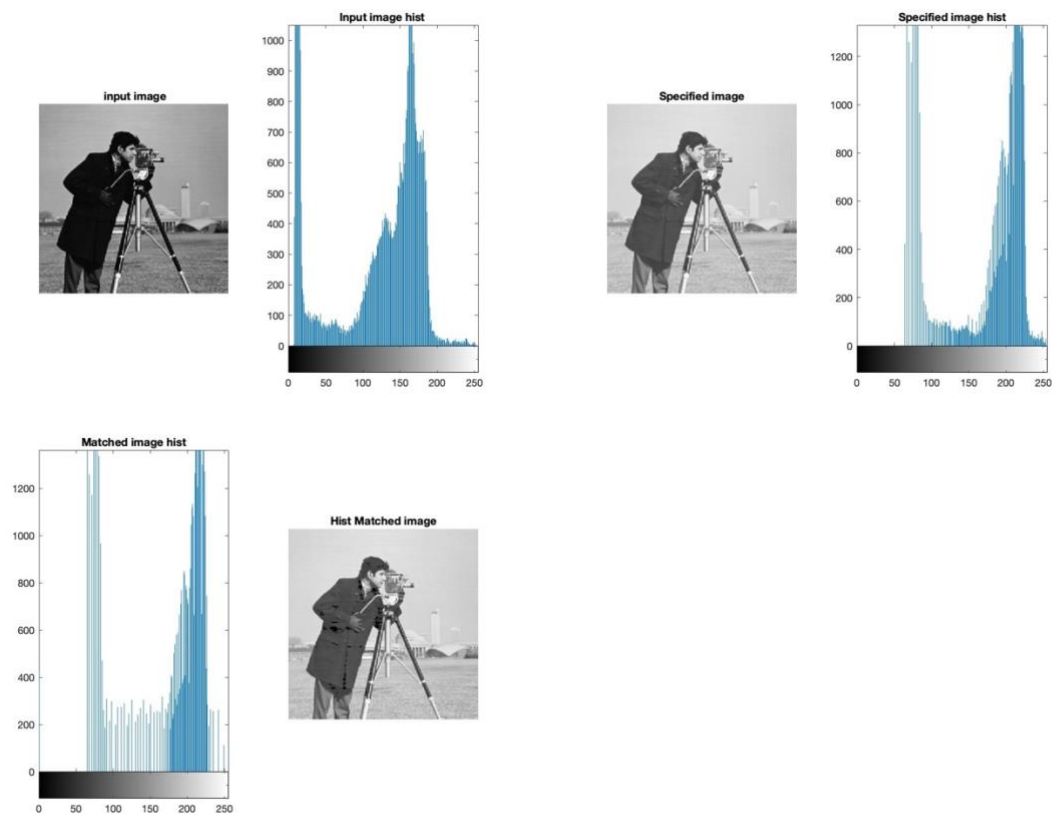


Assignment 3  
Deadline: 28<sup>th</sup> Sept 4PM.

Instructions: Q2, Q3b – theory.

Q1. Perform histogram matching using the cameraman image. Following is given for reference –



Note: inbuilt functions which can directly perform matching are not allowed. Marks will be given on the basis of

- Plotting input image and its histogram
- Plotting specified image and its histogram
- Computing the transfer function for both input and specified histograms
- Mapping between input pixel and output pixel
- Showing the final matched image

You can use the input cameraman image given in assign 2. Specified image is provided as "specified image.jpg" in zip file.

Q2. Image sharpening process involves three stages

- a) Computing Laplacian filtered image
- b) Multiplying (a) with constant "c" which takes the sign of center of Laplacian filter
- c) Adding (b) to original image

Derive an expression so that all three stages can be jointly done in a single step. The final expression should be in the form of  $g(x,y)=f(x,y) * w(x,y)$ , where  $f$  denotes input image,  $w$  denotes the equivalent filter and  $g$  denotes the sharpened image.

Q3. a. Write a function to implement the 2d convolution  $f(x,y) * h(x,y)$ .

$h(x,y) = \begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$        $f(x,y) = \begin{bmatrix} \mathbf{6} & 7 \\ 8 & 9 \end{bmatrix}$       Bold indicates origin. You are not allowed to use inbuilt 2d conv functions.

b. Verify the answer obtained via code by manually solving for (a).

Q4. For Q2, write a program using  $w(x,y)$ . Assume the center to be -4 for the Laplacian filter. Use the chandrayaan.jpg image as input. Make use of the convolution code written in Q2. You cannot use inbuilt convolution functions. Display both input and output image. Evaluation will be based on

- Correctness of  $w(x,y)$
- Output image' sharpness

Input and output images would have the following appearance.

