TEL411 – Digital Image Processing

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Assignment 3
Due date: Tuesday, October 22, 2020

Exercise 1

Build the Gaussian pyramid (see Fig. 1) in order to decompose a grayscale image:

Analysis/decomposition:

1. Build a 5×5 Gaussian Filter g(x, y) with standard deviation $\sigma = 1$ (Hint: You can use the function "fspeacial").
2. Convolve "cameraman.tif" with the Gaussian filter (Hint: You can use "conv2","imfilter" or your own function).
3. Downsample ($\downarrow$) the rows and columns of the filtered image.
4. Convolve the filtered image with the Gaussian filter.
5. Iterate steps (3)-(4) in order to build $N - 1$ decomposition layers, where $N = 5$ (Note: the G_0 layer is the original image thus you need to generate G_1, G_2, G_3, G_4).

Exercise 2

The Laplacian pyramid was introduced by Burt and Adelson in 1983. It is very similar to Gaussian pyramid but more efficient from the compression point of view.

1. Compute the Laplacian pyramid by subtracting every two sequential layers of the Gaussian pyramid (upsample the downsampled scales, see Fig. 1).

2. Construct 5 Laplacian decomposition layers L_0, L_1, L_2, L_3, L_4 where $L_4 = G_4$.

3. Combine the Gaussian and Laplacian layers to recover the original image G_0.
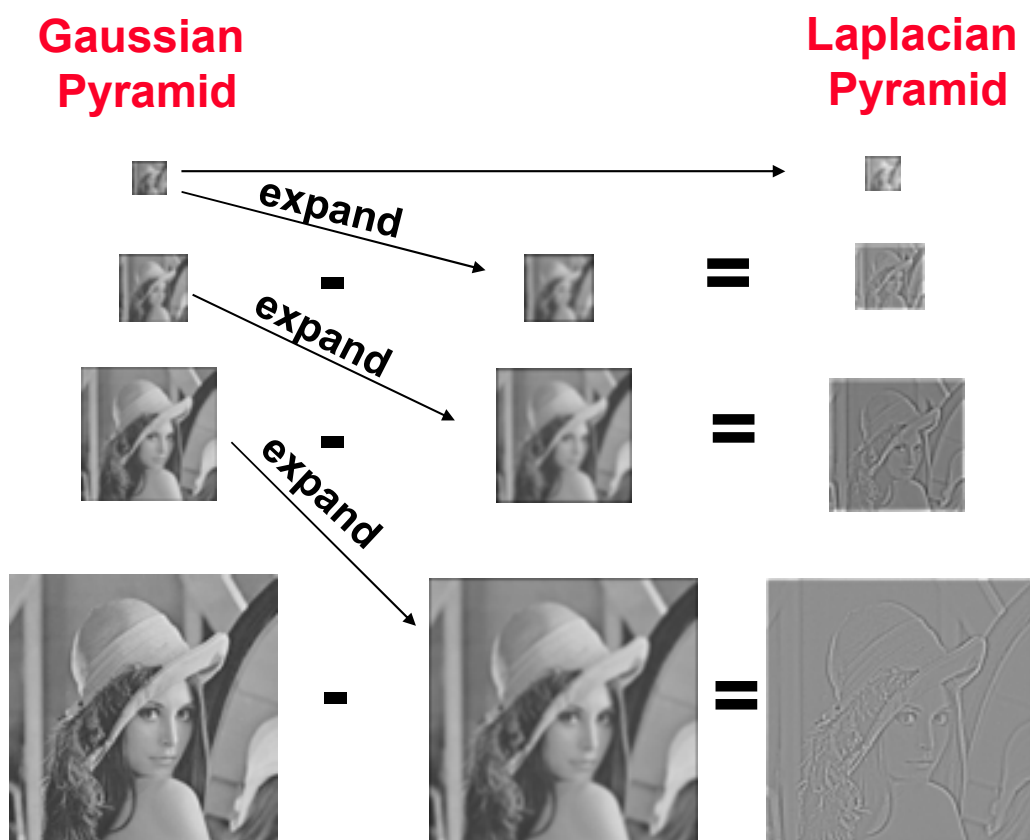

Fig. This example illustrates the Gaussian and the Laplacian pyramid that consists of 4 layers.