Practice Lab 1

1. Read and display a grayscale image.
2. Find the maximum, minimum and average intensity values of the image.
3. Use the sample images provided with the the Virtual Lab.
4. Or use http://www.cs.iit.edu/~agam/cs511/data/images/index.html.
5. Or download (cameraman, lena, circuit etc) - 256*256 grayscale image from the internet.
6. Submit your codes, input and output images as a zip file in the format <rollno>iplab1.

DFT Computation

1. Compute the basis vectors of the forward 1D DFT for N=4
2. Compute the basis vectors of the inverse 1D DFT for N=4
3. Consider a sequence f(x) = [2, 3, 4, 4]. Find the DFT of f(x).

Zip these 3 programs and their respective output into a single folder named <rollno><assgn1> and upload here.

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CS4093D Image Processing Laboratory - *Practice Questions*

February 8, 2021

1. Take an image of size 1024 * 1024. Reduce the spacial resolution by half by replacing each 2 by 2 block of pixel by a single pixel. The gray value of the pixel can be taken as the mean of the four pixels in the block. To have a better comparison bring the image up to size 1024 * 1024 by row and column pixel replication. Repeat the experiment to reduce the resolution to 256 by 256, 128 by 128, 64 by 64 32 by 32 and 16 by 16. In all cases bring the image to its original size.

2. Create an image of size 64x64 where

$$I(i,j) = \left| cos\sqrt{(i^2 + j^2)} \right|$$

   Display the image.

3. 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

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

5. 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 (with image in question 5).

6. Perform the following arithmetic operations on two sample images of size 256*256.

   (a) Addition

   (b) Subtraction

   (c) Multiplication by a constant factor

   (d) Division by a constant factor

   Comment your observations.

7. Compute the 1D basis vectors for a 4-point DFT.

8. Using the above results, compute the 2D basis vectors $F(i, j)$ for a 4*4 DFT.

9. If the only 2 non-zero coefficients of a 4*4 image are $F(1, 1) = 3$ and $F(1, 2) = 2$, get the original image.

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CS4093D Image Processing Laboratory - *Assignment II*

February 25, 2021

1. Compute the 1D basis vectors for a 4-point DCT. Using these results, compute the 2D basis vectors $C(i, j)$ for a 4*4 DCT.
2. Repeat the above for Walsh, Hadamard transforms.
3. Perform following operations on a sample standard gray level image of size 256*256.
   (a) Compute the Discrete Fourier Transform.
   (b) Compute the Discrete Cosine Transform.
   (c) Compute the Walsh Transform.
   (d) Compute the Hadamard Transform.

   Remove some fixed number of transform coefficients and reconstruct the original image. Report your observations.

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CS4093D IMAGE PROCESSING LABORATORY - *Practice Questions*

March 2, 2021

1. Perform following operations on any sample gray level image of size 256*256.
   (a) Find DFT of the given image.
   (b) Find the magnitude spectrum.
   (c) Find the phase spectrum.
   (d) Double the magnitude spectrum.
   (e) Reconstruct the image using the IDFT.
   (f) Reconstruct the image removing phase spectrum.
   (g) Put the results together in one window.

   Explain your results
2. Pick any sample gray level image of size 256*256 image and follow the operations given below.
   (a) Multiply image by $(-1)^{x+y}$.
   (b) Compute the DFT.
   (c) Take the complex conjugate of the transform.
   (d) Compute the IDFT.
   (e) Multiply the real part of the result by $(-1)^{x+y}$.

   Compare the input image and the output images. Explain (mathematically) why does the output image appear as it does.
3. Obtain the Fourier spectrum of a given image. Pad the image with zero's, and obtain Fourier spectrum.
   (a) Explain the variation in the overall image contrast.
   (b) Explain the significant increase in signal strength along the vertical and horizontal axes of spectrum on the second output image.
4. What is the result of two DFTs performed in succession? Apply a DFT to an image, and again DFT to the resultant image. Can you account for what you see?
5. Compute the 2D basis vectors of 2D DCT using the separability property of DCT.
6. Compute the 2D basis vectors of 2D Haar Transform using the separability property.
7. Compute the Walsh transform of the following image.

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 4 & 5 & 6 & 7 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$

8. Convolve the following sequences.
   $f(x) = [1, 2, 3, 4]$ and $g(x) = [1, -1, 1]$
9. Use DFT to convolve the sequences.
   $f(x) = [1, 2, 1, 1]$ and $g(x) = [1, -1, 1]$
10. Compute and plot the histogram of any sample gray level image of size 256*256.

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CS4093D Image Processing Lab

Date of posting assignment : 11/03/2021

1. Add gaussian noise to the grayscale image (*cameraman.tif*) with the following parameters:

   (a) Mean 0, variance 0.01

   (b) Mean 0, variance 0.02

   (c) Mean 0, variance 0.05

   (d) Mean 0, variance 0.1

   Perform Image Averaging.

2. Read cameraman image, create a dark image with it (*It will appear as a very dark version of the cameraman image).*

   (a) Compute the histogram of the original image.

   (b) Compute the histogram of the dark image.

   (c) Apply histogram equalization on the dark image.

   Compare the results.

3. Create a menu-driven program to implement 3*3 median, min, max and mean filter (*n is odd*). Apply above filters on the given image. Give a plausible explanation for the observations.