

IMAGES, FILTERS, AND MANIPULATING PIXELS

AUDIO VISUAL PROGRAMMING

IMAGE DEFINITION

An image is a visual representation of something



Landscape



Us



Objects

COMPUTER IMAGES DEFINITION

An image is a picture that has been created or copied and stored in electronic form
An image is therefore computer graphics

Raster



Vector



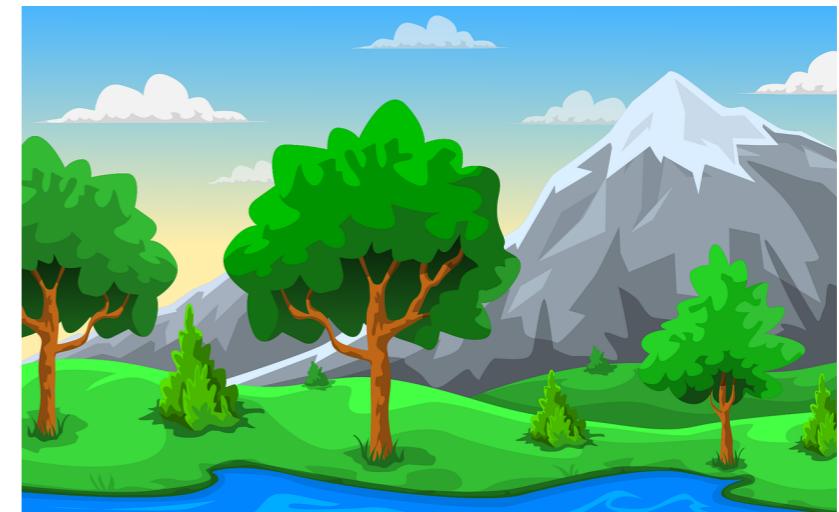
RASTER IMAGES

Raster images are created using pixels containing a position, unique colour, and tonal information that come together to create the image.

JPG/JPEG



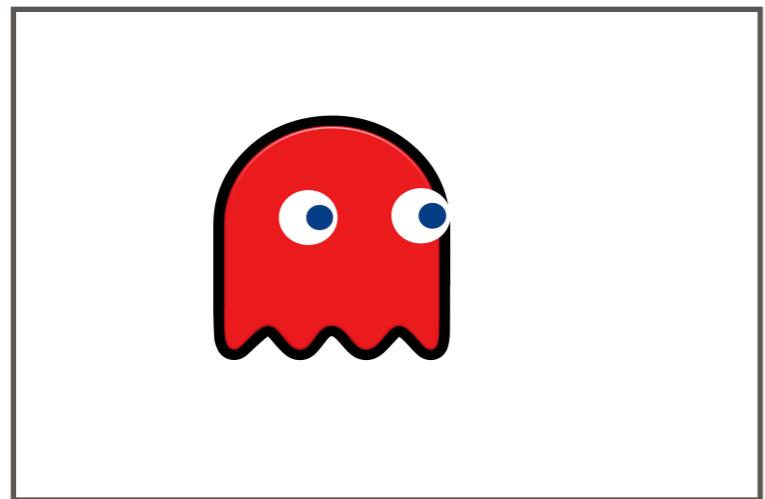
PNG



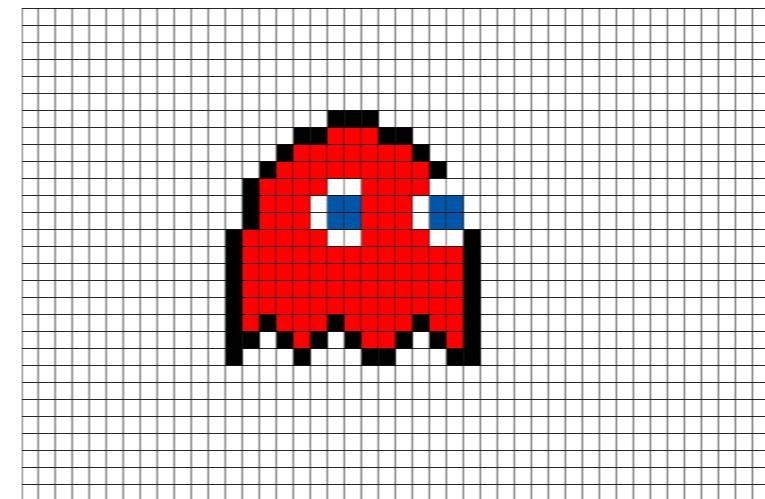
- ▶ Joint Photographic Experts Group (JPEG)
- ▶ Supports 16,777,216 colors
- ▶ Lossy Compression
- ▶ Lower file size

- ▶ Portable Networks Graphics (PNG)
- ▶ Supports 16,777,216 colors + alpha
- ▶ Lossless Compression
- ▶ Larger file size

IMAGE TO DATA



Visual Representation

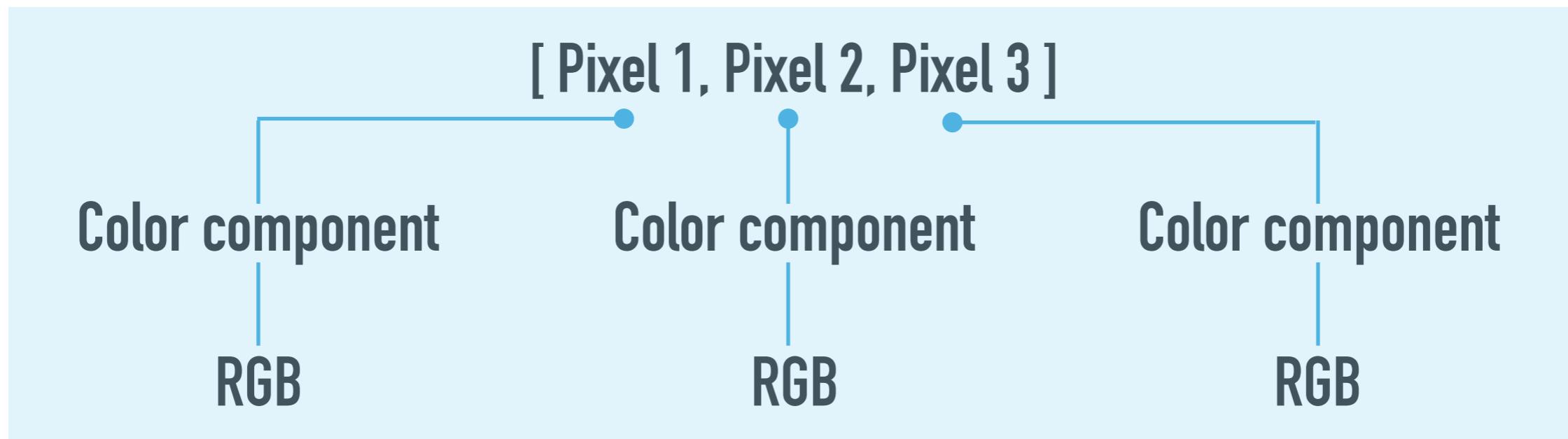


Raster or Bitmap Image

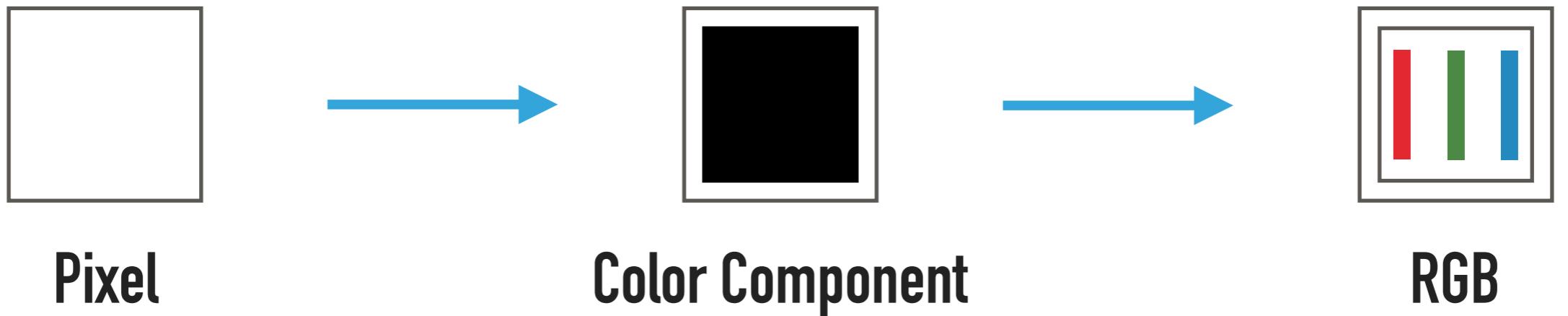
A computer only understands binary language, how can it store all the colour information and in what format?

IMAGE TO DATA

- ▶ 1) A collection to store each image pixel
- ▶ 2) Each pixel in the collection has a colour component
- ▶ 3) Each colour has a tone of red, green, and blue



RGB COMPONENT



RGB COMPONENT



RGB(255,0,0)

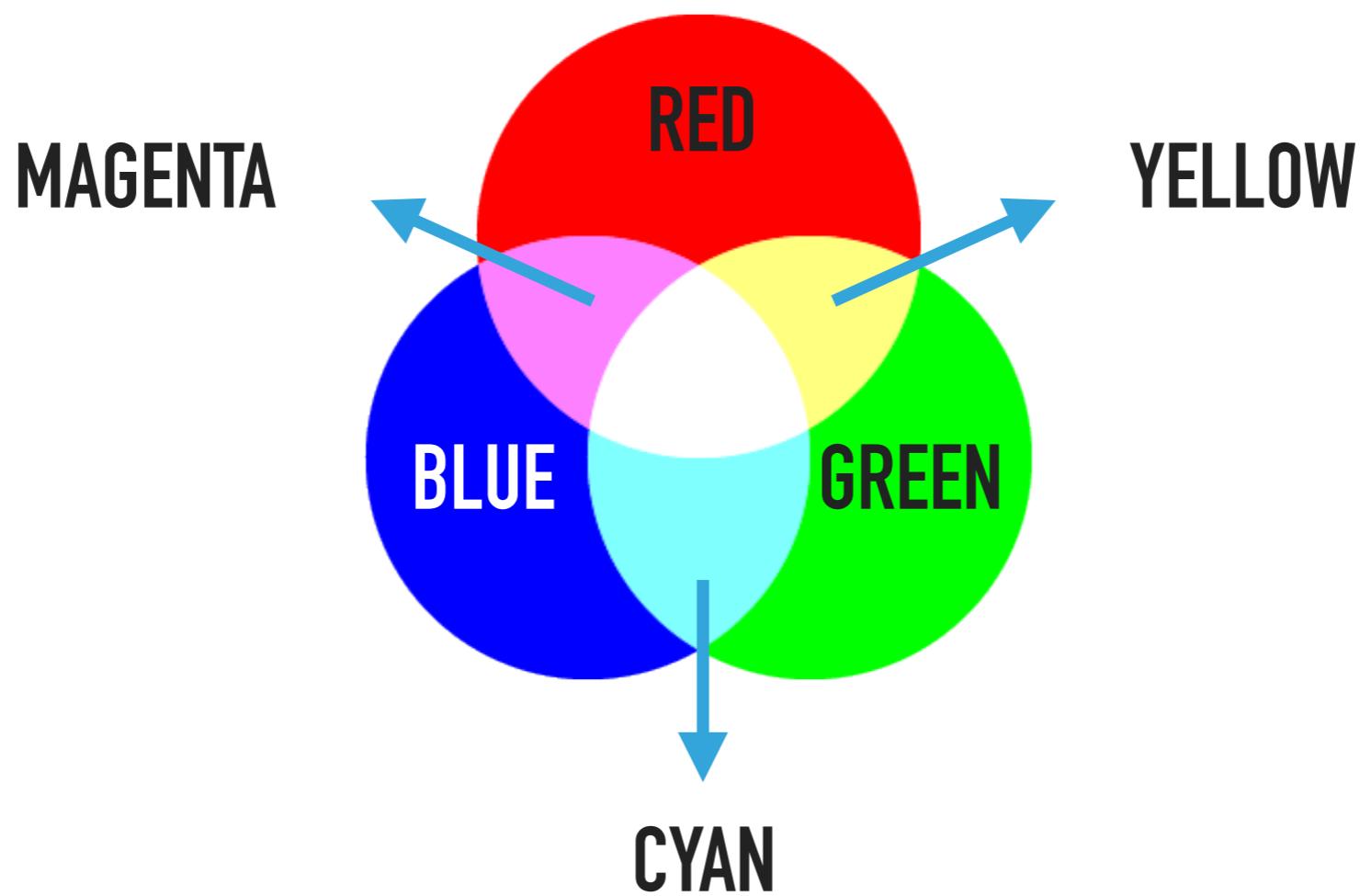
RGB(0,255,0)

RGB(0,0,255)



ADDITIVE COLOUR SYNTHESIS

Additive colour synthesis describes the creation of colour by the mixing of two or more coloured light sources.



HOW MANY COLOURS?



X

256



X

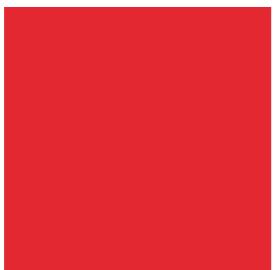
256



256

16,777,216

HOW DO WE STORE IT?



✗

256

00000000

8 bits

1 byte



✗

256

00000000

8 bits

1 byte



256

00000000

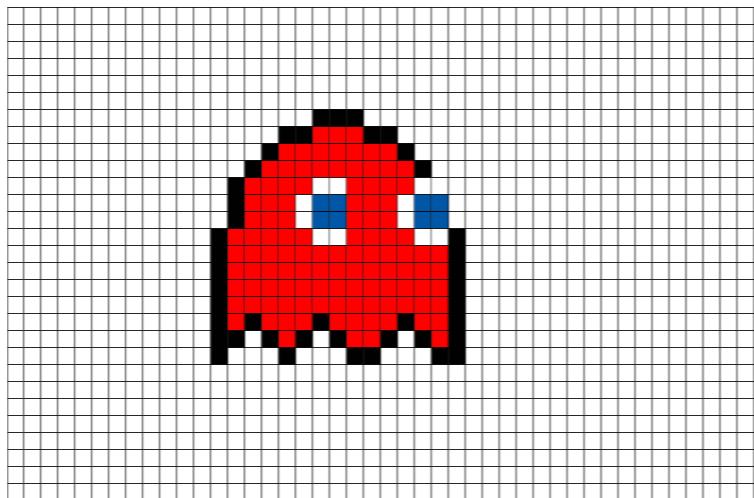
8 bits

1 byte

A single pixel is therefore 3 bytes if the alpha value is not considered

IMAGE TO DATA

Pixel Vertically



Pixel Across



[RGB(r, g, b), RGB(r, g, b),
RGB(r, g, b), RGB(r, g, b),
RGB(r, g, b), RGB(r, g, b),
RGB(r, g, b), RGB(r, g, b), ...]

Array size = Pixel Across * Pixel Vertically

MANIPULATING PIXELS

CANVAS 2D



LOAD IMAGES

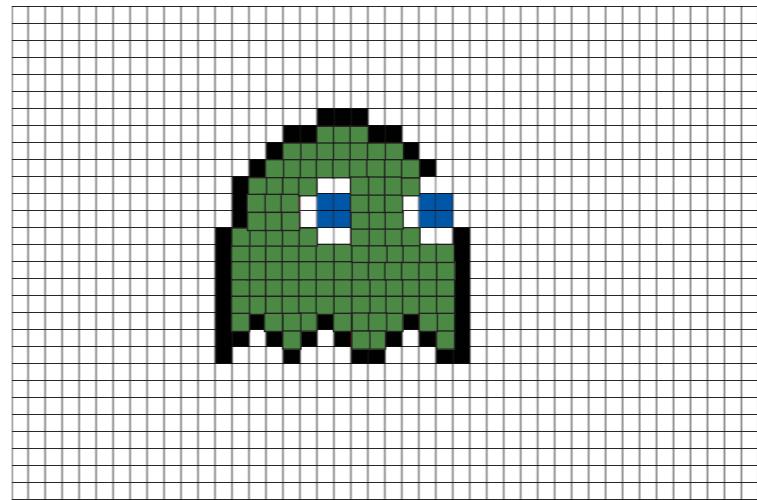
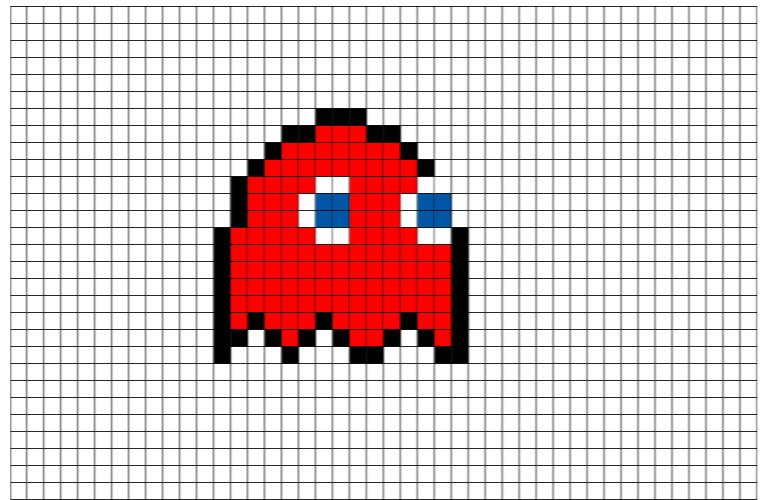


GET THE ARRAY OF PIXELS



MANIPULATE THE ARRAY OF PIXELS

MANIPULATING PIXELS



ARRAY OF PIXELS.length



$\text{PIXEL}[i].r = 255$

YES

NO

$\text{PIXEL}[i].r = 0$

$\text{PIXEL}[i].g = 255$

$\text{PIXEL}[i].b = 0$

$\text{PIXEL}[i]$

FILTERS AND KERNEL CONVOLUTION

- ▶ Kernel convolution is a general purpose filter effect for images
- ▶ It is the application of a matrix to an image, resulting in a mathematical operation comprised by integers
- ▶ It works by determining the value of a central pixel by adding the weighted values of all its neighbours together
- ▶ The output of the calculation is a new modified filtered image

FILTERS AND KERNEL CONVOLUTION

3 X 3

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Kernel Matrix



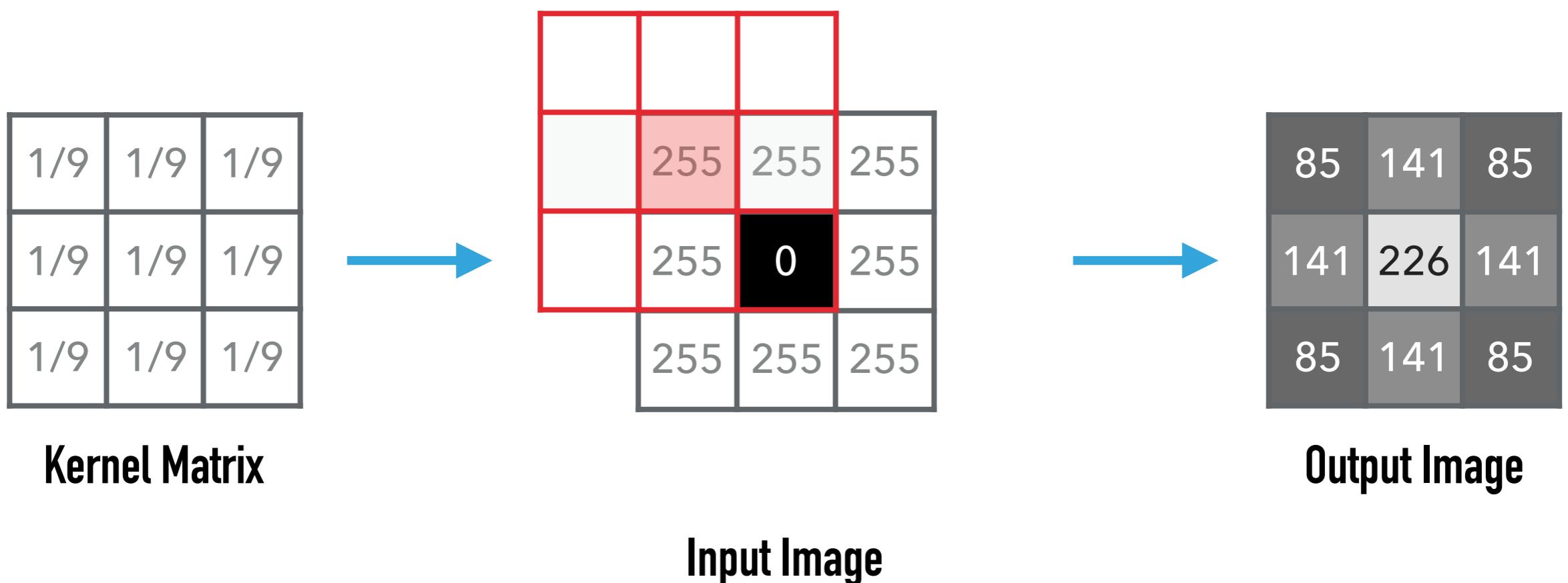
Apply the matrix to the image

3 X 3

255	255	255
255	0	255
255	255	255

Image

FILTERS AND KERNEL CONVOLUTION



FILTERS AND KERNEL CONVOLUTION



1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Kernel Matrix



DIFFERENT KERNELS

0	0	0
0	1	0
0	0	0

Identity

0	-1	0
-1	5	-1
0	-1	0

Sharpen

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Box blur

-1	-1	-1
-1	8	-1
-1	-1	-1

Edge Detection

-2	-1	0
-1	1	1
0	1	2

Emboss

x	x	x
x	x	x
x	x	x

Custom