Processing of 2D Signals (Images)

Lab 09, DSP

Objective

Students should be able to implement basic low-pass and high-pass filters for 2D data (images).

Exercises

1. Load the `Lena` image (use `imread()`) and display it (use `imshow()`).
2. Implement the following 2D system:

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

   Display the resulting image. What has changed? What type of filter is this?
3. Repeat the same operation 3 times. Display the resulting image. What has changed?
4. Implement the following 2D system:

$$y[i,j] = -\frac{1}{4}x[i-1,j] - \frac{1}{4}x[i,j-1] + \frac{1}{2}x[i,j] - \frac{1}{4}x[i,j+1] - \frac{1}{4}x[i+1,j].$$

   Display the resulting image. What has changed? What type of filter is this?
5. Repeat the same operation 3 times. Display the resulting image. What has changed?

Final questions

1. TBD