

HCI/ComS 575X: Computational Perception

Homework 1, Part II (Basic Matlab)

Out: Wed. Jan 14, 2009

Due: Mon. Jan 28, 2009

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 (or google) if you have any problems.

1. Image Transformation

Start with a color JPEG image of yourself. Load it in matlab. Convert it to grayscale. Flip it so that the image is upside-down. Finally, find the edges of the image. Save the resulting image. Post your original image, your result image, and your matlab code on your wiki page.

2. Try Some Other Functions

Pick your favorite function from matlab's image processing toolkit. Convert the image that you used in 1) to grayscale and perform the function on the image. 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 $\mu = -1$ and standard deviation $\sigma = 2.5$.

b) Write another matlab program that plots the probability density function of a 2D Gaussian function with mean $\mu = (\mu_x, \mu_y) = (1.5, -2)$ and a diagonal covariance matrix Σ as shown below:

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

where $\sigma_x^2 = 1$ and $\sigma_y^2 = 3$. Hint: In this case the result should be a surface.

c) Load your image used in part 1 above and plot a rectangle around your face. It is OK to guesstimate the corners of the rectangle (i.e., don't try to do face detection, at least not yet).

d) Plot the function $f(x) = \sin(x) + \cos(x)$ in the interval $[-2\pi, 2\pi]$.

e) Solve problem 12 from HW1 (part 1: Linear algebra) using matlab. When you are done post your five 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 14, 2009

Due: Mon. Jan 28, 2009

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

a) 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.

b) Use the same image as in a) to produce three other images which contain the Red, Green, and Blue components of the original image.

2. Inverting 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, flips each frame upside down, 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 Multiple Videos

These days many news channels show several live feeds at the same time on the same TV frame. Your task in this problem is to replicate this. Instead of live feeds, however, you must read from several video files at the same time and combine them into one movie. Your program should be able to handle up to 4 videos (if you can't find 4 videos it is OK to use the two that we provide twice). In addition to that, your application should be able to save the movie to a file. The arrangement/format of the frame is up to you.

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

That's it. Good Luck!