Assignment A4: Gaussian Pyramids and Normalized Correlation

CS 5320/6320
Spring 2016

Assigned: 1 February 2016

Due: 24 February 2016

For this problem, handin a lab report A4.pdf (include name, date, assignment and class number in pdf) which develops and studies the camera calibration process.

Develop the Matlab functions implementing normalized correlation and Gaussian pyramids as described by the function headers below, and use them to develop a method to detect hands raised in surrender in an image and provide a matlab function for this as described below. You are to optimize the method based on (1) success, and (2) efficiency. Success means that all raised hands in the image are found (compared to ground truth supplied by human analysis). Efficiency means lowest computational cost (i.e., perform correlation on the the smaller images in the pyramid). You are to carefully explain in section 2 of the lab report your method for measuring these, and you should give detailed findings on your efforts to find an optimal combination. Use the four images (S1,S2,S3,S4) given in the class web page data/A4 (see Figure 1).

You should handin the report A4.pdf as well as the source code developed in the study. The code should conform to the style requested in the class materials.

In addition, please turn in a hardcopy of the report in class before the start of class on February 24, 2016.

Write a lab report in the format (please do not deviate from this format!) described in the course materials.

Figure 1: Hands Raised in Surrender Images.

```
function C = CS5320_normcorr(T,im)
% CS5320_normcorr - normalized correlation
% On input:
%     T (pxq array): template kernel
%     im (nxm array): image
% On output:
%     C (nxm array): correlation coefficients in [-1,1]
% Call:
%     C = CS5320_normcorr(T,s1g);
% Author:
%     T. Henderson
%     UU
%     Spring 2016
%
```

```
function G_pyramid = CS5320_G_pyramid(I, k, sigma)
% CS5320_G_pyramid - Gaussian pyramid image
% On input:
%     I (mxn array): input image
%     k (int): size of smoothing window (2k+1 by 2k+1 window)
%     sigma (float): sigma for Gaussian function (scale parameter)
% On output:
%     G_pyramid (mxnx5 array): 5 images (stored in upper left corner)
%      comprising Gaussian pyramid
% Call:
%     pyr = CS5320_G_pyramid(I,4,2);    % 9x9 window with variance 2
% Method:
%     See Forsyth and Ponce, Chapter 5
% Author:
%     Randy Hamburger     Modified: T. Henderson; Spring 2016
%     UU - CS5320
%     Spring 2007
%
% Algorithm 7.1: Subsampling and Image by a factor of Two
% Apply a low-pass filter to the original image
% Create new image with dimensions half those of the old image
% Set the value of the i, jth pixel of the new image to the value
%   of the 2i,2jth pixel of the filtered image
%

function hands = CS5320_hands(im)
% CS5320_hands - find hands of surrender in image
% On input:
%     im (mxn array): image
% On output:
%     hands (mxnx3 array): rgb image of original with hands outlined
%     in red
% Call:
%     hands = CS5320_hands(s1g);
% Author:
%     T. Henderson
%     UU
%     Spring 2016
```