

HCI/ComS 575X: Computational Perception

Homework 1, Part II (Basic Matlab)

Out: Wed. Jan 17, 2007

Due: Mon. Jan 29, 2007

Submit this part in electronic form on your section of the class wiki.

This part requires you to use matlab to perform some simple imaging and plotting operations. Please refer to the matlab tutorial from last week (or google) if you have any problems.

1. Edge Detection

Start with a JPEG image of yourself. Load it in matlab. Perform edge detection on it using your favorite edge detection operator. Save the resulting edges image. Post your original image, your edges image, and your matlab code on your wiki page.

2. Try Some Other Functions

Pick your favorite function from matlab's image processing toolkit. Perform the same procedure as in 1 but replace the edge detection function with your new function. Now choose two more functions and do the same. Post your original image, your three resulting images, and your code on the wiki.

3. Plotting Different Functions

a) Write a short matlab program that plots the probability density function of a 1D Gaussian function with mean $\mu = 3$ and standard deviation $\sigma = 2.5$.

b) Write another matlab program that plots the probability density function of a 2D Gaussian function with mean $\mu = (\mu_x, \mu_y) = (1, 2)$ and a diagonal covariance matrix Σ as shown below:

$$\Sigma = \begin{bmatrix} \sigma_x^2 & 0 \\ 0 & \sigma_y^2 \end{bmatrix}$$

where $\sigma_x^2 = 2$ and $\sigma_y^2 = 3$. Hint: In this case the result should be a surface.

c) Plot the circle given by the equation $x^2 + y^2 = 9$.

d) Plot the $\sin(x)$ function in the interval $[0, 6\pi]$.

When you are done post your four programs and your resulting plots (matlab can save them for you; check the figure window menu) on the wiki.

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Homework 1, Part III (Basic OpenCV)

Out: Wed. Jan 17, 2007

Due: Mon. Jan 29, 2007

Submit this part in electronic form (see details below).

To introduce you to OpenCV, we will do three fairly simple tasks. For this part you must submit your results in electronic form on your section of the class Wiki. The TAs have prepared some templates that you can use to simplify your task (check the wiki page).

1. Image Negative

Start with a color JPEG image of yourself. If you don't have one already find a webcam and take one. Now write a complete C/C++ code using openCV that reads your image, converts it to grayscale, inverts the grayscale image to produce the negative, and then saves the negative to another JPEG file. Post your original image, your edges image, and your code on your section of the wiki.

2. Cropping and labeling a video

For this task you must first find a digital movie (on Windows you can only use the AVI format; on Linux you can use MPEG if you compiled openCV with ffmpeg; see the online tutorials for more details). If you don't have a movie we posted some that you can download from the wiki page. Once you have the movie, write a program that uses openCV and reads the video one frame at a time, crops a 160x120 pixel window, prints your name on each frame, and saves the resulting video to another file.

Post your original video, your results video, and your code on your wiki page. If you choose to use your own video please choose a small one ($\leq 2M$) to save web space. If all else fails, just compress your videos in zip or tar.gz files before you upload them.

3. Combining Two Videos

This task is very similar to the previous one. This time, however, you must read from two video files at the same time and combine them into one movie. The left part of the resulting movie should come from the first video; the right part from the second one. Also, add a slider to your openCV window which controls the width (in pixels) of the screen occupied by the first movie. Your application should be able to save the movie while you actively change the width parameter by dragging the slider with the mouse. The initial value of the slider should be set to 50% of the screen width.

Post only the resulting movie and your code on the wiki page.

That's it. Good Luck!