Upsampling

Upsampling

Why is it needed?

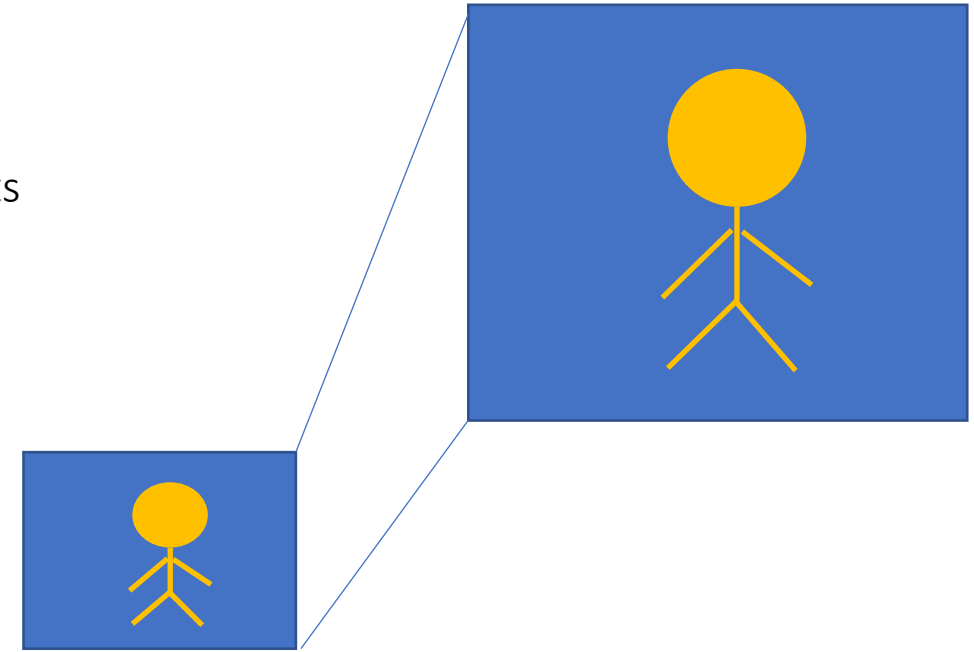
- Contraction path (encoding) consists of convolutional and pooling layers

→ resolution gets smaller and smaller

→ good knowlegde of what area represents

- final image shall have same dimensions as input image

→ upsampling required to fit the location (WHERE) to the classes (WHAT)

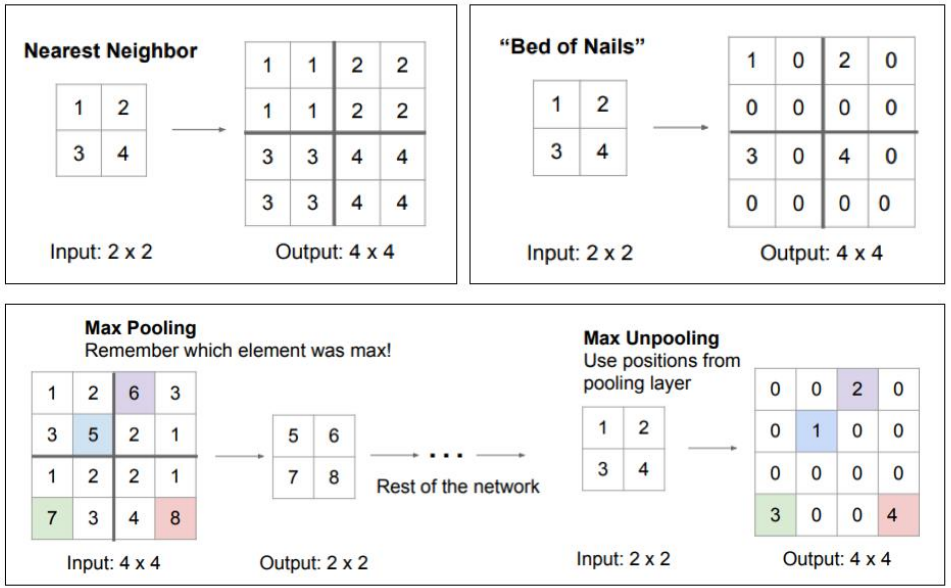


Upsampling

Methods

Upsampling techniques:

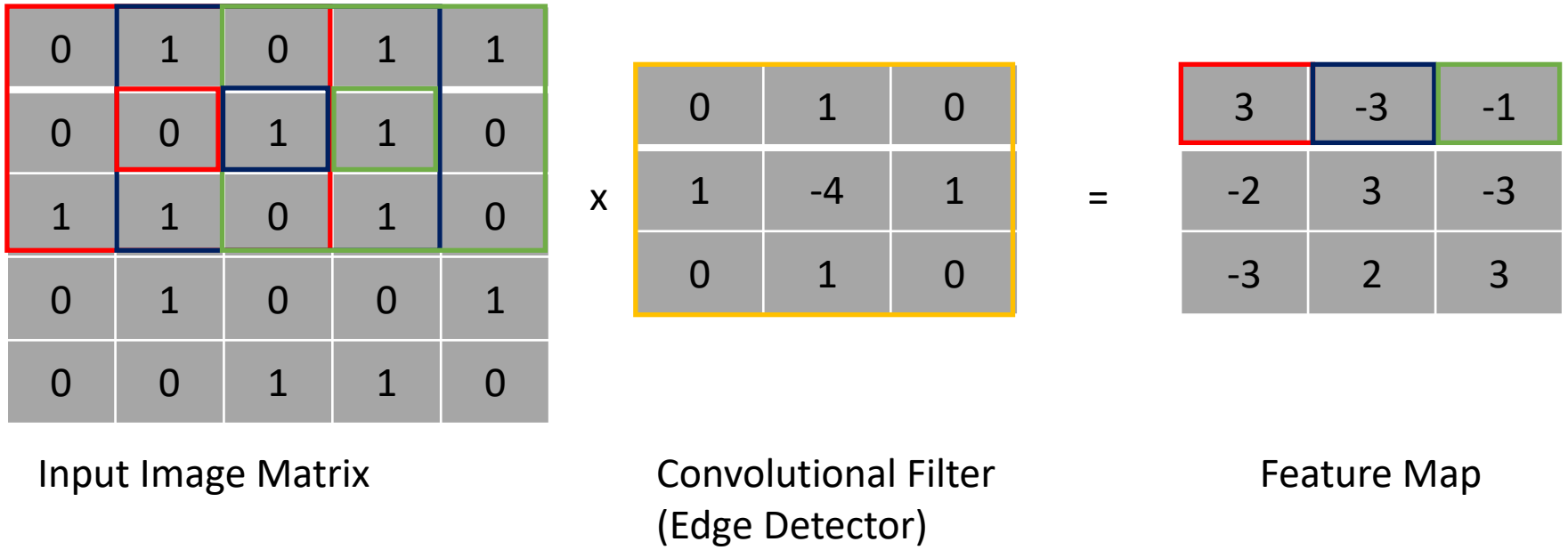
- nearest neighbor
- bi-linear interpolation
- max pooling
- max unpooling
- transpose convolutions



Source: https://towardsdatascience.com/transposed-convolution-demystified-84ca81b4baba#:~:text=Transposed%20convolution%20is%20also%20known,upsample%20the%20input%20feature%20map.

Upsampling

Convolution



Input Image Matrix

Convolutional Filter
(Edge Detector)

Feature Map

Upsampling

Transposed Convolution

- Convolutional step
  - keeps positional information
  - many-to-one relationship
- Transposed Convolutional step
  - one-to-make relationship

3	-3	-1
-2	3	-3
-3	2	3

Feature Map

x

0	1	0
1	-4	1
0	1	0

Convolutional Filter
(Edge Detector)

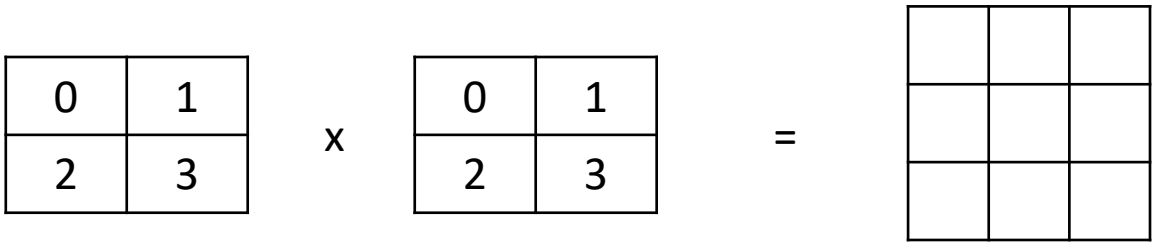
=

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

Input Image Matrix

Upsampling

Transposed Convolution Example



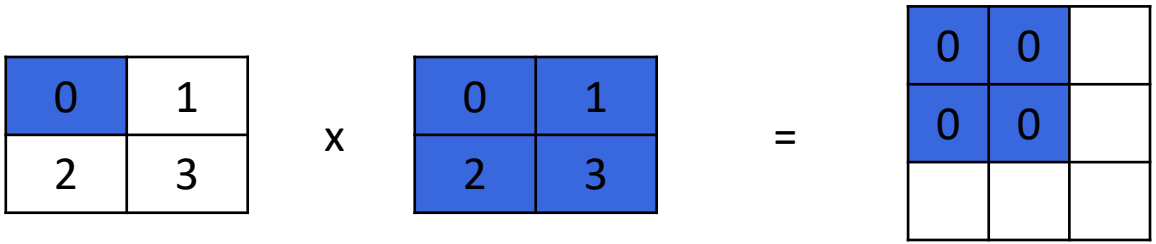
Input Feature Map
2x2

Kernel
2x2

Output Feature Map
3x3

Upsampling

Transposed Convolution Example



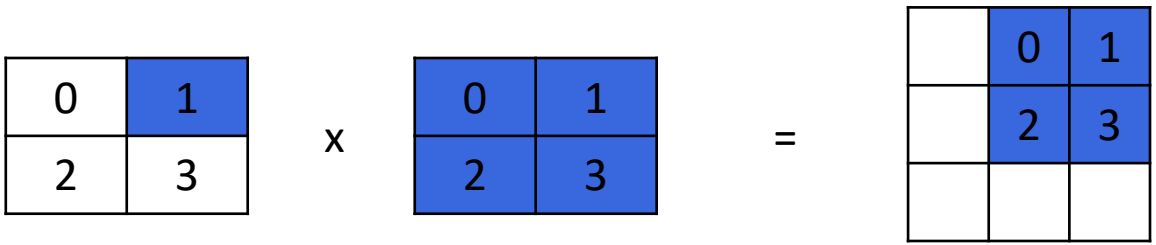
Input Feature Map
2x2

Kernel
2x2

Output Feature Map
3x3

Upsampling

Transposed Convolution Example



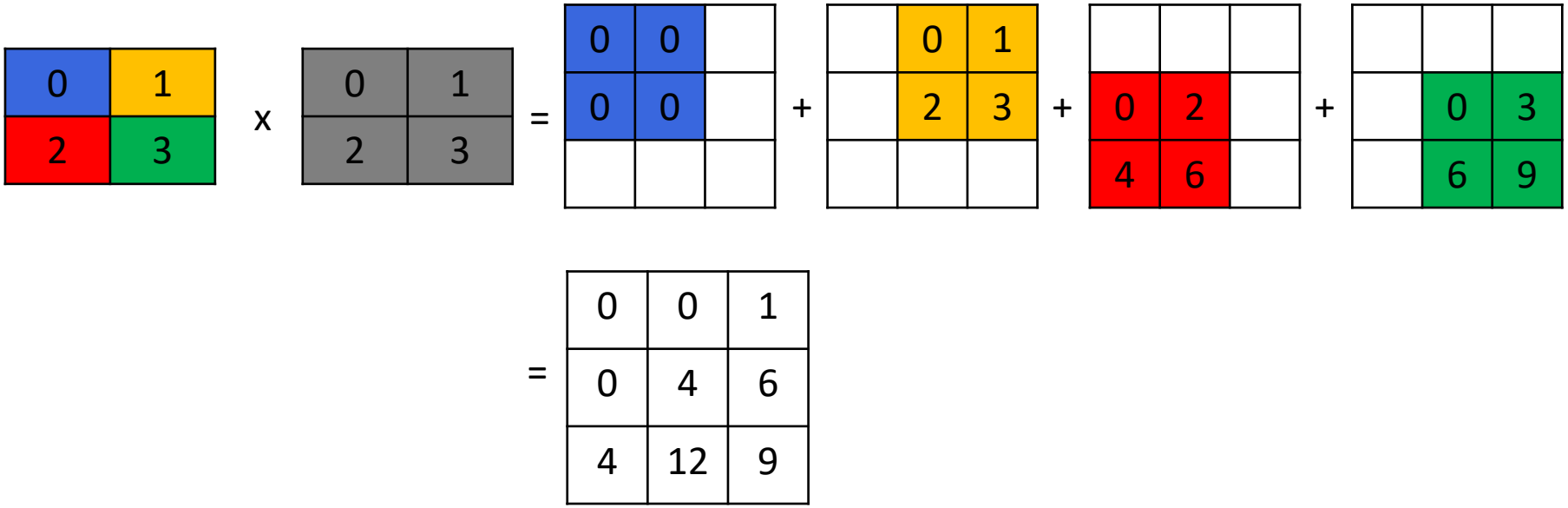
Input Feature Map
2x2

Kernel
2x2

Output Feature Map
3x3

Upsampling

Transposed Convolution Example



=

0	0	1
0	4	6
4	12	9

Input Feature Map
2x2

Kernel
2x2

Output Feature Map
3x3

Upsampling

Transposed Convolution Issues

- checkerboard artifacts, especially in images with strong colors

Source: https://distill.pub/2016/deconv-checkerboard/