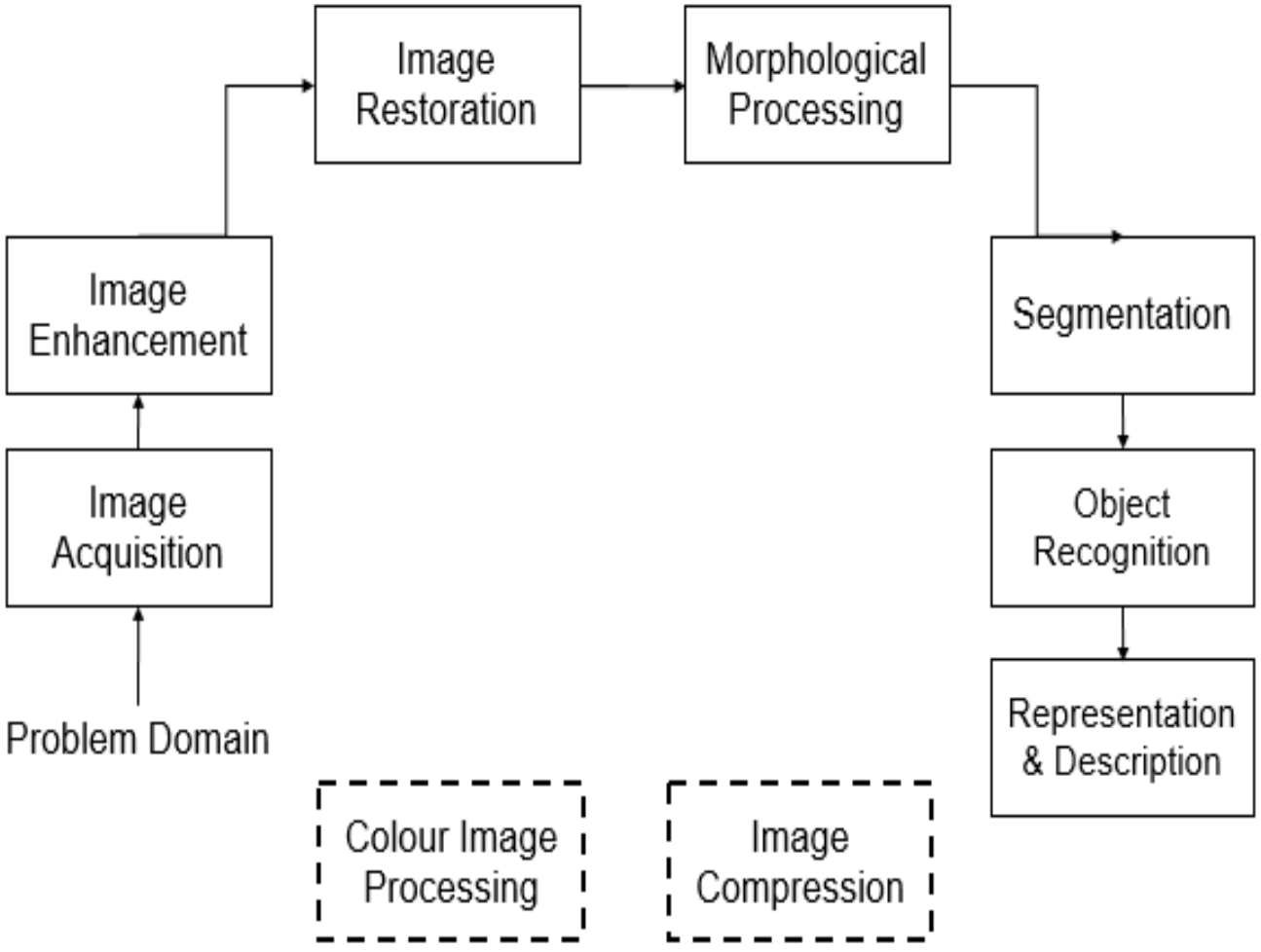
Improves the quality (clarity) of images for human viewing. Removing blurring and noise, increasing contrast, and revealing details by using auto libraries like "OpenCV". By using some inbuilt functions of the imported libraries, we improve the quality, brightness and contrast of image.

The purpose of image enhancement is to improve the perceptibility, enhancing the structural features can improve perceived image quality.

WE HAVE SOME OTHER TECHNIQUES:

- Histogram Equalisation
- Adaptive Iterative Histogram Matching
- Stochastic Resonance

4.Prototype of proposed system:



5.Detailed description of project:

"Image enhancement using background brightness preserving histogram equalisation" 2011 proposed the Histogram equalisation technique that is widely used to enhance the image contrast but it tends to over-enhance the image background brightness. The brightness preserving bi-histogram equalisation (BBHE) was proposed to preserve the image brightness by decomposing the image into two based on the input mean. The sub-images are then independently equalised and combined into the output image.

Image enhancement techniques in order to make familiar with the enhancement of a blurred image, noise removal, setting the brightness, contrast and various other degradations in the image processing. Critical review concludes that modern techniques like retinex are much better than histogram equalization. These techniques are based on enhancement and can be used to evolve out a modified method of image enhancement in the world of constant evolution.

A method for enhancing the color images based on nonlinear transfer function and pixel neighbourhood by preserving details. In this method, the image enhancement is applied only on the V (luminance value) component of the HSV color image and H and S component are kept unchanged to prevent the degradation of color balance between HSV components.

The V channel is enhanced in two steps. First the V component image is divided into smaller overlapping blocks and for each pixel inside the block the luminance enhancement is carried out using nonlinear transfer function.

In the second step, each pixel is further enhanced for the adjustment of the image contrast depending upon the center pixel value and its neighbourhood pixel values. Finally, original H and S component image and enhanced V component image are converted back to RGB image.

A multi-scale enhancement algorithm in which they utilize LIP model and consider characteristics of the human visual system (HVS). Then a new measure of enhancement based on JND model (Just Noticeable Difference, JND) of human visual system is proposed and used as a tool for evaluating the performance of the enhancement technique.

6.Final version of prototype / product (only images):

INPUT IMAGE

OUTPUT IMAGE

7.Any other information:

```
import cv2
def funcBrightContrast(bright=0):
    bright = cv2.getTrackbarPos('bright', 'Life2Coding')
    contrast = cv2.getTrackbarPos('contrast', 'Life2Coding')
    effect = apply_brightness_contrast(img,bright,contrast)
    cv2.imshow('Effect', effect)
def apply_brightness_contrast(input_img, brightness = 255, contrast = 127):
    brightness = map(brightness, 0, 510, -255, 255)
    contrast = map(contrast, 0, 254, -127, 127)
    if brightness != 0:
        if brightness > 0:
            shadow = brightness
            highlight = 255
        else:
            shadow = 0
            highlight = 255 + brightness
        alpha_b = (highlight - shadow)/255
        gamma_b = shadow
        buf = cv2.addWeighted(input_img, alpha_b, input_img, 0, gamma_b)
    else:
        buf = input_img.copy()
    if contrast != 0:
        f = float(131 * (contrast + 127)) / (127 * (131 - contrast))
        alpha_c = f
        gamma_c = 127*(1-f)
        buf = cv2.addWeighted(buf, alpha_c, buf, 0, gamma_c)
    cv2.putText(buf,'B:{},C:{}'.format(brightness,contrast),(10, 30), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 0, 255), 2)
    return buf
def map(x, in_min, in_max, out_min, out_max):
    return int((x-in_min) * (out_max-out_min) / (in_max-in_min) + out_min)
if __name__ == '__main__':
    original = cv2.imread("C:\\Users\\Dhamodhar\\OneDrive\\Pictures\\pbl pics\\p2.jfif", 1)
    img = original.copy()
    cv2.namedWindow('Life2Coding',1)
    bright = 255
    contrast = 127
    cv2.createTrackbar('bright', 'Life2Coding', bright, 2*255, funcBrightContrast)
    cv2.createTrackbar('contrast', 'Life2Coding', contrast, 2*127, funcBrightContrast)
    funcBrightContrast(0)
    cv2.imshow('Life2Coding', original)
cv2.waitKey(0)
```

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