CIS 441/551: Project #1G
Gray Scale Shading with CUDA

Instructions: You will be converting an image to grey scale using CUDA 10.

1. You can use the skeleton code provided to you, called project1G.cu

2. You will be responsible for handling all memory allocations to and from the device. Don't forget to free memory!

3. You will also be responsible for writing the grey scale shader. You must use the correct luminosity equation (see below)

4. Comments are provided to you in the code to help you out. Read over them before you begin typing. You can change any code you wish, as long as your image is the same, **BUT** you only need to add code and the comments will tell you where to place certain things, ensuring that you have the correct order of operations (this is very important).

5. You should not expect a pixel perfect image. Expect the reference image to match by eye.

Hints: Where to start? There is a lot of documentation around for cuda. I would suggest searching the internet and find a source that makes sense to you (sometimes it just takes another source). Some helpful links are Nvidia's documentation and The Supercomputing Blog. Both these resources contain all the information needed to complete the task.

Luminosity: The human eye does not see all colors with the same magnitude. The center of our color vision is near yellow-green, and colors closer to that will appear brighter. Thus we can't just average

the RGB colors and get an accurate looking image (try it). The correct formula to use is

$$L = 0.21 * Red + 0.72 * Green + 0.07 * Blue \tag{1}$$

You can see here that we have higher preferences to green and the lowest preference to blue, just like in the natural world.

Compiling: Compile with the command

```
nvcc -o project1G{,.cu} 'pkg-config --cflags --libs opencv'
```

This command will work on Ubuntu systems. If you are using another system then you will need to add the same cflags and libs that opencv requires. Note that we are using the back-tick, ', which is (probably) located at the top left of your keyboard, left of the 1 key.

Getting a GPU: If you don't have access to a GPU please email swalton2@uoregon.edu with the title "Alaska Access: 441" and an account will be created for you and instructions will be provided on how to access the GPU.

Checking with CPU: If you decide to check your result with a CPU you will not get a pixel perfect representation. It is normally a good idea to check results like this, but your images will have differences unless you take into account FMA instructions (on the GPU). More documentation can be found in the cuda documentation. You can also email Steven if you need to edit your code to perform this check.