**PRAKTIKUM 4**

**Gamma Correction & Histogram Equalization**

**SISTEM PENGOLAHAN CITRA**

**PROGRAM STUDI SISTEM KOMPUTER**

**SCHOOL OF INFORMATION SCIENCE AND TECHNOLOGY**

**UNIVERSITAS PELITA HARAPAN**

**DISUSUN OLEH:**

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**Part 1 – Gamma Correction**

In a typical cathode ray tube (CRT) monitor, brightness of the illuminated phosphors is approximately equal to the applied voltage raised to a power of 2.5, which is known as **gamma (γ)** of the CRT. With x as the original pixel value and y is pixel intensity as it appears on the display, we have the following equation:

**y = 255 (x/255)^γ**

To achieve the correct reproduction of intensity, this nonlinearity must be compensated by a process known as **γ** **correction**. Images that are not properly corrected usually appear too light or too dark. If the value of γ is available, then the correction process consists of applying the **inverse** of the given equation.

Tasks (part 1):

1. Write a Matlab/Octave function that will γ correct an image by applying the inverse of given equation. The syntax should be: **B = gammCorr(A,gamma)**, where A is original image, gamma is gamma of the device, and B is corrected image. Submit the code of your function.
2. Use the provided **dark.tif** image with **gamma=2.2**. Submit your gamma corrected image.
3. Experiment with other gamma values. Hand in your gamma corrected image with **gamma=1,3 and 4**. Comment on the quality of the output image on your lab report.
4. HINT: be careful with data types. Before calculating the corrected image, convert to double; before displaying (and writing the image) corrected image, convert to uint8.

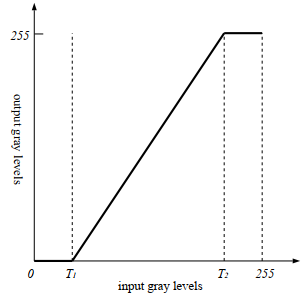
**Part 2 – Histogram Equalization**

Download the image file narrow.tif and read it into Matlab/Octave. The reason the image appears “washed out” is that it has a narrow histogram. One can display the histogram of an image by using the following functions:

x=reshape(A,1,M\*N);  
hist(x,0:255);

Where A is an image, M and N are number of rows and columns in A. The **reshape** command creates a row vector out of the image matrix, and hist plots a histogram with bins centered at [0 : 255].

To spread out said image’s histogram, one can use pointwise transformation like the figure below:



This is called pointwise transformation and it maps pixel values in range [0,T1] to 0, range [T2,255] to 255, and pixels in range [T1,T2] stretched out to use the full scale of [0,255]. Thus we have three input regions to consider if we are to make a function for pointwise transformation.

Tasks (part 2):

1. Write a Matlab/Octave function that will implement the described pointwise transformation with syntax: **B = pointTrans(A,T1,T2)**, where A is original image, B is corrected image, and T1,T2 the thresholds. In addition, your function should plot the **histogram of both original narrow.tif and corrected image**. Label your histograms (use functions **xlabel, ylabel, title**) and submit both histogram plot and the code of your function.
2. HINT: use the **figure** command to open another figure window. Or you can use **subplot()** to put multiple figures in one window.
3. Use the provided **narrow.tif** with **T1=70 and T2=180**. Submit the corrected image.
4. In the lab report, comment on the quality of the histogram equalized image compared to the original. What would the effect of changing T1 and T2 values be? Answer in the lab report.

References:

* <https://www.gnu.org/software/octave/>
* GNU Octave Manual
* Class Materials, Slide Week 4
* Purdue ECE 438 Lab 10a: <https://engineering.purdue.edu/VISE/ee438L/lab10/pdf/lab10a.pdf>