EE 4704 Project
Semester1, AY1819

A. Fourier Spectrum (10 marks)

1. Obtain the 2D DFT of image test1.bmp. Display the Fourier spectrum (with the maximum value scaled to 255).

2. Shift the Fourier spectrum to the center with "fftshift" and display it.

3. Use the log function to enhance the Fourier spectrum and display it.

4. Experiment with different color maps to display the Fourier spectrum. Which is better for visualisation: gray scale or false color? Which color map would you recommend?

B. Contrast Stretching (10 marks)

1. Implement contrast stretching with adjustable stretch α (as described in Tutorial D, Q2).

   (a) Follow the template below to write your function:

```
function [I_out] = hstretch[I_in, α]
%
% put your code here
%
end
```

   (b) Apply contrast stretching to test2bmp. Which value of α gives the best result in your opinion? Show the histogram.

C. Histogram Transformation (30 marks)

1. Enhance image test3.bmp with histogram equalization. Compare the histogram-equalized image with the original. Does histogram equalization work well in this case? Why?

2. Implement histogram transformation with four key points. These four points include the mapping of the end points at gray levels 0 and 255. Make sure the transformation is done in less than 10s.

   (a) Follow the template below to write your function

   ```
   function [I_out] = htransf[I_in, keypoints]
   %
   % put your code here
   %
   end
   ```

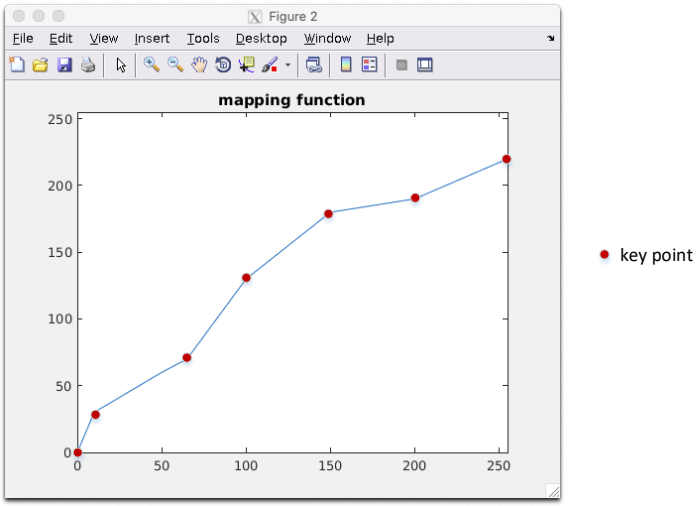
   (b) The argument "keypoints" is a matrix of size $N \times 2$, where N is the number of key point pairs. The first column of the matrix shows the original gray levels, while the second column the target gray levels. In the following example

   $$\begin{bmatrix} 0 & 10 \\ 50 & 80 \\ 180 & 160 \\ 255 & 233 \end{bmatrix}$$

   $0 \rightarrow 10$, $50 \rightarrow 80$, and so on.

   (c) It would be desirable if your function is able to recognize more than four key points, e.g., "keypoints" could be a 5×2 matrix indicating five key points.

   (d) Experiment with different transformation functions on test3 and display your "best" result. The aim is to obtain an image with good contrast and visible image details. Show the histogram and plot the transformation function (key points do not have to be shown).



D. Report

1. Your report should contain the results, observations, explanations and discussion.

2. Submit the hard copy of the report by 5 pm, 7 November 2018 in the box outside the Vision and Machine Learning Lab (E4-08-24). Do not include the Matlab code.

3. Submit a softcopy of the report to the "Project" workbin in the EE4704 IVLE module website, also by 5 pm, 7 November. The softcopy is to include:
   - MS Word file of your report
   - m file containing the Matlab code

   The two files should be zipped and the zip file named as follows:
   matric number_full name (e.g., A010134J_Tan_Shu_King).

4. ***The results and report must be your own work. Plagiarism is a serious offence.***

E. Appendix

E.1 Matlab

Matlab tutorials/primers

- https://www.tutorialspoint.com/matlab/
- http://homen.vsb.cz/~lud0016/nm/matlab_guide.pdf
- http://mayankagr.in/images/matlab_tutorial.pdf
- https://engineering.purdue.edu/AeroAssist/wp-content/uploads/2013/08/Introduction-to-Matlab1.pdf
- http://www.math.ucsd.edu/~bdriver/21d-s99/matlab-primer.html

Image Processing Toolbox

- http://www.cs.otago.ac.nz/cosc451/Resources/matlab_ipt_tutorial.pdf

E.2 Graduate Assistants

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