San Diego State University

CompE 565: Multimedia Communication Systems
HW1: Basic Digital Image Processing Operations

Due on **02/21/2021 (11:59 pm)**

Learning Goals:

- You may work in the groups of two students each for Home Assignments (IGNORE THIS INSTRUCTION AND WORK INDEPENDENTLY OF OTHER STUDENTS).

- Learn how to read and display Digital Image files in Matlab.
- Learn RGB and YcrCb color spaces.
- Learn subsampling, upsampling, interpolation, replication methods and MSE computation in Matlab.

Support Information:

A 704X536 color (24-bit per pixel) JPEG image (Flooded_house.jpg) is provided with this homework. The image is posted on the same page with this document.

- **Read the Image:** Matlab provides a command "imread" to read various image file formats. To read the image file provided with this project you can use, I = imread('filename.jpg','jpg')

  This command will open the image file and read the data into the array I. I is a three dimensional array with array dimensions I[1..800][1..600][1..3]. The third dimension is color band index.

- **Display the image:** Matlab provides a command "imshow" to display images. The image read as given above can be displayed simply by using the Matlab instruction, Imshow(I)

Project Description:

1. Read and display the image using Matlab (10 points).

2. Display each band (Red, Green and Blue) of the image file (15 points)
   Hint: Red = I[:][:][1] captures the read component of the image and stores it into array Red.

3. Convert the image into YCbCr color space: (5 points)

   3.1. Matlab provides a command "rgb2ycbcr" to convert an RGB image into a YCbCr image.

3.2. Matlab also provides a command "ycbcr2rgb" to convert a YCbCr image into RGB format.

4. Display each band separately (Y, Cb and Cr bands). (10 points)

5. Subsample Cb and Cr bands using 4:2:0 and display both bands. (10 points)

6. Upsample and display the Cb and Cr bands using: (15 points)

   6.1. Linear interpolation

   6.2. Simple row or column replication.

7. Convert the image into RGB format. (5 points)

8. Display the original and reconstructed images (the image restored from the YCbCr coordinate). (5 points)

9. Comment on the visual quality of the reconstructed image for both the upsampling cases. (5 points)

10. Measure MSE between the original and reconstructed images (obtained using linear interpolation only). Comment on the results. (10 points)

11. Comment on the compression ratio achieved by subsampling Cb and Cr components for 4:2:0 approach. Please note that you do not send the pixels which are made zero in the row and columns during subsampling. (5 points)

Report: Please use the report writing and coding guidelines provided in Home Assignment #1 folder to report your work. Some of the sample output images are also uploaded in this directory.