

EE4704 Image Processing and Analysis

Semester 1, AY2022/23

CA1

This assignment is to be done with Matlab. You may use built-in Matlab functions or write your own Matlab scripts.

A. Image quality (10 marks)

1. Load test1.
2. Examine the image and describe its quality. The Matlab functions `imtool` and `improfile` may be useful in examining an image.
3. Examine the histogram and, where possible, relate its features to the regions of the image.
4. Apply histogram equalization to the image. Does it work well? Explain.

B. Image enhancement (25 marks)

[see ch 6a](#)

1. Write a Matlab script to implement the transformation function
$$T: s_k = a(r_k + b)$$
for enhancing an image. It will also compute the image mean m and histogram moments μ_2 and μ_3 (as defined in the lecture notes). Note that clipping of the output image at gray levels 0 and 255 (if any) is to be done only after the entire transformation equation has been applied, i.e., do not clip after $r_k + b$.
2. The script is a function `[Iout,m,mu2,mu3] = enh(Iin,a,b)` (see Section D).
 - The function will show the calculated values m , μ_2 and μ_3 in the Matlab command window.
 - With respect to the output image, a message will inform the user whether there is clipping at 0, clipping at 255, clipping at both 0 and 255, or no clipping.
 - The function will display a figure showing the input and output images with their respective histograms (see Fig.1). [use subplots](#)
 - Ensure that you test your script rigorously, e.g., by applying it to a variety of images with different a and b values.
3. Show the result (output image and histogram moment values) of applying T to test2 with $a = 1.2, b = -10$.
4. With $b = 0$, apply T to test2 with a varying from 0.5, 0.6, ..., 1.5, and plot m , μ_2 and μ_3 against a . Comment on how m , μ_2 and μ_3 vary with a and relate this to your visual observations. Explain your answer.
5. Experiment to decide which combination of a and b gives you the best image. Explain your answer, and describe how it could be better.
6. Compare your best result with the image obtained by histogram equalization

C. Report

1. Your report should focus on the results, observations, explanations and discussion. Relevant images should be included. The figures in your report should be numbered and captioned (e.g., Fig 1: Image test1 and its histogram).
2. You have been split into two groups according to the last numeric digit of your student number. You belong to Group 1 if the last digit is odd, Group 2 if the last digit is even. The GA for Group 1 is Pan Jiachun (pan.jiachun@u.nus.edu); for Group 2, the GA is Mohamed Mikhail Kennerley (mikhailk@u.nus.edu). You may consult the appropriate GA if you need any clarification on the assignment.
3. Submit a softcopy (pdf file) of the report to the “CA1-report” folder on the EE4704 module LumiNUS website, by 3pm, 29 September 2022. Zip the Matlab code/scripts (m files) together with the pdf report file.
4. The files are to be named as follows:
matric number_full name.pdf, matric number_full name.zip,
e.g., A010134J_Tan_Shu_King.pdf.
5. ***The results and report must entirely be your own work. Plagiarism is a serious offence.***

D. Matlab code

Follow the template below to write your image enhancement code as a function.

```
% To enhance an image using the transformation  $s_k = a*(r_k + b)$ .  
% Inputs: the uint8 matrix of the gray level image 'xxx.bmp' (load the image  
using "imread" into Matlab first), and the parameters a, b.  
% Outputs: the figure showing the input and output images with their  
respective histograms, the message to indicate clipping, and the histogram  
features m, mu2, mu3.  
  
function [Iout,m,mu2,mu3] = enh(Iin,a,b)  
%  
% put your code here  
%  
end
```

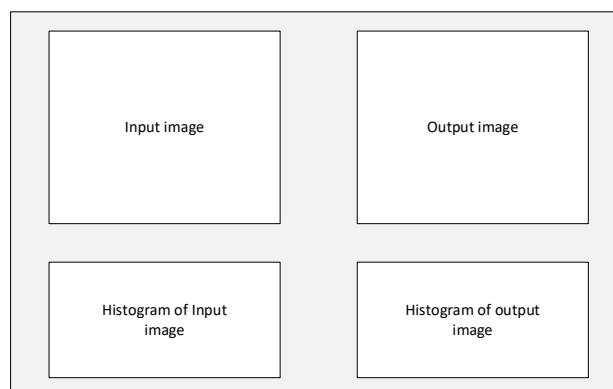


Figure 1