

## IMAGE PROCESSING LAB SESSION 1

This lab needs mostly Matlab (already installed on your computer). Some Processing manipulations are also needed at the end (to be downloaded from [www.processing.org](http://www.processing.org)). All the lab will focus on one image of a hand (hand.jpg) to be downloaded from the Moodle platform. This first lab mainly deals with the two first courses of image processing.

### ***I. Hand segmentation***

1/ Read and show the "hand.jpg" image (imread, imshow)

Display the histograms (imhist) of different RGB components. Which one seems to be the most suited for the hand segmentation? Do the same operations into the YCbCr color space (rgb2ycbcr). Which are the differences between the two color spaces? Which very simple segmentation method could you first apply to get the hand?

2/ Use the Otsu thresholding (graythresh) on the RGB and the YCBCR components. Can you confirm the predictions of the previous question? Describe some differences between the different components. How to combine two of those results by using logical operations (OR, AND, XOR) to get only the hand? Use mathematical morphology to get rid of the noise (imclose, imopen). Is there part of the hand missing? Select the whole hand on the image where the hand is the best (find, bwselect).

### ***II. Bracelet segmentation***

1/ By combining two results you already have, segment the bracelet in the image.

### ***III. Finger segmentation***

1/ How could you characterize the difference between the fingers and the other parts of the hand? Use the segmented hand you obtained in the first part to obtain the fingers.

### ***IV. Hand characteristics***

1/ In this question, you will perform some high-pass filtering in the spatial domain. Use first a second order filter and then two first order filters in two different directions (imfilter, fspecial). What happens if the size of the kernel increases?

2/ Compute and show the amplitude of the fast fourier transform of the initial image (fft2, fftshift). What can you see? Compute the discrete cosine transform (dct2) of the binary segmented images (the entire hand, the bracelet and the fingers). Comments? Compute a low-pass filter on one of the binary images by using the amplitude of the discrete cosine transform at different cut-off frequencies (zeros, ones). If you only keep very few low frequencies do you see some artifacts? How could you partially solve this problem?

## ***V. Processing***

1/ Open the example from Examples->Topics->Image Processing->Convolution

Save it under another name in a different folder. Use the hand.jpg image instead of the image from the initial example. Use a window of 120 pixels around the mouse pointer. And a window of 415 pixels?

Which kind of filtering the initial kernel provides? Use a second order high pass filter. Try a first order high pass filter. Make than a low-pas filter. Use a kernel of a higher size to do the low-pass filtering: which difference do you see and why?