

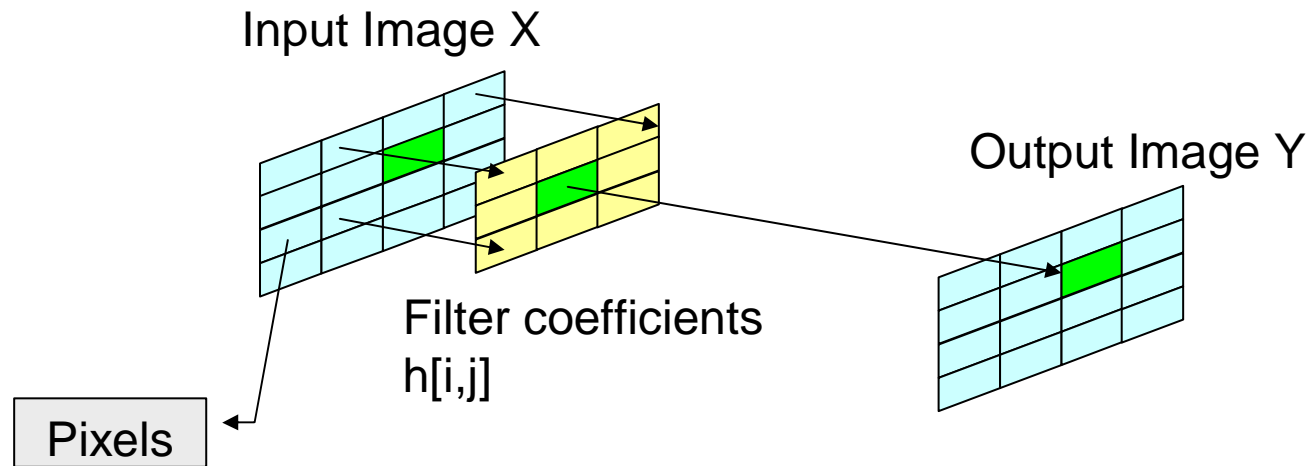
Digital Image Filters (Convolution Based Method)

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Filtering in Images

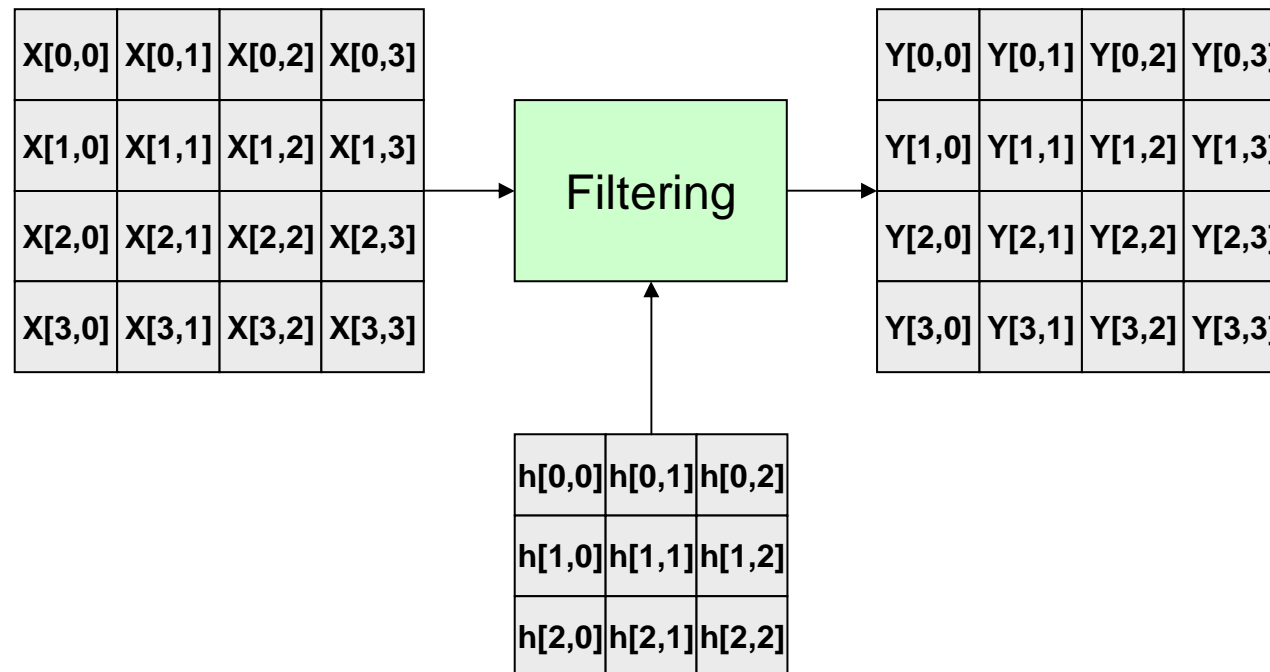
- Convolution between images and 2D filter coefficients
 - 2D filter coefficients have another names: mask, kernel, template, or window
- Separable Filter
 - 1D filter used for images
 - Row filtering followed by column filtering

Basics of Spatial Filtering

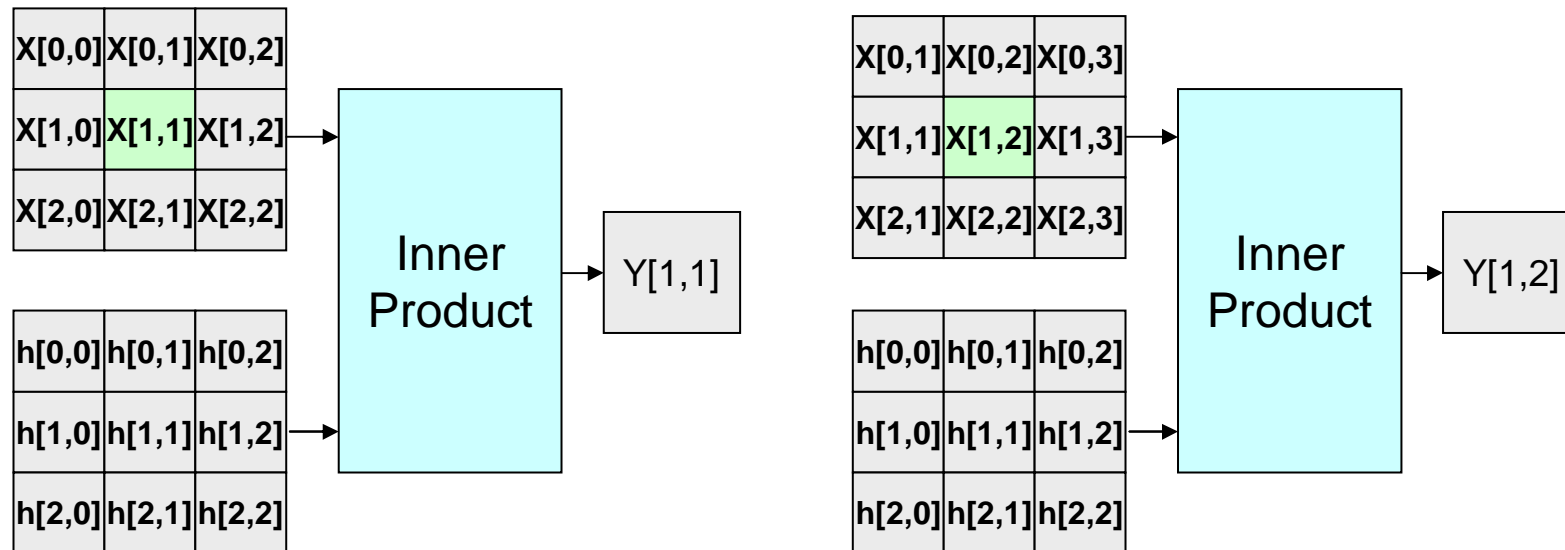


$$Y[i,j] = \text{Operation}(X[i,j], h[i,j])$$

Basics of Spatial Filtering

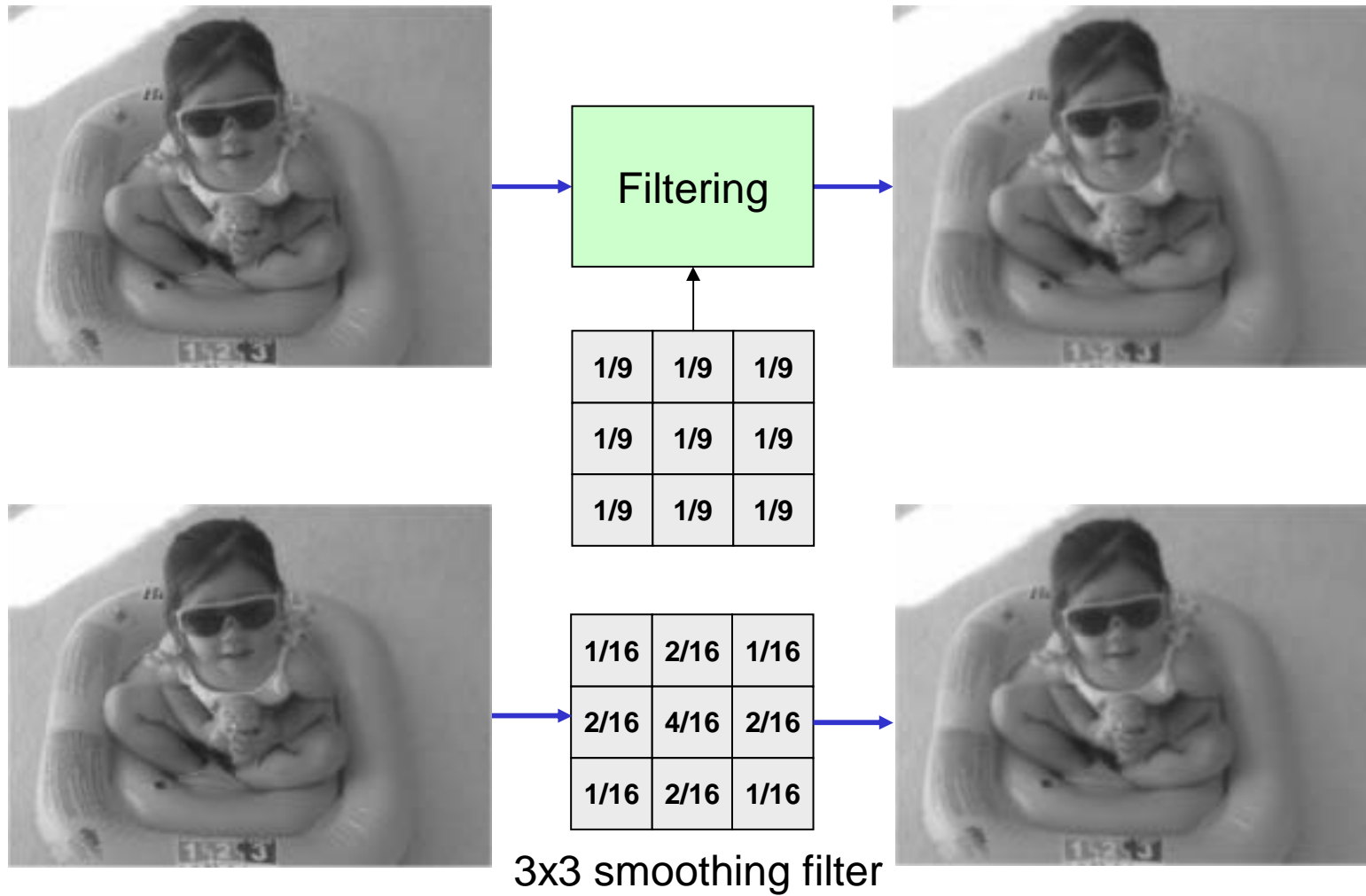


Basics of Spatial Filtering

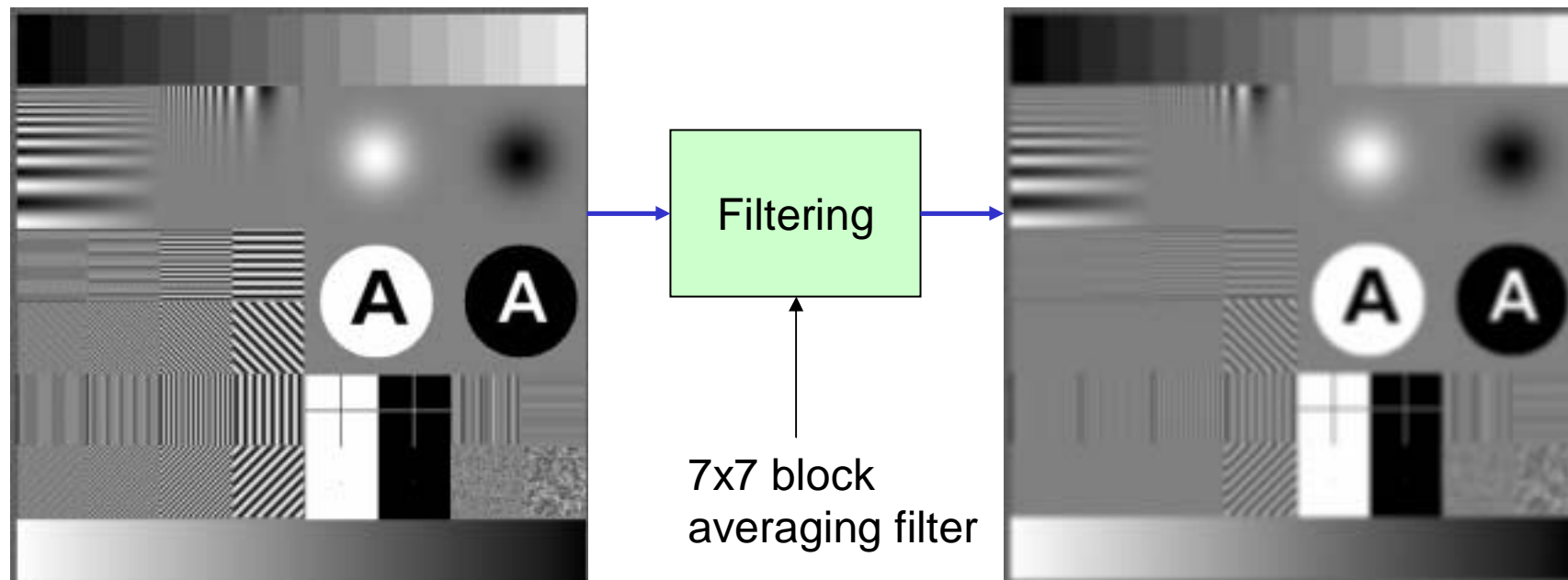


Low Pass Filter

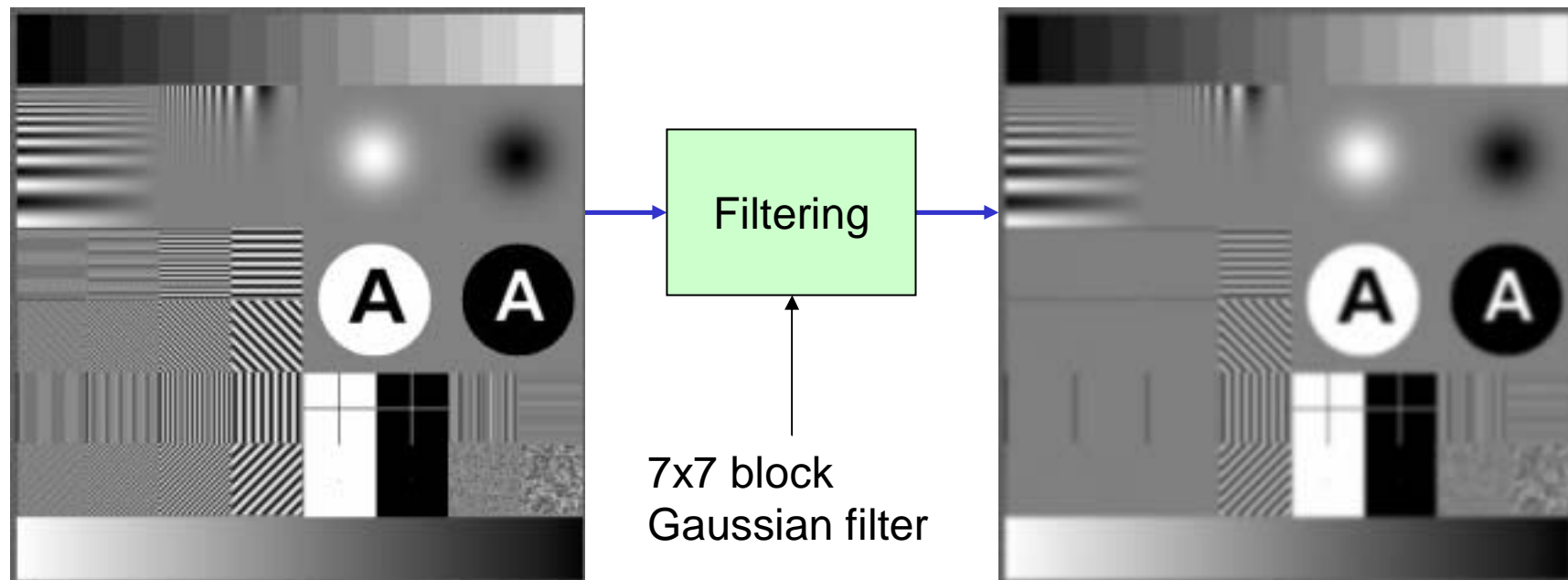
3x3 block averaging filter



Low Pass Filter

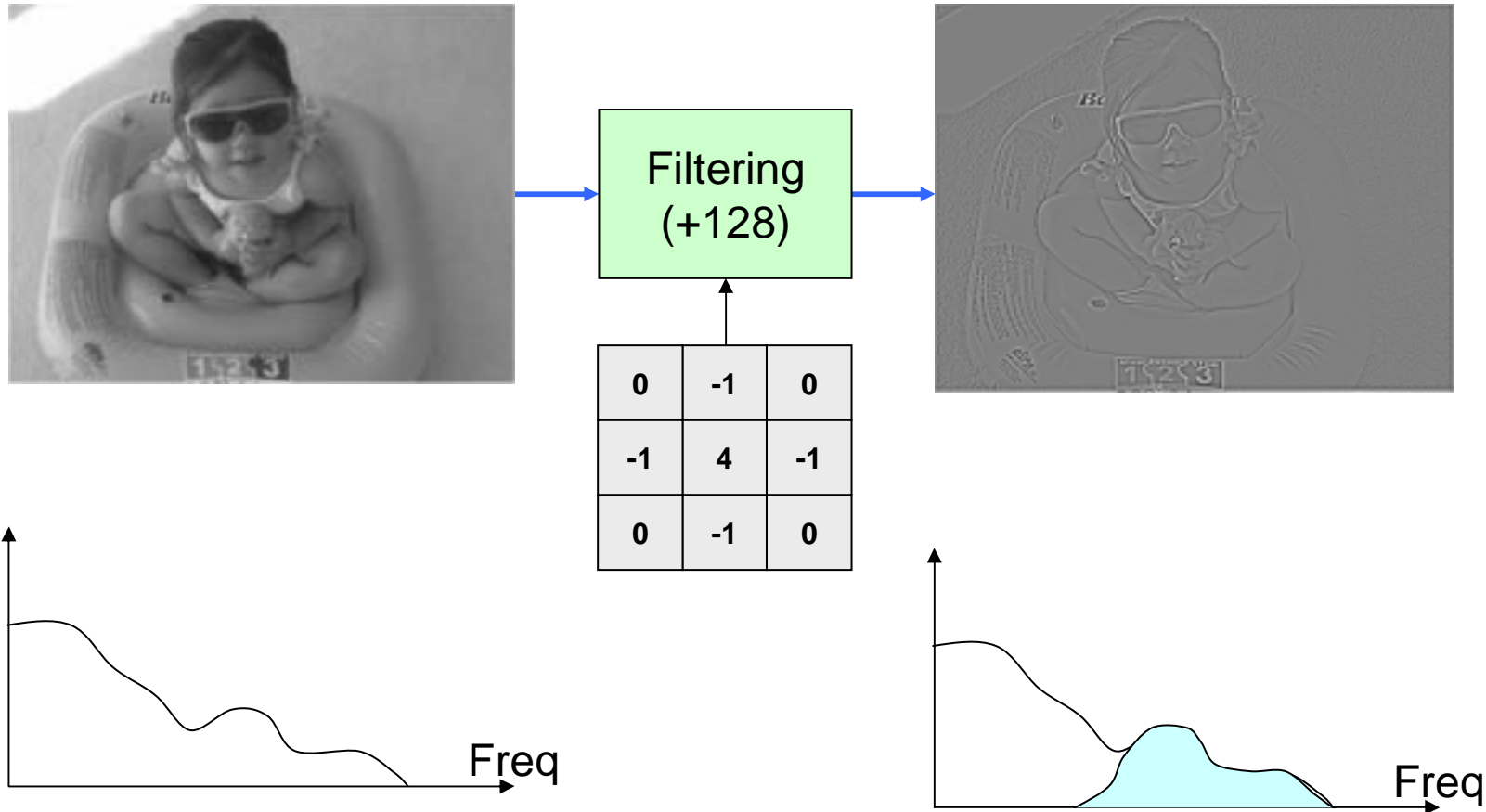


Low Pass Filter

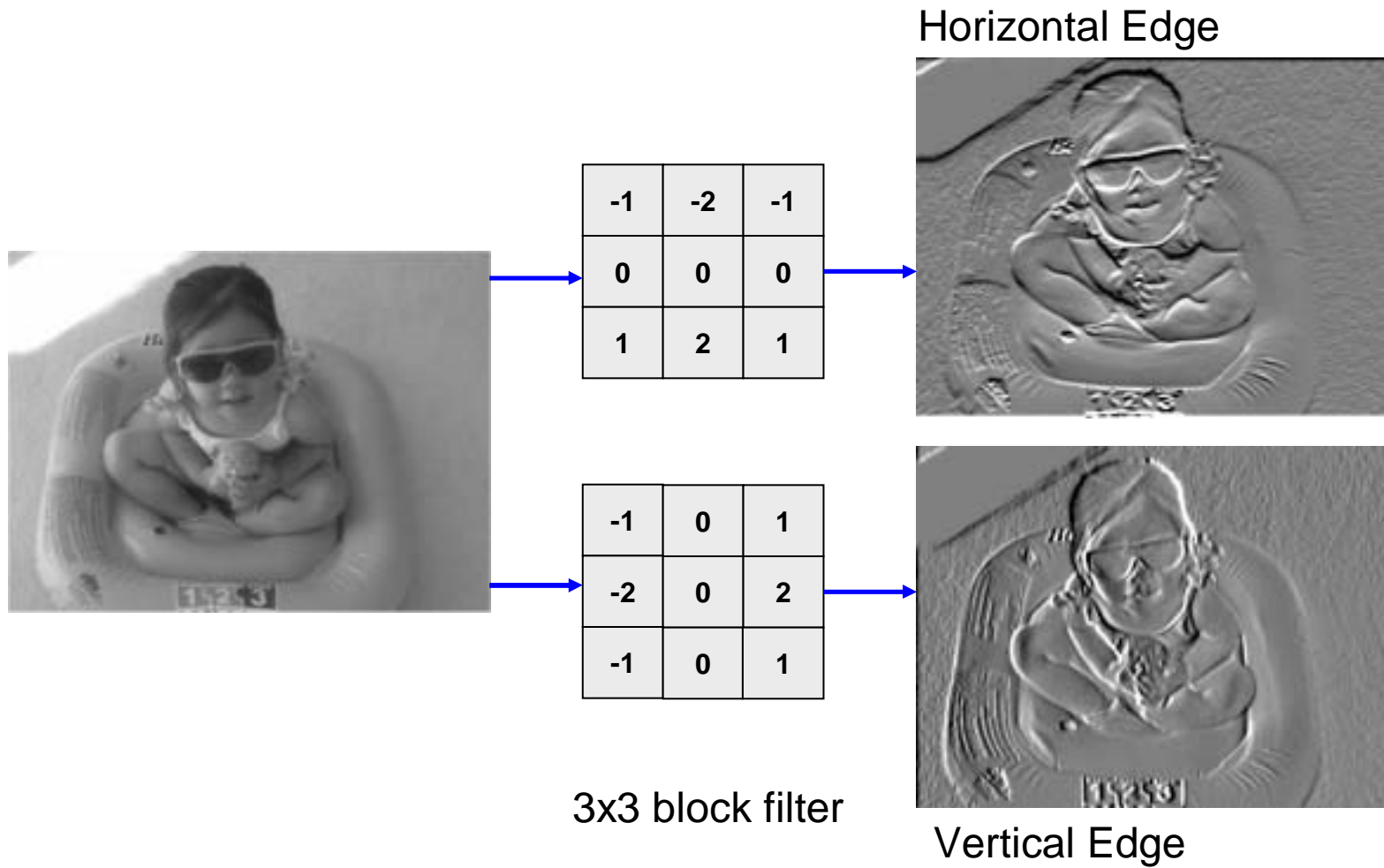


High Pass Filter

3x3 block filter

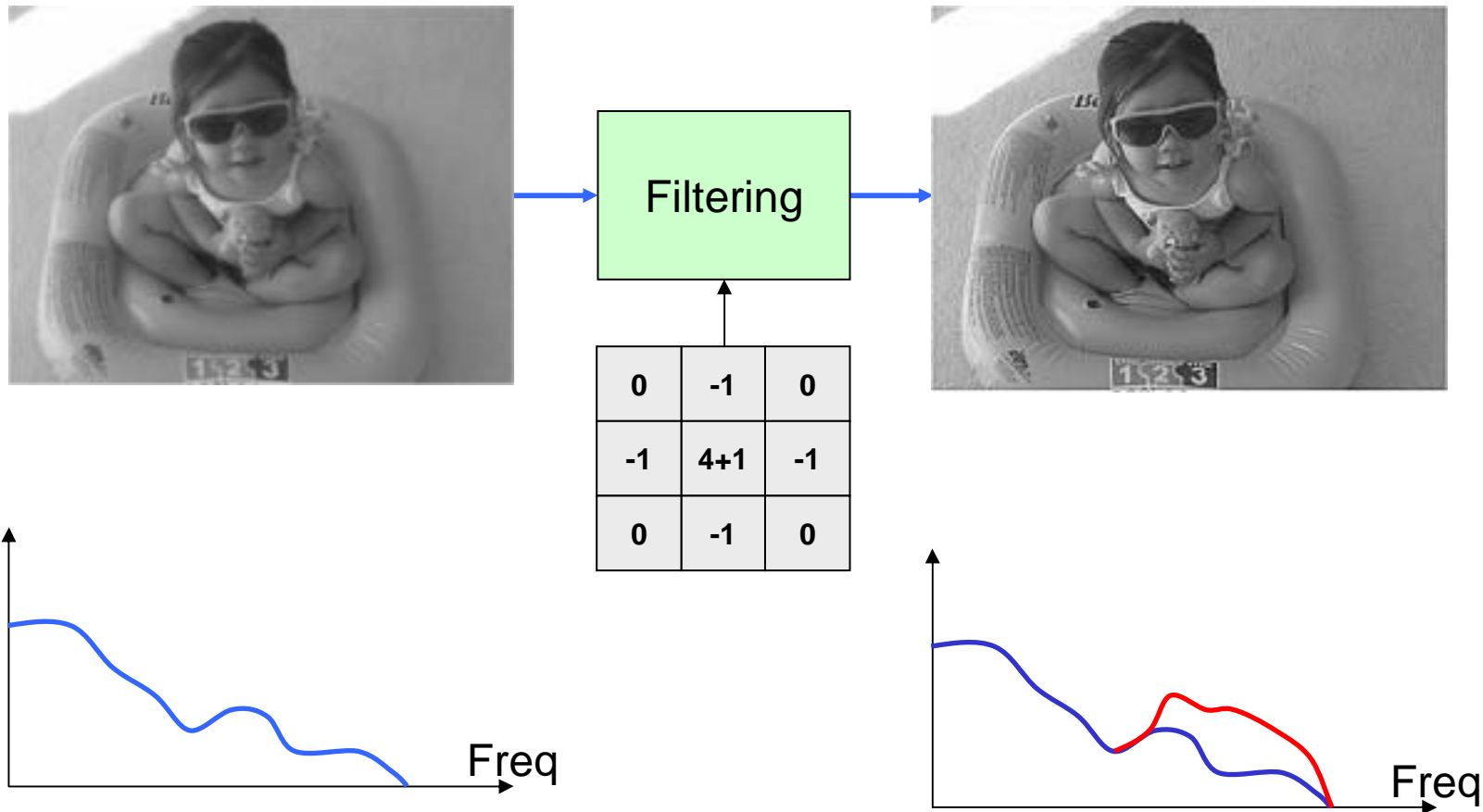


High Pass Filter



High Enhancement Filter

3x3 block filter



Separable Filter

1	2	1
2	4	2
1	2	1

 $=$

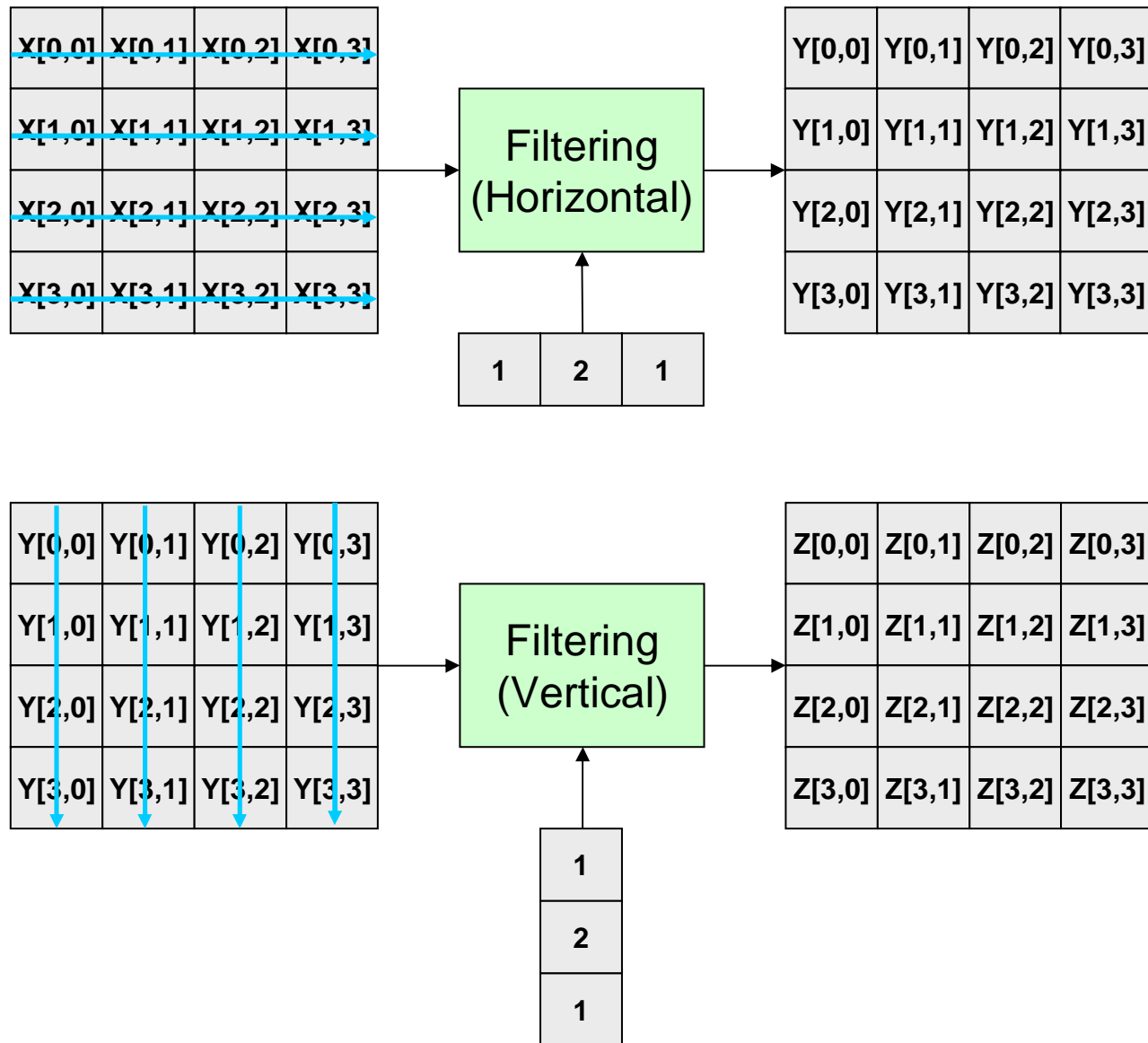
1
2
1

 \times

1	2	1
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$$\begin{pmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} \times \begin{pmatrix} 1 & 2 & 1 \end{pmatrix}$$

Separable Filter



Summary

- Image Filtering
 - Filter coefficients, Mask, etc
- Low Pass Filter
- High Pass Filter
- High Enhancement Filter