CS 506 Programming for Computing
PE05 Image Manipulation in Python
School of Technology & Computing (STC)
City University of Seattle (CityU)

Before You Start

- If you have questions about the programming exercise requirements, please ask a TA to clarify for you.
- If you are not sure what to do:
  1. Consult the resources listed below.
  2. If you cannot solve the problem after a few tries, ask a TA for help.

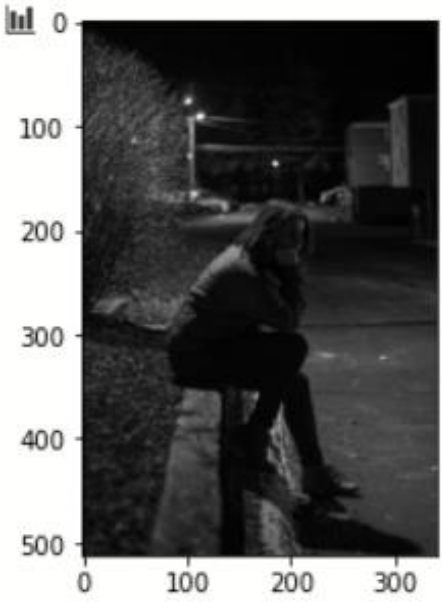
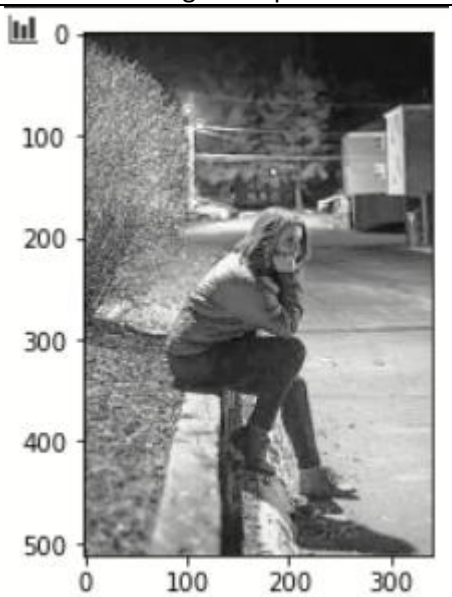
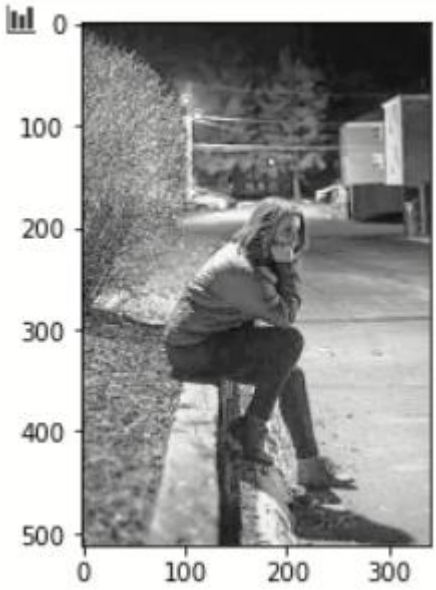
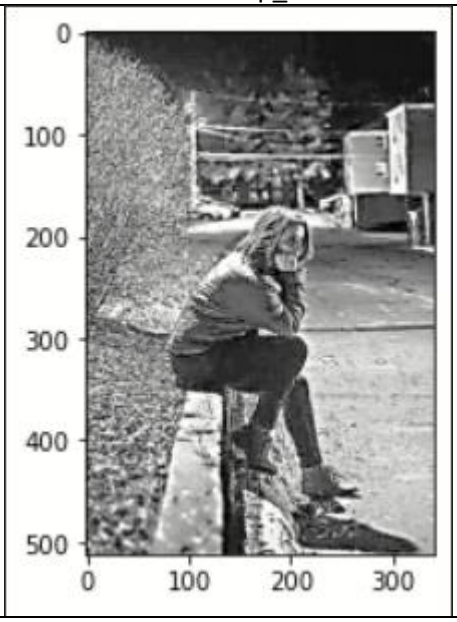
What and how to submit

- Write Python programs to complete the exercises below.
- Once you have solved all given exercises, submit the source code to Brightspace

Lab Tasks

- Write Python programs to complete the given tasks

Introduction: This week's assignment involves several basic image processing techniques that enhance the overall image using PIL (ImageFilter and ImageEnhance) library. There are many filters available to modify the quality of images. For instance, when the image too dark with lower contrast, one can use equalize (https://en.wikipedia.org/wiki/Histogram_equalization) or the image is captured too blurred due to motion, one can use unsharp masking filter (https://en.wikipedia.org/wiki/Unsharp_masking#Digital_unsharp_masking).

Input Image	After histogram equalization
	
Input Image	After unsharp_mask
	

Part 1 involves reviewing the image filters and image enhancer that are available in Pillow (PIL) links.

https://pillow.readthedocs.io/en/stable/reference/ImageFilter.html

Filters

The current version of the library provides the following set of predefined image enhancement filters:

- BLUR
- CONTOUR
- DETAIL
- EDGE_ENHANCE
- EDGE_ENHANCE_MORE
- EMBOSS
- FIND_EDGES
- SMOOTH
- SMOOTH_MORE
- SHARPEN

`ImageFilter` Module

The `ImageFilter` module contains definitions for a pre-defined set of filters, which can be be used with the `Image.filter()` method.

https://pillow.readthedocs.io/en/stable/reference/ImageEnhance.html

`ImageEnhance` Module

The `ImageEnhance` module contains a number of classes that can be used for image enhancement.

Example code snippet

```
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image, ImageOps, ImageFilter, ImageEnhance
%matplotlib inline

img = Image.open('input.jpg')
# Different ways to apply image filters
img = img.filter(ImageFilter.DETAIL)
img = img.filter(ImageFilter.SHARPEN)
img = img.filter(ImageFilter.MedianFilter)
img = img.filter(ImageFilter.UnsharpMask(5.0, 200, 20))
# Histogram equalization from ImageOps
img = ImageOps.equalize(img)
# Using Enhancer
img = ImageEnhance.Sharpness(img).enhance(-2.0)

plt.imshow(img)
```

Part 2 requires you to apply necessary filters to improve the quality of the input image posted in BB to answer the following questions. Submit both your code and output image to support your answers. Make sure your answers are written in the code comment rather than in a separate document.

PE05-input.jpg

Answer the following questions after you improved the image as an output image.

1. How many people do you see in the output image?
2. How many trees can you identify?
3. How many windows can you identify on the 2nd floor of the first building (labelled as "1") on the right-hand side of the road?
4. How many windows can you identify in the second building (labeled as "2") on the right-hand side of the road facing you?