



## Matlab Warmup

### Computer Vision, Fall 2018

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This is a walkthrough in Matlab, where you will learn how to use basic useful functions in Matlab, and learn about image convolution.

Use the functions from "matlab getting started" in the course web page

#### Not for submission

Recommended before approaching HW1.

#### Matlab Intro + Convolution walkthrough

- Open Matlab and make sure you are in the direction where all the files are.
- Open the file script in Matlab (use file > open> script\_warmup\_matlab.m)
- Using mark and execute (marking using the mouse and execute using F9) proceed with the following steps.

#### Step A: Read and display images

1. **Your part:** Plot a vertical line on `lm_c1` on column 330. Display a graph (plot) of the intensities on that column;

Have a look at the correlation between the intensity values and what you see in the corresponding regions of the images. Which values are darker?

#### Step B: Smoothing the image with a Gaussian.

A Gaussian is given by: 
$$G(x, y, \sigma) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

2. **Write:** a Matlab function `mask_mid_section(mask)` that plots the horizontal section through a Gaussian mask along the center of the mask.
3. Convolve the image with the Gaussian mask, `G`.
4. **Play:** Define four Gaussian masks, `G`, by using four different  $\sigma$  values: 1, 2, 3, and 5. Convolve each mask with the cones image and display the results.

5. **Display:** display a section through the convolved cones for row 250. Do so on the same plot for the 4 different values of  $\sigma$ , use different colors for each of the values.
6. **Question:** what is the difference between the original image and the convolved image? How do the different sigma values affect the result?
7. **Question:** When smoothing an image we would like the sum of the mask to be one. Why? (Hint, think how it will affect different type of regions in the image.)

### Step C: Compute the derivatives of an image, using convolution.

8. **Question:** The displayed images enhance the horizontal and vertical edges of the image. Why do we use absolute values? Which edges we expect to enhance if we do not use the absolute value?
9. **Your part:**
  - a. Suggest a mask for computing the second derivative of the image in the x direction.
  - b. Convolve the image `cones1` with that mask, and put the results into `cones1_xx`
  - c. Display its absolute value results.
  - d. Display the section through `cones1_xx` for row 250 on the plot on figure h1, using a third color.
10. **Question:** what are the values of the second x-derivatives at vertical edges?  
(If you are more interested, you can have a look at Marr & Hildreth edge detector)

### Step F: A shift filter

11. Assume you would like to shift the image 5 pixels to the left. Suggest a mask for doing so using convolution. Test it on image `cones1`.

### Useful Matlab Functions:

1. There are many Matlab Tutorial on the web. I suggest looking at them.
2. Have a look at `meshgrid`.
3. Have a look at `conv` and `conv2` and consider using the parameter 'same' of these functions.
4. Look at the function `sum`.
5. Look at the function `plot`.
6. Avoid as much as possible the use of loops.
7. For closing all windows, use: `close all`

Please do not hesitate to contact me if you have any problems.

Enjoy!