UNIVERSITY OF ENGINEERING AND TECHNOLOGY TAXILA

FACULTY OF TELECOMMUNICATION AND INFORMATION ENGINEERING

Computer Engineering Department

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. The effect of changing the number of gray levels on the quality of images.
2. The effect of changing spatial resolution on the quality of images, using two methods:
    a) Nearest neighbor interpolation.
    b) Bilinear interpolation.

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

```
% Changing the Gray Resolution From 256 to 2
I = imread('cameraman.tif');
K= imfinfo('cameraman.tif');
if(K.BitDepth ==24)
    I=rgb2gray(I);
end
[r,c] = size(I);
I2= uint8(zeros(r,c));
for i = 1:r
    for j=1:c
        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);
```

Changing the number of gray Levels

Changing the spatial resolution of a digital image, by zooming or shrinking, is an operation of great importance in a wide range of applications (i.e. in digital cameras, biomedical image processing and astronomical images). Simply, zooming and shrinking are the operations of oversampling and undersampling a digital image, respectively. Zooming a digital image requires two steps: the creation of new pixel locations, and assignment of gray levels to those new locations. The assignment of gray levels to the new pixel locations is an operation of great challenge. It can be performed using two approaches:

Nearest Neighbor Interpolation: each pixel in the zoomed image is assigned the gray level value of its closest pixel in the original image.

Bilinear Interpolation: the value of each pixel in the zoomed image is a weighted average of the gray level values of the pixels in the nearest 2-by-2 neighborhood, in the original image.

Example : Reducing the Spatial Resolution

```
% Shrinking the image to 1/2
I = imread('cameraman.tif');
K= imfinfo('cameraman.tif');
if(K.BitDepth ==24)
    I=rgb2gray(I);
end
[r,c] = size(I);

I2(1:r/2, 1:c/2) = I(1:2:r, 1:2:c);

figure,
subplot(121),imshow(I);
subplot(122),imshow(I2);
```

Some Useful Matlab Functions

- imagesc
- colormap
- imfinfo
- BitDepth
- imread
- imshow
- rgb2gray
- im2bw
- zeros
- magic

Task 1

Reducing the Number of Gray Levels in an Image

Write a computer program capable of reducing the number of gray levels in a 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.

Task 2

Zooming and Shrinking Images by Nearest Neighbour

Write a computer program capable of zooming and shrinking an image by nearest neighbor algorithm. Assume that the desired zoom/shrink factors are integers. You may ignore aliasing effects.

Task 3

Zooming and Shrinking Images by Bilinear Interpolation

Write a computer program capable of zooming and shrinking an image by bilinear interpolation. The input to your program is the desired size of the resulting image in the horizontal and vertical direction. You may ignore aliasing effects.