COM-SGN.110 Introduction to Image and Video Processing

EXERCISE 1

26.10.2020 - 28.10.2020

This exercise is an introduction to MATLAB Image Processing Toolbox. The tasks should be completed and presented to TA during the lab session. **Do not forget to upload your solutions to Moodle!** Questions about exercises should be addressed to the TA personally, through Moodle messages or via email, which can be found on the Moodle page of the course.

1. Image basics and useful commands

Load the image '`peppers.png`' as matrix `I`. (Hint: `imread`)

You can use the function `imshow` to display images in MATLAB.

a. Convert the color image to a grayscale image `I1` and display it. (Hint: `rgb2gray`)

b. Using MATLAB indexing, display only the red (1st) component of the original image. Compare it with the previous result. (Call the function `figure` before displaying an image to create a new window for it.)

c. Make a copy of the original image and name it `I2`. Add value 50 to the green component of `I2`. Display the result and compare with the original image.

d. Store the Red, Green and Blue components of the original image as matrices `R`, `G`, `B`. Create an image `I3` by recombining the components in the order BGR. (Hint: `cat`)

e. Display 4 images in a 2-by-2 layout in the order of top left to bottom right: `I, I1, I2, I3`. Make sure image content is visible. (Hint: `subplot`)

2. Batch processing

a. Clean the workspace memory and close all the figures in the previous task. (`clear all, close all`).

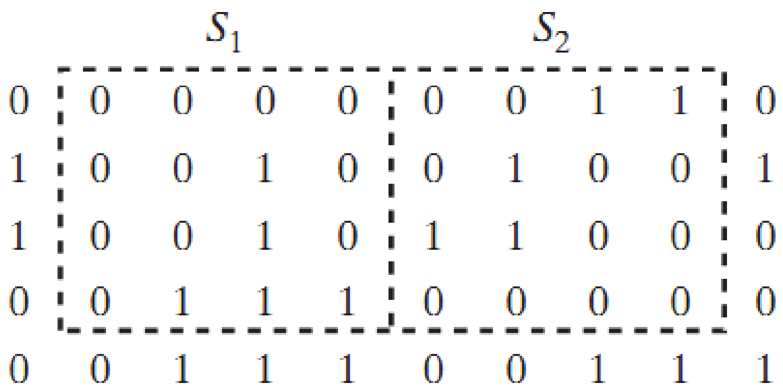
b. Download 6 images (inside Ex1.zip) to your local path in Matlab. Create a new m-file '`Ex1_batch.m`'.

c. Create a function called '`Process`' in this m-file. The function takes an image matrix `I` as an argument and performs the following operations on it:

- scale down to 75% of the original size (`imresize`)
- take the right half of the image and mirror it along the center (`size`, `fliplr`)
- rotate the flipped right half 90 degrees counterclockwise (`imrotate`)
- return the result as the output

d. In the same m-file, but above the function ‘Process’ create a function called ‘Ex1_batch’ without arguments. The function should read the 6 images one at a time inside a for loop, call Process on each and then save the result with the same name, but in bitmap format (*.bmp). (Hint: imwrite, num2str).

3. Binary processing



$$\begin{array}{c|cccc|cccc|c}
 & & S_1 & & & & S_2 & & & \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1
\end{array}$$

Figure 1. Example binary image

a. Create a binary image as shown in Figure 1. Display it properly in only black and white colors without manually resizing. (Hint: imshow)

b. Consider two image subsets as S1 and S2. Implement a function with input parameter S to return the total number of non-zero values in a matrix. Print the output of your function for each subset using fprintf.

c. Load the provided file ‘S.mat’, run your function from b) with new matrix S and show the result.