Advanced Image Processing (IT507)

Assignment 3

March 17, 2022

1 Instructions

- Implement the following problems in Python or MATLAB.
- **Do not copy code from any source.**
- Prepare a report based on the theory and observations (one report per group).
- Submit the report (PDF format) in the Google classroom within the deadline.
- The assignments will be evaluated on Monday from 5:30 PM to 7:30 PM.

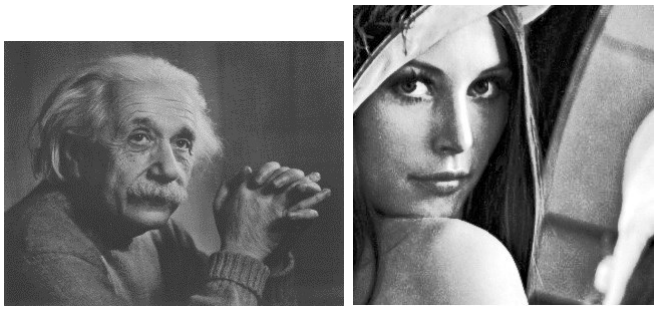
2 Problems

1. Decompose the *Building* image (Fig.1) into 8 bit planes. Show the bit planes. Then reconstruct the image back by removing three least significant bit planes. What will happen if you reconstruct the image by removing three most significant bit planes?

Figure 1

2. Write a program which will transform a given image (Fig.2(a)) in such way that the resultant image histogram is equivalent to histogram of another image (Fig.2 (b)). In the process, show the individual histograms and the intensity transformation curve.

   [Hint: Use the histogram specification algorithm].



(a) (b)

Figure 2

3. Perform gamma transformation and histogram equalization (separately) on the given hazy image (Fig. 3 (a)) to enhance the contrast of the image. Choose the parameter (if any) of these transformations such that the resultant images have dehazing effects. Fuse both the images to generate a single image such that it has better visual appearance. Note that the objective is to get a better dehazed result. Now, consider the haze model

$$\mathbf{I}(\mathbf{x}) = \mathbf{J}(\mathbf{x})t(\mathbf{x}) + \mathbf{A}(1 - t(\mathbf{x})),$$

where $\mathbf{I}(\mathbf{x})$ is the given hazy image. $\mathbf{J}(\mathbf{x})$ can be approximated with resultant image that have been generated by fusing the results of gamma transformation and histogram equalization. Assume the atmospheric light is $\mathbf{A} = [0.8159, 0.8186, 0.8272]$. Now estimate the transmission map $t(\mathbf{x})$ using the above equation. To see the accuracy of the results, compute the Euclidean distance between the estimated transmission map and the given transmission map (Fig.3(b)). A lower distance indicates a better dehazing result.

(a) (b)

Figure 3

[Hint: Apply both the transformations on each of the R, G, and B color plane.].

4. Find out the difference between averaging operation and weighted averaging (higher weight to center pixel) operation on Fig. 4 by applying spatial filtering. For this purpose, convolve the image with 9×9 masks (averaging mask and weighted averaging mask).

Figure 4