**CPS 843 (CP 8307) Problem Set 1**

(25 points)

**Purpose**

* Familiar with programming for image processing
* Understand the basic intensity transformation algorithms
* Understand the code and principle for image padding and shearing

**Requirements**

* The assignment is due on Monday, October 12th @ 11:59pm. Late submissions will not be accepted.
* Submit all your work in one PDF file through D2L (multiple submission is allowed, but only the last submission will be kept and evaluated).
* Use IEEE double-column format. The Word and LaTeX template can be found at <http://www.ieee.org/conferences_events/conferences/publishing/templates.html>
* Please resize all images properly in line with the text of your report.
* Submit the source code, if any, along with the report of each part.
* You can directly use available functions or software packages of Matlab in your work.
* Complete the report by yourself. We will use Turnitin® for similarity check.
* Start your report for each problem with a new page.

Part 1:

Problem 1. Write down the equations for log, inverse log, and power-low transformations and analyze the effect when applying these transformations to an image. Take or download a jepg image, and convert it into grayscale images. Then, perform a power-law transformation on the intensity image with and , respectively. Show the results before and after transformation, and make a brief analysis of the results. (5 pts)

Problem 2. Use the same grayscale image generated in Problem 1, show the 8 bit-plane slicing results, then reconstruct an image from the highest 2 and 4 bit-planes, respectively. Show the reconstructed images and make a brief analysis of the results. (4 pts)

Problem 3. For the image and the two transformed images obtained in Problem 1, compute the histogram of the three images, and then apply the histogram equalization on them. For each image, show the histograms and images before and after equalization, then, make a brief analysis of the results. (4 pts)

Problem 4. Describe the process of histogram matching. For a real image, will you obtain the same histogram as the desired one after histogram matching? Why? (3 pts)

Problem 5. For the following 3-bit image, compute the histogram of the image and manually perform histogram equalization. Show the computation steps, as well as the histograms before and after transformation. (5 pts)

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| --- | --- | --- | --- | --- |
| 1 | 2 | 4 | 7 | 3 |
| 2 | 4 | 7 | 3 | 1 |
| 5 | 6 | 2 | 1 | 1 |
| 4 | 7 | 1 | 1 | 1 |

Part 2: (4 pts)

**Software:**

The padding and shearing example in Matlab Image Processing Toolbox

<https://www.mathworks.com/help/images/examples/padding-and-shearing-an-image-simultaneously.html?prodcode=IP&language=en>

**Work to do:**

* Download or take an image yourself, and crop the image properly if necessary.
* Follow the instruction of the four steps and perform the transformation and padding as instructed. You may choose different parameters based on your understanding

**Report:**

* A brief technical description of each step, the source code, and the results.