EECS6323 – Assignment 4: Bayer demosaicing
Assigned: Feb 1 (Thu)
Due: Feb 11 (Sun) by 11.59pm <- I gave you a little extra time.
Percentage of total grade: 10%

Objective
1. To perform Bayer demosaicing.
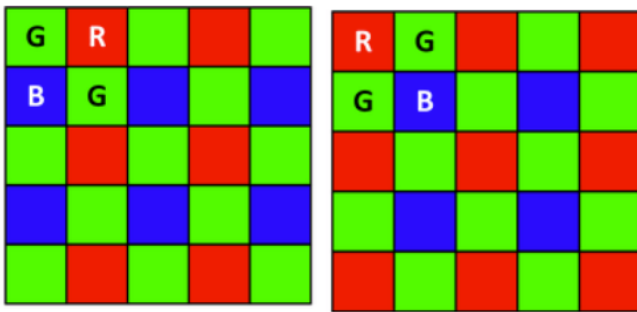2. To get more familiar with RAW image manipulation.

Provided to you.
1. Four DNG files **(2 encoded in GRBG and 2 encoded in RGGB).**
2. Video of the assignment

How the program should work.
1. The DNG files are encoded in their native Bayer format
2. The images are encoded in the following Bayer
     "GRBG"   "RGGB"

3. To extract which format use the following (via rawpy):

```
with rawpy.imread(raw_image_path) as raw:
    raw_image = raw.raw_image.astype('uint16')
    bayer_pattern = "".join([chr(raw.color_desc[i]) for i in raw.raw_pattern.flatten()])
    print(bayer_pattern)
```

4. Notice that the type is kept at uint16 (don't make it uint8).
5. You need to compute two RGB images:
i. An RGB image where the missing color channels in the Bayer image are set to 0.
    This is an RGB image where only the values in the Bayer image are shown.
    This is a nice way to help visualize the data you are starting with (see next page).
ii. Demosaiced the image based on the Bayer layout.
    - You must demosaic this image *yourself*; you cannot call any functions (even to
      perform interpolation).
    - I'm fine if you only do bilinear sampling using a 3x3 window.
      But if you have time, try something better.
    - It is OK to ignore the boundary. For example, in my code, I used a 3x3 window
      and ignored the boundary rows and columns (I left them black).
6. Plot all three images (use matplot or something that supports zoom—see video).
7. No need for black level subtraction (rawpy gives incorrect black level values – I'm
working on solving this for you.)
8. Scale the image by the maximum intensity and apply a 2.2 gamma.
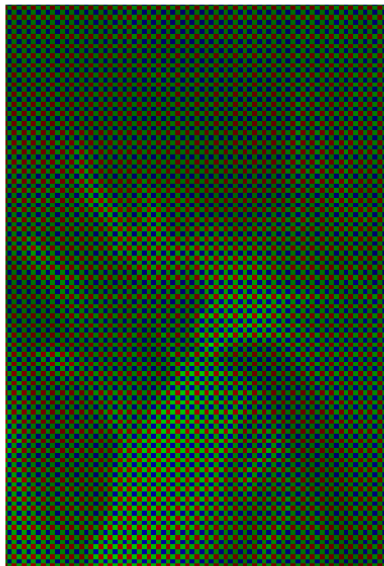
Bayer Grey Pattern

Bayer RGB Pattern

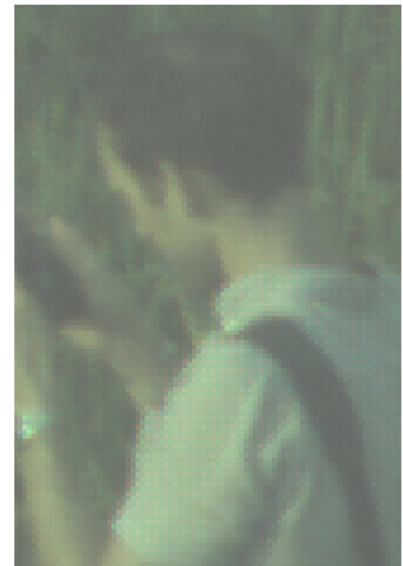### Demosaiced Pattern

Bayer Grey Pattern

Bayer RGB Pattern

Demosaiced Pattern

Original Bayer Image. Scaled by max intensity and with a 2.2 gamma applied.

RGB image where the missing two channels are set to 0. Scaled and gamma applied.

Demosaiced using 3x3 bilinear interpolation. Scaled and gamma applied.

What to submit via e-class:
Two files
1. Your Python code (zip).
2. Video of your program running w/o audio (mp4).

Comments:
1. The assignment must be done in Python.
2. You are welcome to use ChatGPT (although it likely isn't that helpful).
3. Useful Python packages/functions:
numpy
rawpy
matplotlib