

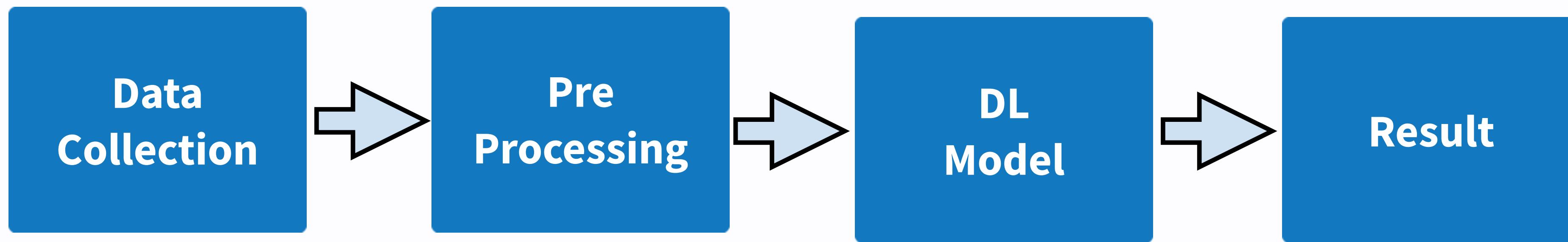
Practices in visual computing 1

Fall 2022

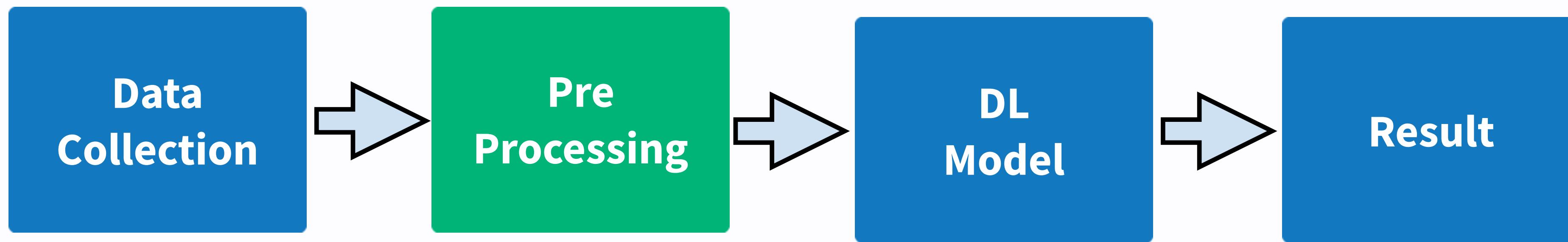
Lab Session #2: Numpy and OpenCV

Slides Prepared by Mehdi Safaee

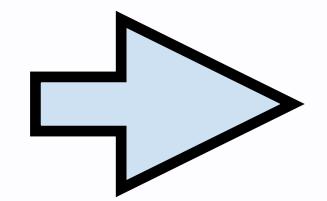
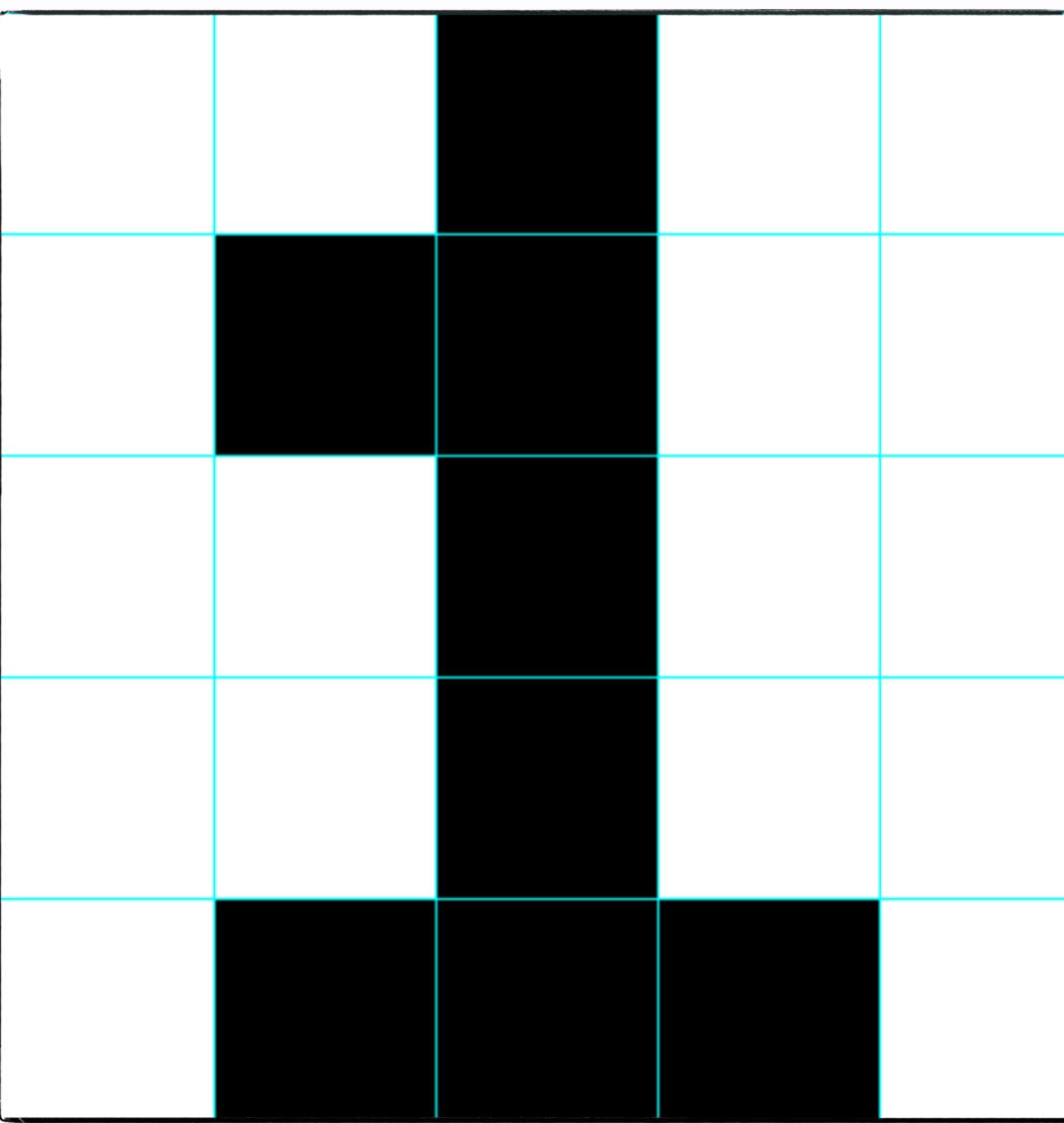
Modern machine learning pipelines



Modern machine learning pipelines



Basics of digital images



0	0	1	0	0
0	1	1	0	0
0	0	1	0	0
0	0	1	0	0
0	1	1	1	0

Image intensity

In an image, intensity of a pixel is defined as the value of the pixel. (e.g. 0 to 255 in grayscale images)



Color images

Color images in the simplest form, are represented by a matrix, each with an intensity value of [0-255]

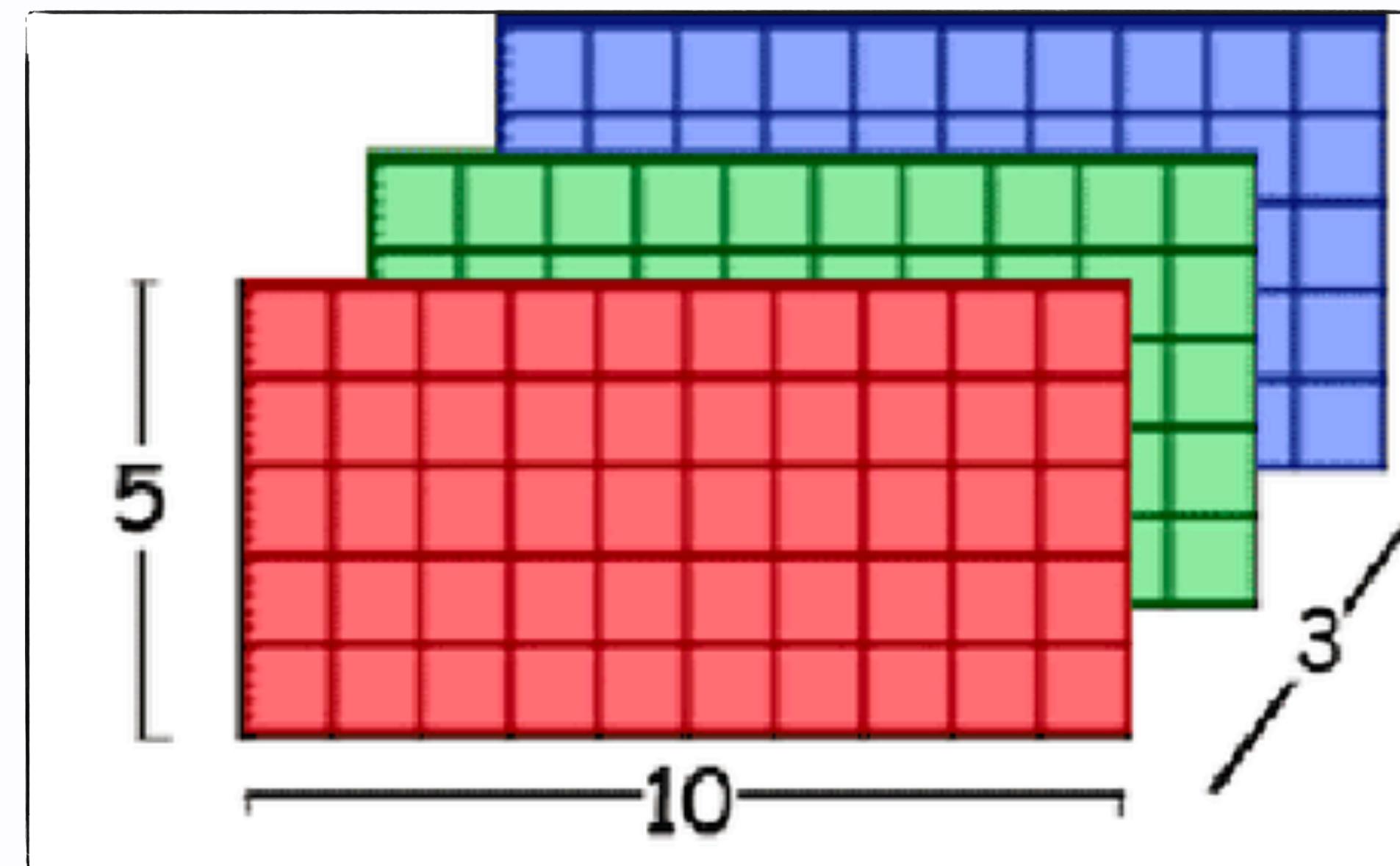
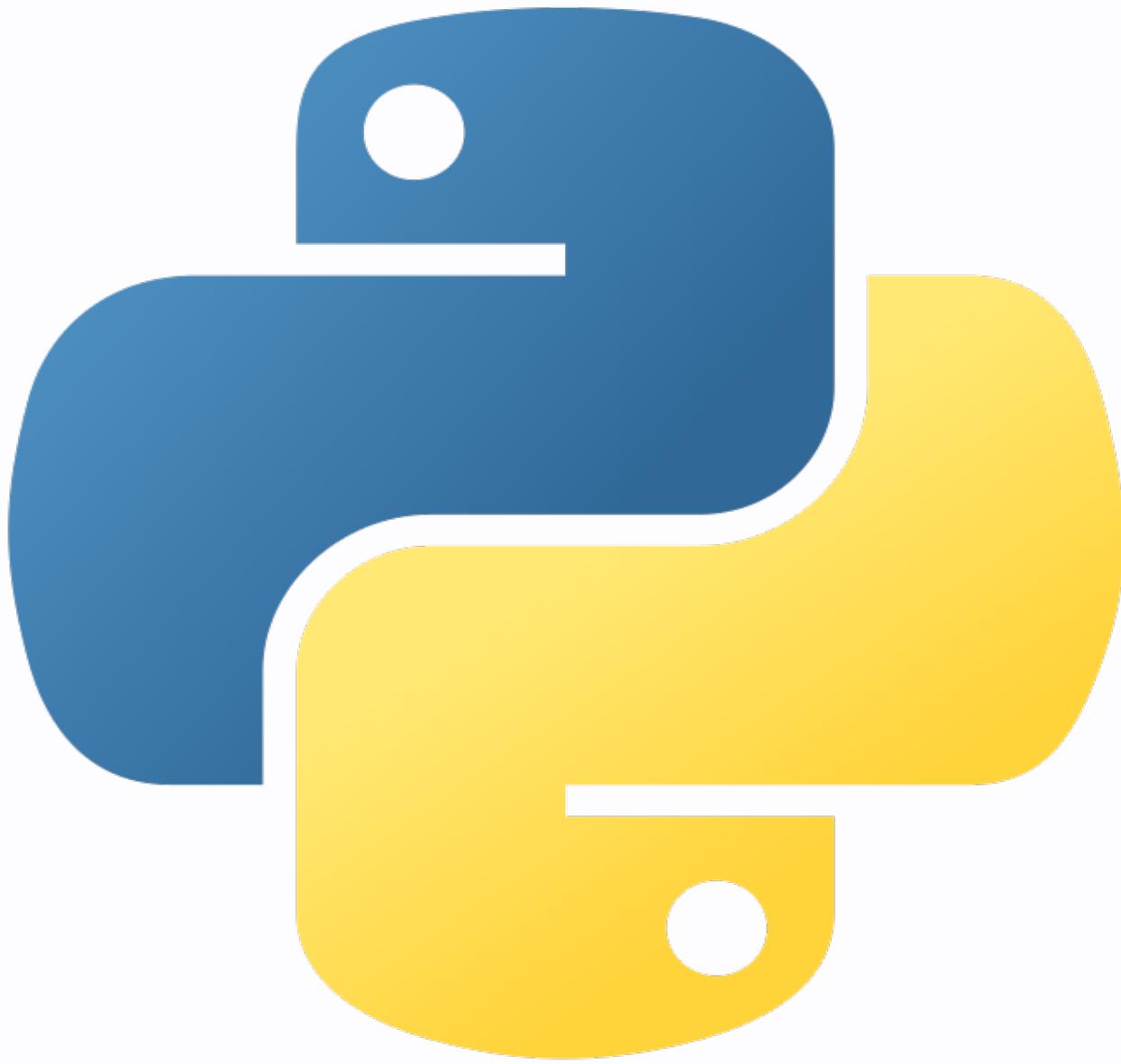


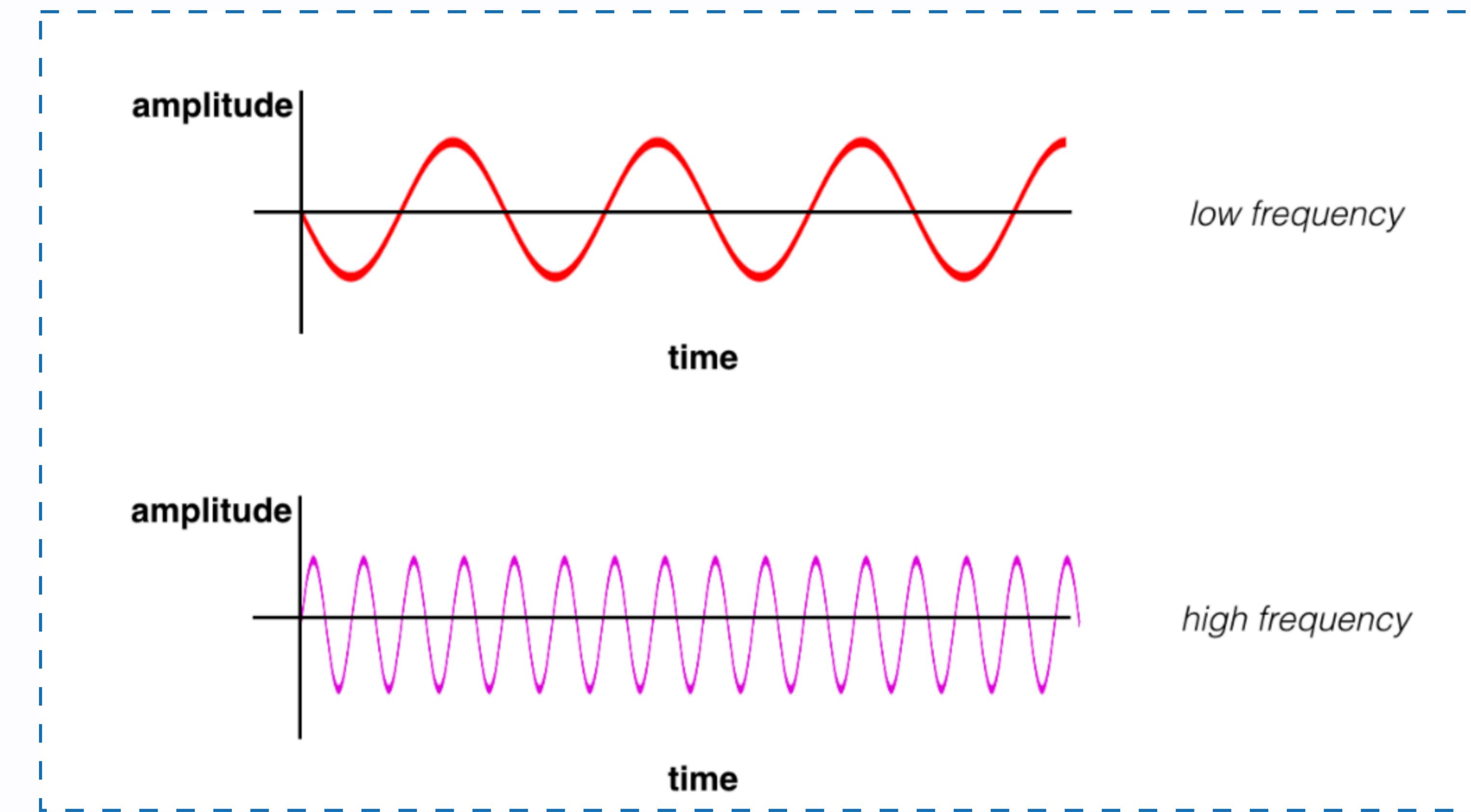
Image manipulation tools



Lets walk through some examples



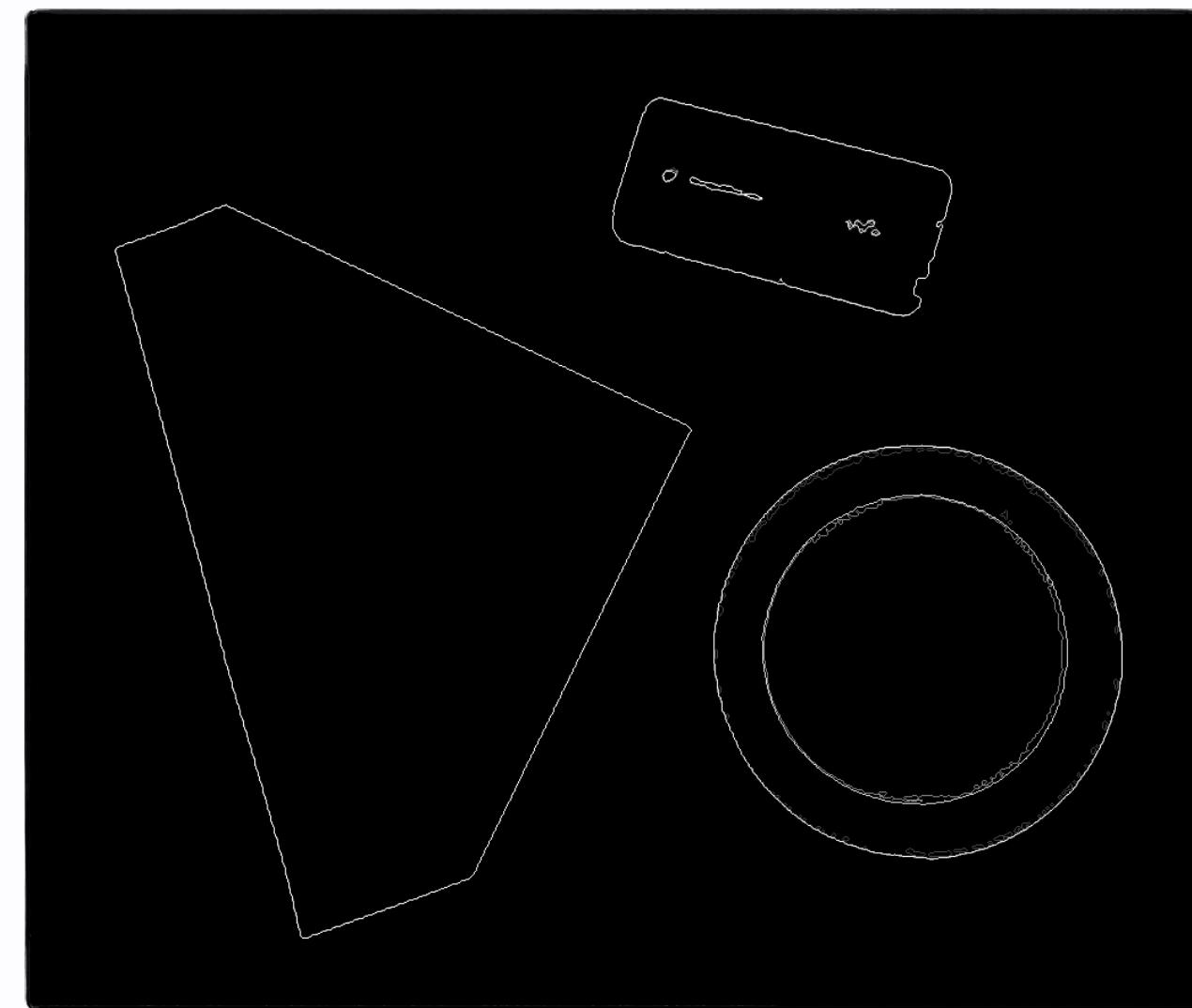
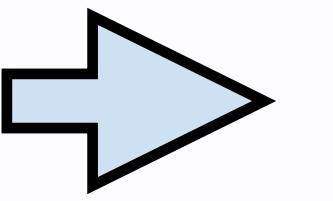
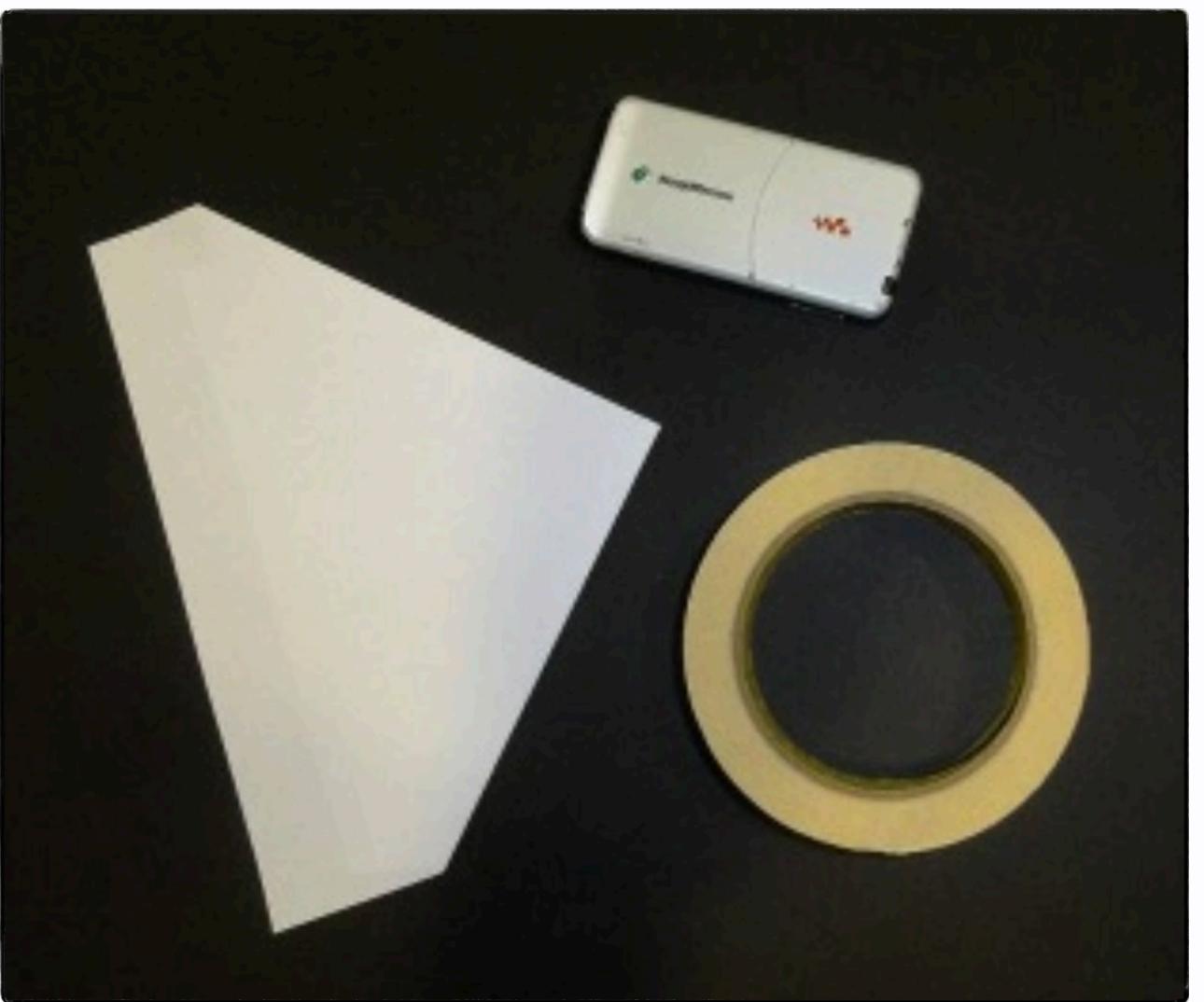
Frequency in signals



Frequency in images



High-pass filters in images



Edge detection

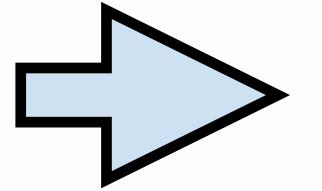
Filtering is done through convolution. Here we have an edge detector convolution kernel:

0	-1	0
-1	4	-1
0	-1	0

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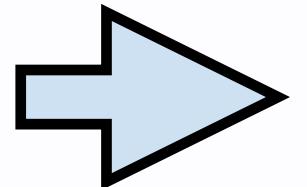


41	42	38	35	34	33
51	57	59	58	55	49
56	64	67	59	58	55
55	62	66	67	66	61
43	50	52	52	49	46

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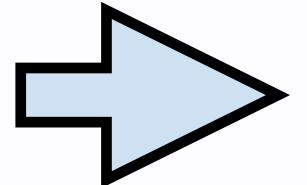


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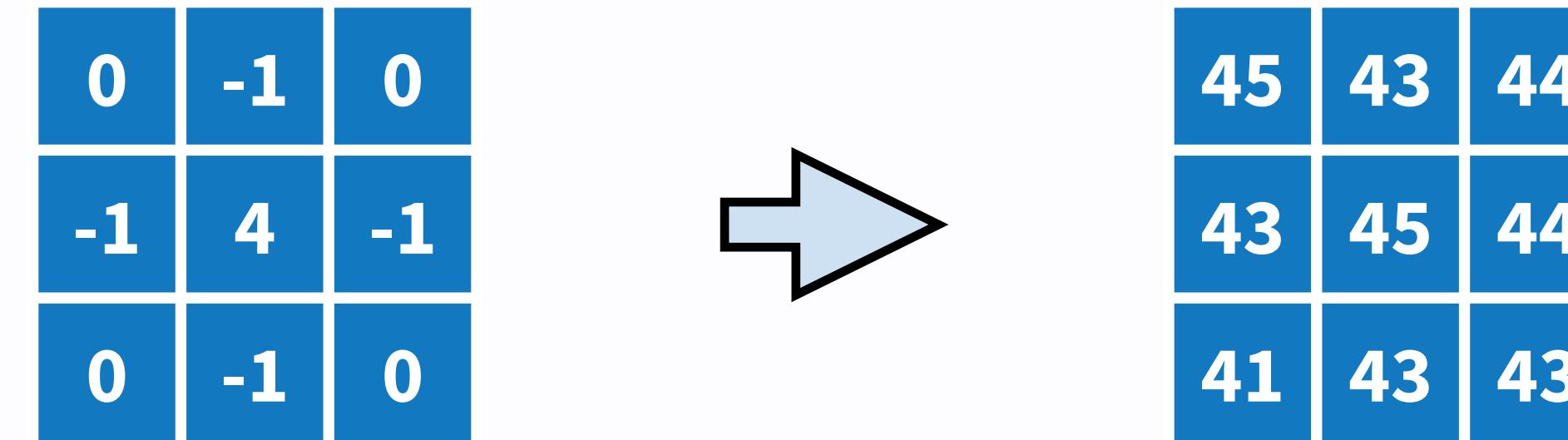


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55	62	66	67	66	61
43	50	52	52	49	46

$$4 \times 57 - 42 - 49 - 51 - 64 = 22$$

Why edge detection works?

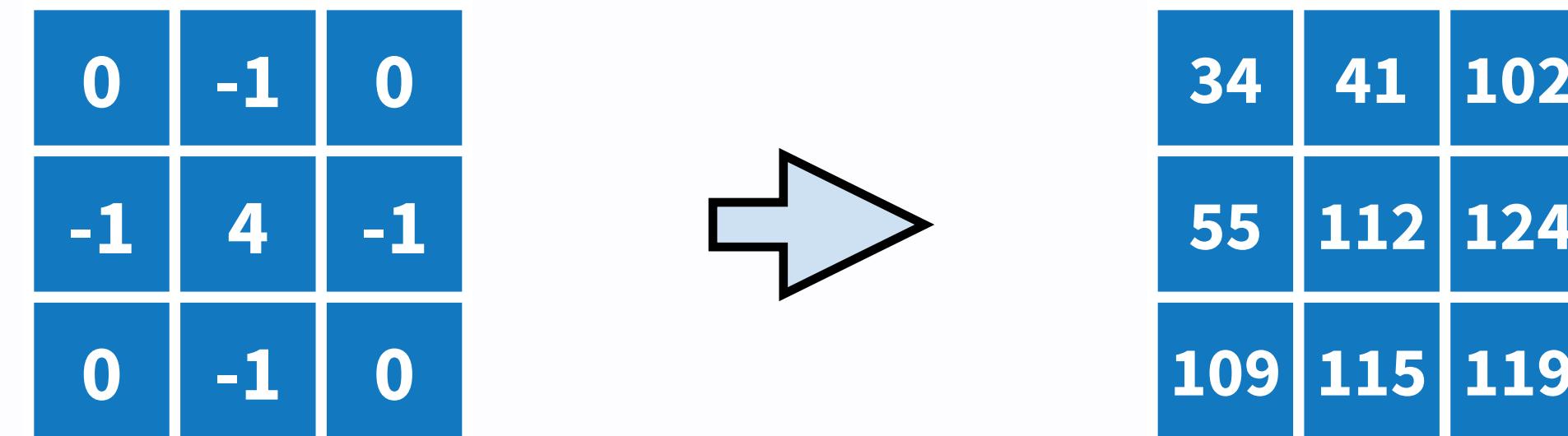
Filtering is done through convolution. Here we have an edge detector convolution kernel:



$$4 \times 45 - 43 - 43 - 44 - 43 = 7$$

Why edge detection works?

Filtering is done through convolution. Here we have an edge detector convolution kernel:



$$4 * 112 - 124 - 115 - 41 - 55 = 113$$

Box blur and Gaussian blur

$$\frac{1}{9} \times \begin{matrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{matrix}$$

$$\frac{1}{16} \times \begin{matrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{matrix}$$