

198:334 Digital Imaging and Multimedia Fall 2021

Assignment 2 – Multimedia Digitization

Due Date – online – Tuesday October 12th at 11:55pm – on Sakai

Submission instructions:

– You need to create a report where you put all your results (use MS word or other word processors). Make sure to put all the images you created (whenever the assignment says “print” or “plot” something, it means to include it in the report), and the codes you written in that report. At the end export everything into one pdf file to upload in sakai.

– *Late submission policy:* 10% of the grade for each day late.

[Q1 – 10 pts]

a) A camera with a focal length $f=50$ mm is used to take a photo of a vertical column that is 12-meter-high and 95 meters away from the camera. Determine its height in the image in mm and the number of pixels assuming the camera has a resolution of 300 dots per inch (dpi)

[Q2 – 15pts]

Write an ImageJ plugin that count the number of pixels of a given color. Use this plugin to count the number of pixels with pure red (255,0,0), pure green (0,255,0), pure blue (0,0,255), white (255,255,255), and black (0,0,0) in an input image (generate such images at size 640x480 to test your code). Test your code on a selfie photo of you and report the result. Test your code on the image **shapes.png** and report the result.

[Q3 – 10 pts]

a) Develop an ImageJ plugin that uses the Java methods `Math.random()` or `Random.nextInt(int n)` to create an image with random pixel values that are **uniformly distributed** in the range [0,255]. Analyze the image’s histogram to determine how the pixel values truly follow a uniform distribution.

- b) Repeat the above question with a **Gaussian distribution** with mean =150 and standard deviation=50 (use `Random.nextGaussian()` with appropriate scaling). Print the images and histograms for both cases.

[Q4 – 25pts]

Take a selfie with your cell-phone camera of your face and download it to your computer.

- a) Use ImageJ to plot the R,G,B component histograms, as well as the luminance histogram.
- b) Comment about the image defects that you can notice from these histograms, including problems with contrast, exposure, dynamic range, and compression effect.
- c) Convert the original image to gray-scale image by applying the transformation $(R+G+B)/3$, then apply a gamma function to your image, with $\gamma = \frac{1}{4}, \frac{1}{2}, 2, 4$; in each case visualize (you can use the gamma correction code in Program 4.4).
- d) Which of the images (including the original downloaded image) you think gives the most faithful visualization compare to what you see on your phone.

[Q5] This is a continuation of Q6 in Assignment 1. Please enter the data points you obtained in the following shared spreadsheet. Please add your datapoints at the bottom and don't override other student data.

<https://docs.google.com/spreadsheets/d/1uasHVhVjHKZfpyrnuXc4zonANeGhLnS4PXPvx2ngG4o/edit?usp=sharing>

You are not allowed to enter new data points at this time, only the ones that you already included in your assignment 1 report should be entered here.