

## ECE4580 FA23 - Prof. Jones – HW 1

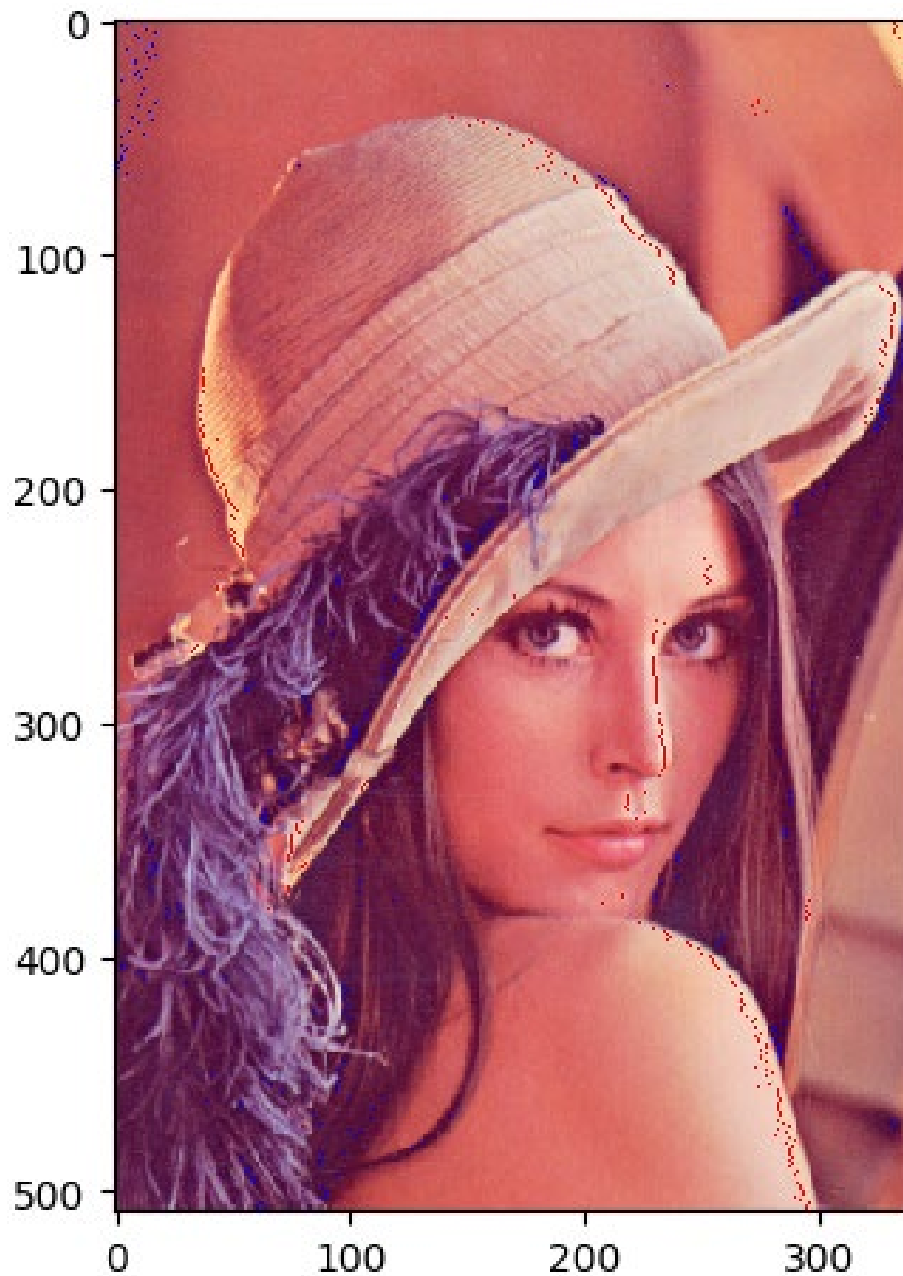
Due Thursday, Sep 7, 2023 – 11:59 PM via Canvas

In this assignment you will begin to explore simple image manipulations in Python using NumPy and SciKit-Image on Google CoLab.

### **PART I**

1. Get started by visiting [colab.research.google.com](https://colab.research.google.com). This is the home of Google Colaboratory – a fully online development environment that allows easy use of Python and related tools. You should be able to access CoLab using your VT email address.
2. Upload the image file “eye1.jpg” to a convenient place on your Google Drive (I create a folder called “images” in MyDrive).
3. Write a Python program to do the following:
  - a. mount your google drive;
  - b. load the image into a numpy array, using `skimage.io.imread()`;
  - c. print the sizes of the image (rows, columns and planes);
  - d. create a grayscale image as the average of the RGB planes;
  - e. find the brightest pixel on each row of the grayscale image, and color that pixel red in the original image;
  - f. find the darkest pixel on each row of the grayscale image, and color that pixel blue in the original image;
  - g. display the resulting image.

Here is the result of Part 1 on a different image:



## PART II

Write a Python function that will perform a power law transformation on a color image. Each pixel in the output is calculated from the input pixel raised to a given power  $\gamma$ ; color planes  $p$  are processed separately. In other words,

$$I_o(y, x, p) = [I_i(y, x, p)]^\gamma$$

We want the output image to fit within the range  $[0, 255]$  for each color plane. One nice way to do this is to convert the image to a float, scale the image to the range  $[0, 1]$ , then apply the power law transformation, then scale it back to  $[0, 255]$  and convert back to an unsigned 8-bit integer.

Test your function on several images and several values of gamma (both above and below 1). Show three interesting cases of input and output images, labeled with the gamma that you used.

### **SUBMISSION:**

For your submission, paste your code and the results of running your program into a single Word (or pdf) file. Paste code and program output as plain text (no dark-mode or screenshots). Also submit your final Python notebook (as an ipynb file). Submit two separate files: your Word or pdf submission and your CoLab notebook. Submit your files using Canvas. Do NOT put your files into a zip file for submission; submit them as separate files.

### **HINTS:**

- How does one access a Google Drive file in CoLab? Look here:  
<https://saturncloud.io/blog/how-to-read-a-file-from-drive-in-google-colab/>
- Numpy is documented here: <https://numpy.org/doc/stable/reference/index.html>
- SciKit-Image (usually called skimage) is documented here:  
<https://scikit-image.org/docs/stable/api/api.html>