ID2090 : Introduction to Scientific Computing

2nd Semester (Mar-2023 to Jun-2023)

Assignment : 5

As part of this assignment, you are expected to upload a tar file named after your roll number, eg., me22b001.tar which when "untar"ed will create a folder me22b001 in which your scripts, source files like image, a PDF report etc., should be found. You need to upload the tar file on moodle page for this course.
Important: The scripts will be checked for their execution. The scripts should work when opened with octave interpreter.

[Q1, 8 marks] Look up the concept of "kernel" operations on an image. Look at the following URL for more information:

https://en.wikipedia.org/wiki/Kernel_(image_processing)

Consider a 3x3 kernel which is a matrix A_{ij} that will operate on an image as follows: For a pixel located at *(m,n)* the value of the pixel $P_{m,n}$ in the image, the new value is given by the following formula:

$$P^{\text{new}}_{m,n} = \sum_{i=0,j=0}^{i=2,j=2} A_{ij} P^{\text{old}}_{m-1+i,n-j+1}$$

For the boundary pixels, you can either skip them or consider a periodic boundary condition as you wish. For the image, you can take any image from the Internet or your mobile camera. Make sure the image is at least 1 mega pixel in resolution.

(i) By taking up kernels for at least 2 different image operations (such as brightness change, contrast change, gamma correction, motion blur, edge detection etc.,) illustrate how the image is modified. Your PDF report should contain the old and the modified images for illustrating the kernel operation.

(ii) Create a histogram of the pixel values for the image before and after the operation and comment about the change done to the image.

[Q2, 8 marks] Generate an array *x* to contain at least 100 values in the range from 0 to 1. Pick a function *f(x)* of your choice – with at least 3 constants - that has sufficient variation for the domain x ϵ [0:1] and generate an array *y* that contains the values of *f(x)*. Add a random noise in the range [-δ:+δ] where δ is a small value, say, 0.02 or so, to the array *y*. Now, fit the data of new values of y to a function of the same nature as *f(x)* and obtain the fitted constants of the function. Compare these to the ones in the original function and comment on the change. Superpose the plots of original function, noisy version and the fitted function to illustrate the "goodness" of fit.

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