

# Processing of 2D Signals (Images)

## Lab 3, DSP

### Objective

Students should understand and be able to operate with 2D data (images).

### Exercises

1. Create a chessboard image with each square having size  $5 \times 5$  pixels.
  - black = 0, white = 1
  - show the image with `imshow()`
2. Load the **Lena** image (use `imread()`) and display it (use `imshow()`).
3. Construct a new image based on the **Lena**, but in which each pixel value is set as a linear combination of the original pixels around it, as in the following equation:

$$\begin{aligned} y[i, j] = & \frac{1}{9}x[i-1, j-1] + \frac{1}{9}x[i-1, j] + \frac{1}{9}x[i-1, j+1] \\ & + \frac{1}{9}x[i, j-1] + \frac{1}{9}x[i, j] + \frac{1}{9}x[i, j+1] \\ & + \frac{1}{9}x[i+1, j-1] + \frac{1}{9}x[i+1, j] + \frac{1}{9}x[i+1, j+1] \end{aligned}$$

Ignore the first and last row/column, if needed.

Display the resulting image. How did it change?

4. Repeat the same operation 3 times, and show it every time. How does the image change?

5. Repeat Exercise 2 but change the values of the coefficients to

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

6. Repeat Exercise 2 but change the values of the coefficients to

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

7. Repeat Exercise 2 but change the values of the coefficients to

$$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

## Final questions

1. TBD