

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 5x5 pixels.
 - black = 0, white = 1
 - show the image with `imshow()`
2. Modify the chessboard image to have light gray and dark gray instead of white and black.
3. Create a color image representing the Romanian flag (3 stripes of blue, yellow, red).
4. Load the **Lena** image (use `imread()`) and display it (use `imshow()`).
5. 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?

6. Repeat the same operation 3 times, and show it every time. How does the image change?
7. Repeat Exercise 2 but change the values of the coefficients to

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

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

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

9. 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