

# EN.540.635 “Software Carpentry”

## Weekly Challenge 3 - Image Processing with PIL

### Task 1: Changing the luminance of an image

The 3 main properties of a color are its hue, saturation and luminance (also called value). This forms the HSV color space.

1. Hue: These are the colors shown on perimeter of the color wheel. They are the pure colors as all other colors can be created by mixing and manipulating the hues. The wheel (shown in Figure 1) shows the primary hues: red, green and blue, the secondary hues which are created by pairwise mixing of the primary hues are cyan, magenta and yellow.

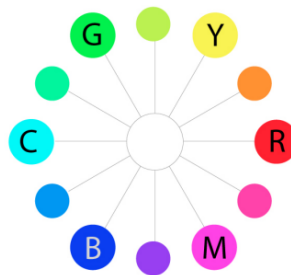


Figure 1: Color Wheel

2. Saturation: The saturation controls how much each hue is blended in to create the color. For instance for cyan there is no red hue and the blue and green hues are mixed in equal proportions (R:0%, G:50%, B:50%). For magenta the proportions are (R:50%, G:0%, B:50%) and for yellow the proportions are (R:50%, G:50%, B:0%).
3. Luminance/Value: This is the brightness of the color. The brightness or darkness of a color can be manipulated by varying the proportion of white or black added to the color. [Formula](#) to calculate how bright a color is given below:

$$L = 0.299 * R + 0.587 * G + 0.114 * B \quad (1)$$

We see in the above equation that the green hue is the major component of luminosity. This is because it is responsible for majority of the brightness perceived by humans. To calculate the luminance of an image we can take the average of the luminance of all pixels in the image. *Note: Most computer screens use 24 bit RGB pixels which means the red, green and blue hues are represented by 8 bit numbers and the largest decimal number that can be represented with 8 bits is 255. Hence the maximum luminosity an image can have is 255.*

Write out the following python functions to set the user desired luminosity for a sample image.

```
def get_pxl_luminance():
    """
    Write the function to get the luminosity of pixel based on the above formula
    """
    pass
    return None

def get_luminance():
    """
    Write a function to get the luminosity of an image based on the above formula.
    """
    pass
    return None
```

```
def set_luminance():  
    '''  
    Write a function that reads the image and user requested luminosity and saves  
    the new image file after setting the luminosity.  
    '''  
    pass  
    return None
```

## Example Output



Figure 2: Original Image



Figure 3: Luminance 100

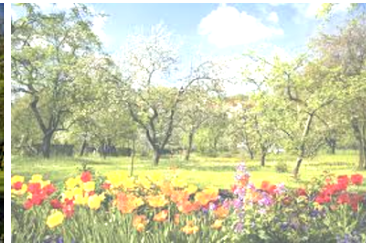


Figure 4: Luminance 200

## Task 2: Blur an image

In lab we have seen how we can convolve portions of an image with a mask (also called as kernel) to blur it. For reference please watch this [video](#).

Write out the following python function to blur an image.

```
def blur():  
    '''  
    Write a function that reads the image and blurs it using a kernel  
    and saves the new image file.  
    '''  
    pass  
    return None
```

## Example Output



Figure 5: Original Image



Figure 6: Blurred Image

## Submission guidelines

1. Please use the function names provided as this helps the grader quickly evaluate your submission.
2. Please adhere to the PEP8 guidelines when writing your code. To check if your code is compatible with pep8 standards run your python script through the autopep8 program. Use the following command to modify your file in place ([Ref](#)):

```
$ pip install autopep8
$ autopep8 --in-place --aggressive --aggressive <filename>.py
```

3. Please write appropriate docstrings for your functions that describe (1) what the function does (2) what are the arguments the function takes and their type (3) what the function returns and their types. An example of how to write a docstring for a function is shown below :

```
def area_of_circle(radius:float=1.0) -> float:
    """
    Computes the area of a circle

    Args:
        radius (float):
            Radius of the circle (Default=1.0)

    Returns:
        area (float):
            The area of the circle
    """
    return np.pi*r**2
```

**IF THERE ARE NO PROPER COMMENTS AND DOCSTRINGS WE WILL DEDUCT POINTS OFF OF YOUR SUBMISSION ACCORDINGLY.**

4. On Canvas, you are to turn in a single .py file with your Python code. Do not write code in the terminal, copy, paste, and turn that in (we will grade harshly if you do so, as the code will 100% not run).