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 dows 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

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

10. Create a function `I2 = myfunc(I, h)` which takes an input image `I` of any size and a 3×3 matrix `h` and does the same operation from the previous exercises.

    Test your function with the matrices `h` from the previous exercises and check that it works correctly.

Final questions

1. TBD