

# Pyramidal Image Compression

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Update: Jan. 2006



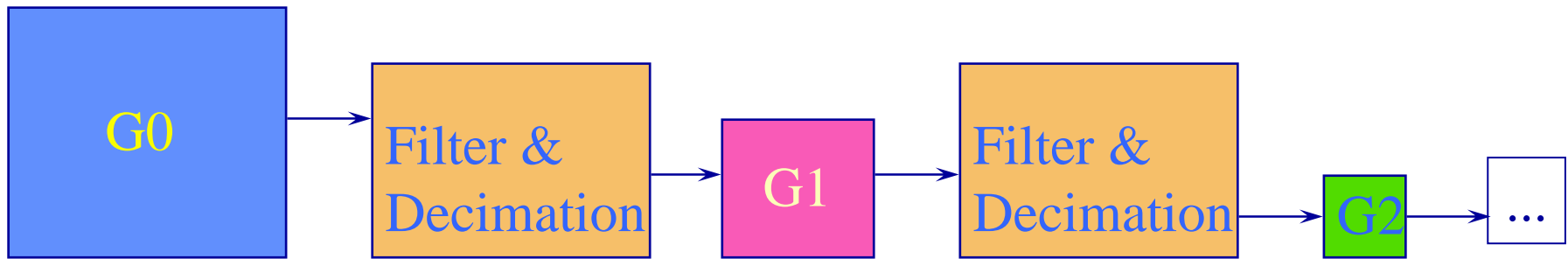
# MultiResolution Representation

- Why ?
  - Resolution too low: critical information is missing
  - Resolution too high: compression needed...

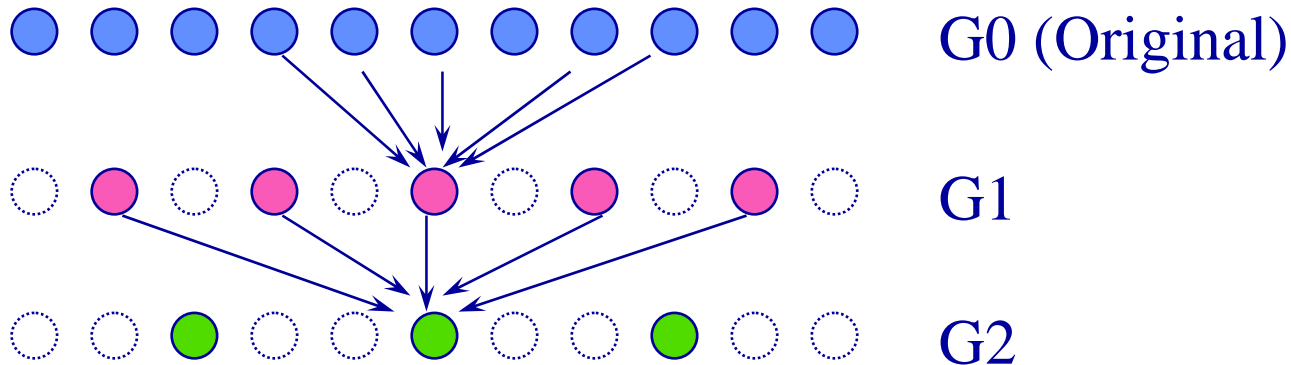


# Gaussian Pyramid

Original Image

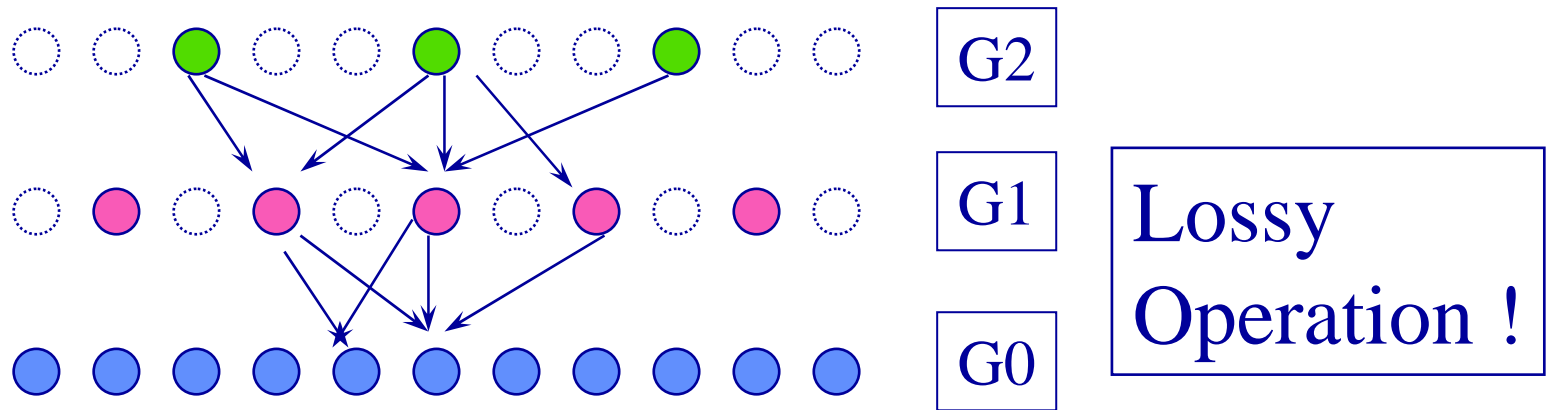


- Decimation (After LP to prevent aliasing):

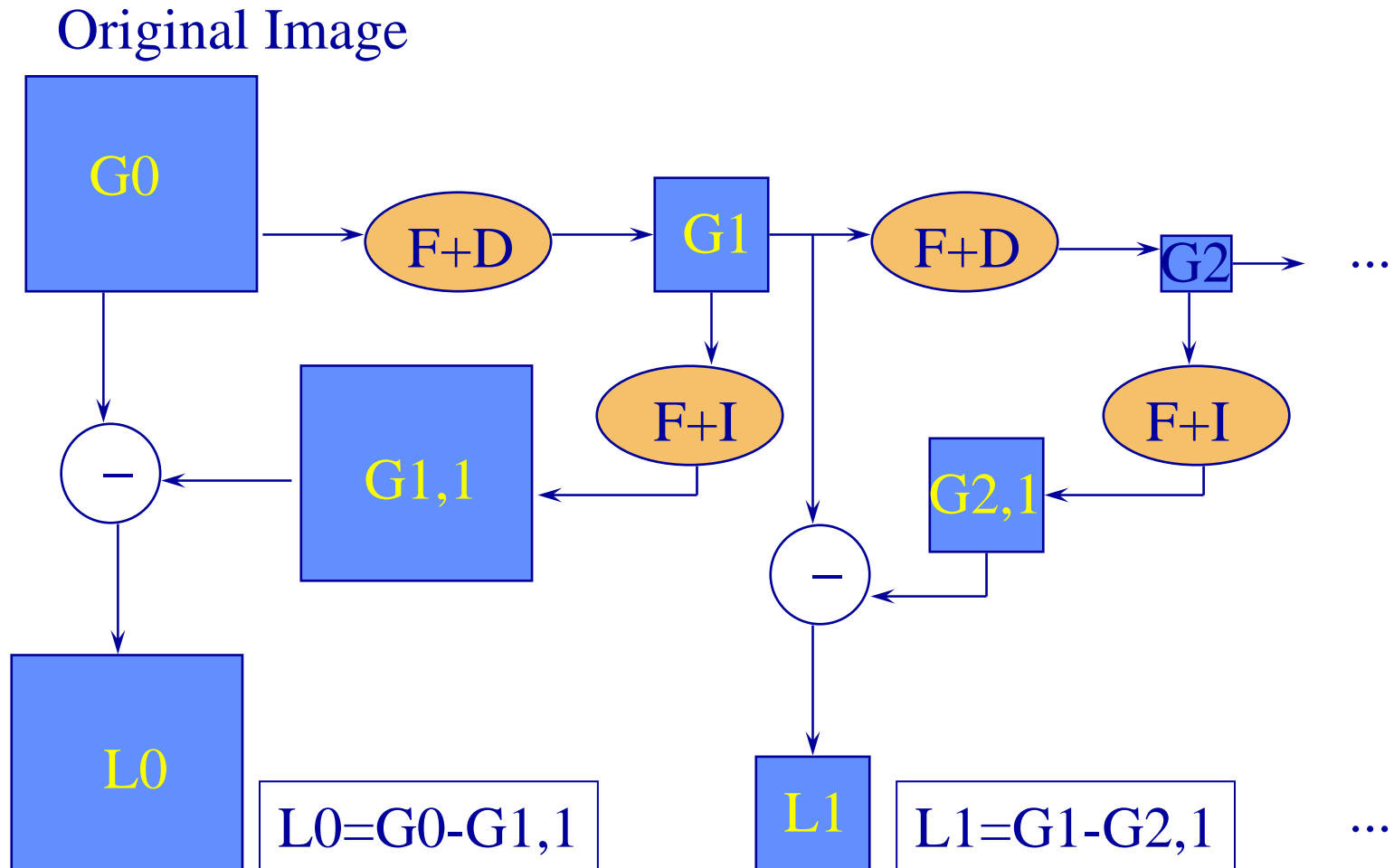


# Expand Operation

- Interpolation with LP Smoothing:



# Laplacian Pyramid



# Transmission Process

- Sending last Gaussian image ( $G_K$ ) which is lowest resolution
- **Successive transmission** of Laplacian difference images till required quality
- A Lossless compression – until the Laplacian difference images are **quantized** !



0

## GAUSSIAN PYRAMID



1



2



3



4



5

Fig. 4. First six levels of the Gaussian pyramid for the "Lady" image. The original image, level 0, measures 257 by 257 pixels and each higher level array is roughly half the dimensions of its predecessor. Thus, level 5 measures just 9 by 9 pixels.

From:

IEEE TRANSACTIONS ON COMMUNICATIONS,  
VOL. COM-31, NO. 4, APRIL 1983

**The Laplacian Pyramid as a Compact Image Code**

**PETER J. BURT, MEMBER, IEEE, AND EDWARD H. ADELSON**

# First 4 levels of the G-L Pyramid

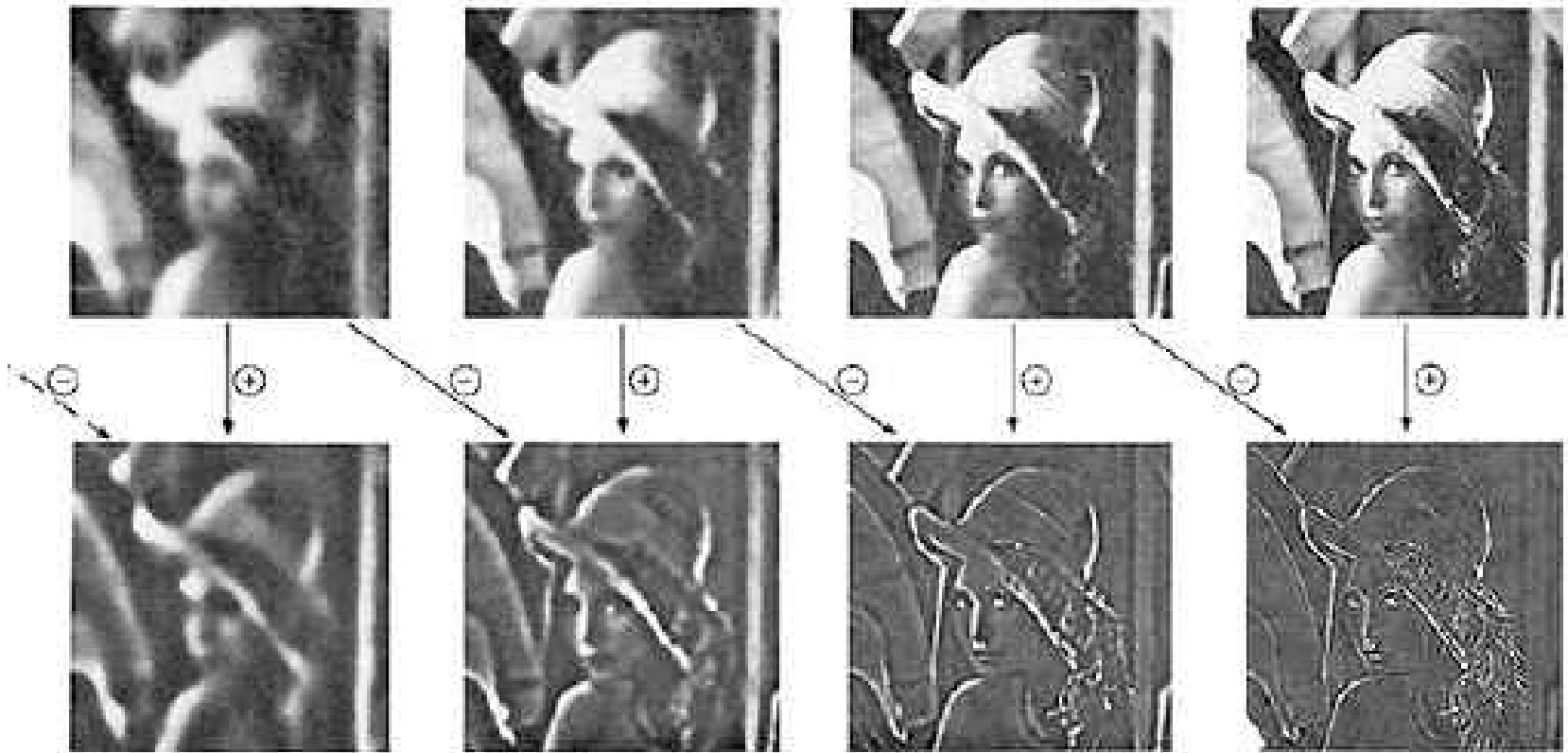


FIG. 1. First four levels of the G-L Pyramid. The original image is shown at the top, and the corresponding edge-detection images are shown at the bottom. The signs (+ and -) indicate the operations used in the pyramid construction.



# Progressive Image Transmission



Fig. 9.1. A pyramid code applied to progressive image transmission. High levels of the pyramid are transmitted first to give the receiver a quick but very coarse rendition of the image. The receiver's image is then progressively refined by adding successively lower pyramid levels as these are transmitted. In the example shown here, the leftmost figure shows reconstruction using pyramid levels 4-5, or just 0.03 bits/pixel. The following four figures show the reconstruction after pyramid levels 3, 2, 1, and 0 have been added. The cumulative data rates are shown under each figure in bits per pixel.