

**CSci 4270 and 6270
Computational Vision,
Spring Semester, 2025
Lecture 01-02 Practice Exercises**

Overview

These are practice exercises that you might find useful in learning the course material and preparing for Quiz 1. As stated in the syllabus quiz questions will be drawn from, perhaps with modifications, from the exercises.

Please note that the instructions for the practice questions are fairly loose on exactly what's expected — there will be more precision in the actual quiz questions.

Problems

1. What is the difference between image classification, object detection, and segmentation?
2. What is the difference between face detection and face recognition?
3. What is the main computational vision problem in background substitution for video conferencing?
4. What are two key problems in building a system that automatically generates speeding tickets based on video?
5. What is the output of the following code:

```
a = np.arange(10, 20) * 2
b = a.reshape(2,5)
print(b)
c = b.flatten().reshape(2,5)
b[0:2, 1] = 99
c[1:2] = 0
print(a)
print(c)
```

6. Given a two dimensional array, write code that assigns every third row and every fourth column to 0.
7. Write a Python script to read a color image and display a new image that shows the original image overlaid with a half-sized (in each dimension) version of the image in the center, and then a quarter-sized image overlaid in the center of it.
8. Write code that reads an image and displays each of the red, green and blue channels as a separate gray scale image. If the image is grayscale already then just display the image.
9. Given a two-dimensional array **A** and two integers **i** and **j**, write code to swap rows **i** and **j** of **A**.

10. Given a color image, write code that creates a new grayscale image that has twice the number of rows and columns: image `im` has M rows and N columns, then the new image should have $2M$ rows and $2N$ columns. The upper left quadrant of the new image should have a copy of `im` after it is converted to grayscale. The upper right quadrant of the new image should have the red component of `im`, the lower left quadrant should have the green component of `im`, and finally the lower right quadrant should have the blur component of `im`.
11. Replace each pixel in an image by the difference between it and the average intensity in the image. Make sure the intensities stay in the range 0, 255 by truncating values outside the range.
12. Suppose you are given set of N vectors stored in a two dimensional NumPy array. In particular, each column should be thought of as a different vector, so that M , the number of rows, is the length of each vector. Write code to normalize the array so that each column is a unit vector.
13. Write NumPy code that applies a threshold to a grayscale image so that all pixels with intensity less than the threshold have their intensities mapped to 0, and all intensities greater than or equal to the threshold map to 255.
14. What does the NumPy code

```
im[im < 128] = 12
```

do?

15. Suppose `h` is a one-dimensional vector storing the histogram of an image's intensities. Write code to find the median intensity of the image.
16. What does the last line in the following code do?

```
im = np.random.randint(1, 100, (6,5))
k = min(im.shape)
r = range(k)
im[r, r] = 0
```