Bangladesh Army University of Engineering & Technology (BAUET)
Department of Computer Science & Engineering (CSE)

DIGITAL IMAGE PROCESSING

LAB MANUAL 2

Introduction to Digital Image Processing
Using Matlab

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DIGITAL IMAGE FUNDAMENTALS

Lab Objectives

This objective of this lab is to understand

1. Some matrix operation.
2. The effect of changing the number of gray levels on the quality of images.
3. The effect of changing in spatial domain on the quality of images, using three methods:
    a. Log transformation
    b. Inverse Log transformation
    c. Power law transformation (n^{th} power & root)

Changing the number of gray Levels

The quality of a gray-level image is significantly affected by its gray-level resolution. Other words, increasing the number of bits per pixel has a great effect in improving the quality of gray-level images. This is because that a higher number of gray levels would give a smooth transition along the details of the image and hence improving its quality to the human eye.

Example: Changing the number of gray Levels

Algorithm	Matlab Code
1. Read a gray image. 2. Start with first row of the image. 3. Traverse all the column 4. Replace each cell value with 256 if cell value >128 5. Replace each cell value	`% Changing the Gray Resolution from 256 to 2` `I = imread('cameraman.tif');` `K= imfinfo('cameraman.tif');` `[r,c] = size(I);` `for i= 1:r  % for each row` `  for j=1:c % for each column`

with 1 if cell value <128 6. Repeat 3,4,5 until last row of the image visited.	``` if (I(i,j)>128) I2(i,j) =256; else I2(i,j) =1; end end end figure, subplot(121),imshow(I); subplot(122),imshow(I2); ```

Output 2 level Image (1 & 256)

Log Transformations

It maps a narrow range of low intensity values in the input into a wide range of output levels. The opposite is true of higher values of input levels. It expands the values of dark pixels in an image while compressing the higher level values. It compresses the dynamic range of images with large variations in pixel values. For doing this you have to use-

$$s = c \log (1 + r)$$

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Power Law (Gamma) Transformations

With fractional values($0<\gamma<1$) of gamma map a narrow range of dark input values into a wider range of output values, with the opposite being true for higher values ($\gamma > 1$)of input levels. C=gamma=1 means it is an identity transformations. Variety of devices used for image capture, printing, and display respond according to a power law. Process used to correct these power law response phenomena is called gamma correction. For doing this you have to use-

$$s = c\, r^{\gamma}$$

Task 1

Write Matlab program to-

a) Read a gray image. Then apply binary and inverse binary thresholding, where thresholding value=155 and display original, binary and inverse binary image in same figure.
b) Then, take a log transformation of original image and
c) Take the power law transformation of gamma=5.0 & .02
d) Show b & c output in same figure with original input image.

Task 2

Write a Matlab program to read a color image file and display each component (R, G, B) image individually.

Task 3

Find out some image conversion function that can be used to convert one type image to another type image. Also apply these function on your image and show the result. [* use help of matlab documentation for your conversion functions].

Task 4

Write a Matlab program capable of reducing the number of gray levels in an image from 256 to 2, in integer powers of 2. The desired number of gray levels needs to be a variable input to your program.