EECS6323 – Assignment 8: HDR by Pyramid Fusion
Assigned: Mar 13 (Tu)
Due: Mar 25 (Mon) by 11.59 pm (A little extra time)
Percentage of total grade: 15%

Objective
1. To learn how to build Gaussian and Laplacian pyramids.
2. To perform HDR fusion based roughly on the method proposed by Mertens et al.
3. To see how modifying Laplacian levels can give an LTM effect.

Provided to you.
1. Two exposure stacks (EV-1, EV0, EV+1)
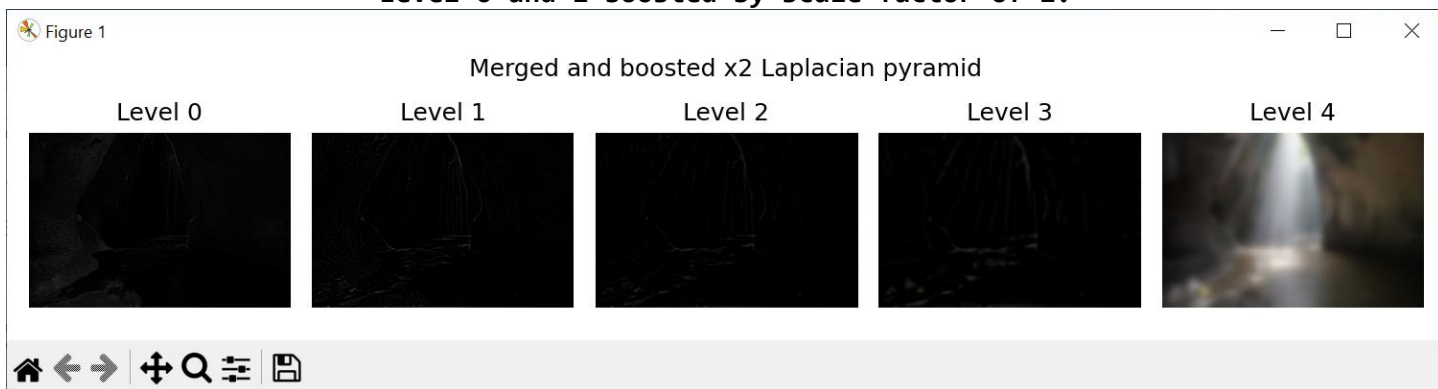2. Video

How the program should work.
1. Hope the three exposure stack images
2. Build the Laplacian pyramid for each EV image (R/G/B channels)
 -- You should be able to pass in the # of levels as a parameter.
 -- I show examples with 5 and 3 levels.
3. Construct a weight map for each.
- Note that I only used the luminance weight described in the notes. You are welcome to try other ways to build the map, but I found this gave reasonable results for out inputs.
- Normalize your weight map such that EV-1, EV0, and EV+1 weight maps add up to 1.0 at each pixel.
4. For each weight map (note this is a single channel), compute its Gaussian pyramid and plot it as shown in the video.
5. Use the weight maps to "fuse" the three pyramids constructed in step 2.
6. Have a "boost factor" that you multiply by levels 0 and 1 of your "fused" pyramid from step 5. (Boost factor of 1 means no change.)

7. "Collaspe the pryamid" from step 6 to contruct the output image.
8. Show the result compared with input image EV0

Note: This assignment took me a bit longer than the others. For me, the challenging part was getting the Gaussian and Laplacian pyramids to work. I recommend avoiding using open CV's pyramid functions; they didn't work well.

Example with "waterfull" (5 levels)

Gaussian pyramid weight maps for EV-1, EV0, EV+1

Gaussian pyramid weight map [ev-1]

| Level 0 | Level 1 | Level 2 | Level 3 | Level 4 |

Gaussian pyramid weight map [ev 0]

| Level 0 | Level 1 | Level 2 | Level 3 | Level 4 |

Gaussian pyramid weight map [ev+1]

| Level 0 | Level 1 | Level 2 | Level 3 | Level 4 |

Example of RGB Laplacian pyramid – fused using the weight maps.
Level 0 and 1 boosted by scale factor of 2.

Merged and boosted x2 Laplacian pyramid

| Level 0 | Level 1 | Level 2 | Level 3 | Level 4 |

Comparison of Fused result and EV0
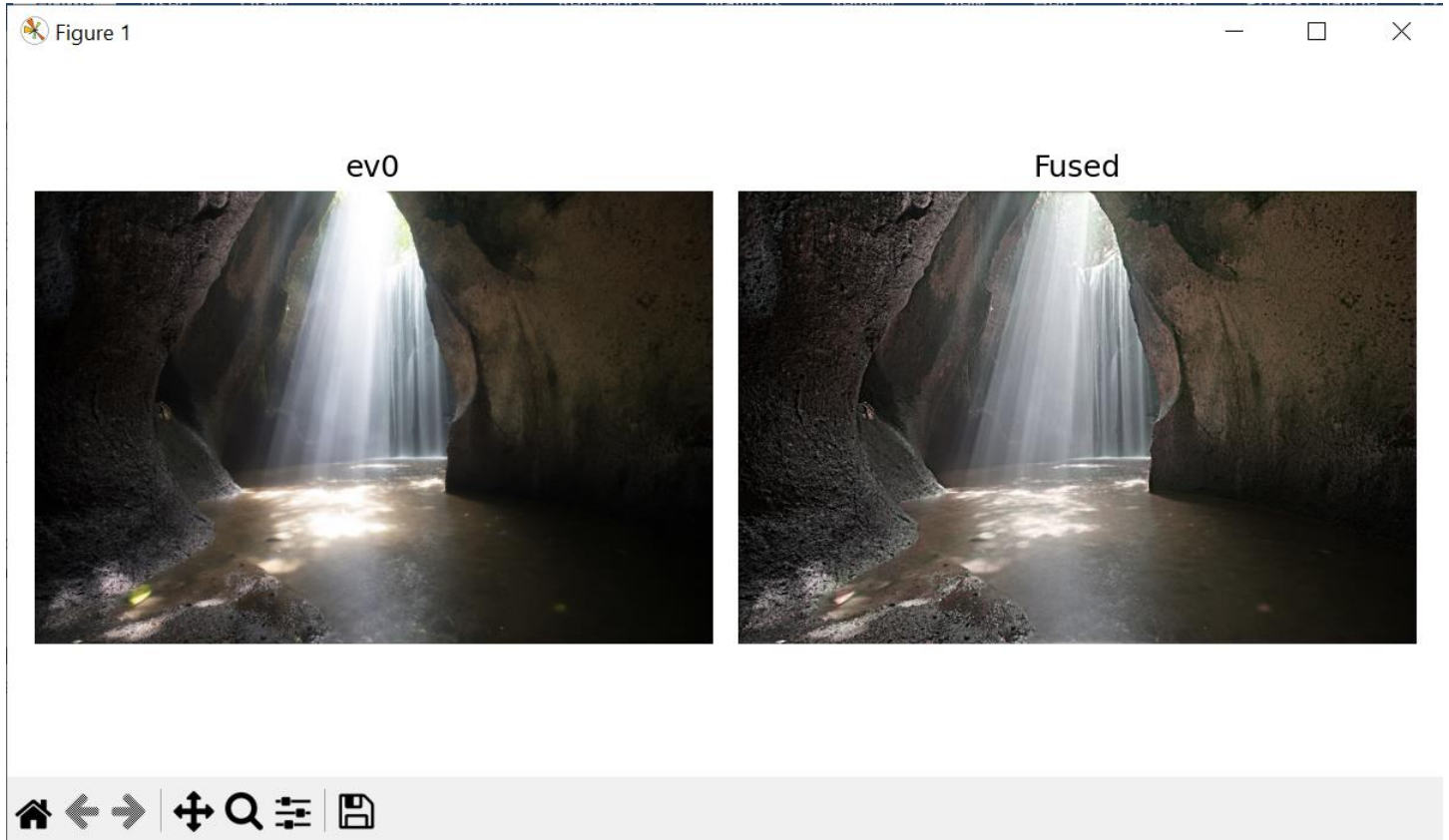
What to submit via e-class:
Two files
1. Your Python code (zip)
2. Video of your program running w/o audio (mp4).

Comments:
1. The assignment must be done in Python.
2. You are welcome to use ChatGPT.
3. Useful Python packages/functions:

This is the function I used to apply the gaussian filter.
from scipy.ndimage import gaussian_filter