Department of Computer Science and Engineering

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CS4043 IMAGE PROCESSING
ASSIGNMENT SET 1

Date of posting assignment : 4/1/17
Date of Submission : 15/1/17

1. Write a program to read and display an image ?
   (a) Find the maximum and minimum pixel value in the image.
   (b) Quantize the image assuming 4 bits are allocated per pixel.
2. Consider the following continuous
$$f(x,y) = \frac{1 + sin(2\pi(x+y))}{2} \qquad 0 \leq x, y \leq 1$$
   (a) Convert to 100x100 image. Determine sampling intervals Δ_x and Δ_y?
   (b) Let $\Delta_x = 0.1$ and $\Delta_y = 0.2$. What is the size of sampled image?
3. Create a checker-board pattern of size 64x64. Each square of the checker-board pattern is a small 8x8 square. Display the image?
4. Create an image of size 32x32 where
$$I(i,j) = \left| sin\sqrt{(i^2 + j^2)} \right|$$
   Display the image?
5. Quantize the intensity levels in the above image by dividing the range [0,1] into four equal intervals. Quantization happens according to the following table.

Image gray level	Output gary level
$0 \leq I < 0.25$	0
$0.25 \leq I < 0.5$	0.25
$0.5 \leq I < 0.75$	0.5
$0.75 \leq I < 1$	0.75
1	1

6. Increase the brightness of the image in Question 1. By increasing the value of each pixel by adding (1/4 * max_intensity). max_intensity is depends on the number of bits allotted for representing the image. For an 8 bit the max_intensity is 255). If on increasing the pixel value it crosses the max_intensity then round it to max_intensity value.

7. Perform

   (a) 4 level quantization of the intensities of the imagei n Question 1.(max_intensity interval divided into 4 equal intervals and follow the scheme in the previous question).

   (b) 8 level quantization of the intensities of the image Question 1.(max_intensity interval divided into 8 equal intervals and follow the scheme in the previous question). Observe the difference in image quality.

8. Find the mean pixel intensity of the image in question 1. Write a program that converts the image to a binary image by using the following transformation.

$$G(i,j) = \begin{cases} 1 & \text{if I(i, j)} > \text{mean} \\ 0 & \text{if I(i, j)} \leq \text{ mean} \end{cases}$$

   (This is also a way of quantizing the image but the range of pixel intensities is not divided into equal halves.This operation is called thresholding)

9. Perform the following the intensity transformations on the image in question 1.

   (a) G(i, j) = log(1+(e^{σ}) I(i, j)) Try this transformation for various values of sigma ranging from 0 to 2 and note down your observations. Give a plausible explanation for the observations.

   (b) G(i, j) = $e^{\sigma I(i,j)}$Try this transformation for various values of sigma ranging from 0 to 2 and note down your observations. Give a plausible explanation for the observations.

   (c) G(i, j) = $I(i,j)^{\gamma}$ Try this transformation for various gamma values ranging from 0 to 3. Note down the observations.

   *(*Hint : Plot the functions above and try to explain the observations based on the function property)*

Output Required

- Create ASSIGNMENT1.tar file containing code for all questions with following naming convention.

$ASSG < number > \_ < rollnumber > \_ < firstname > \_ < questionnumber > if < partnumber > . < extension >$

- Output images with naming convention $< questionnumber > if < partnumber >$
- Observations in a Text file (include plots) for question 9 with naming convention $< questionnumber > if < partnumber >$.