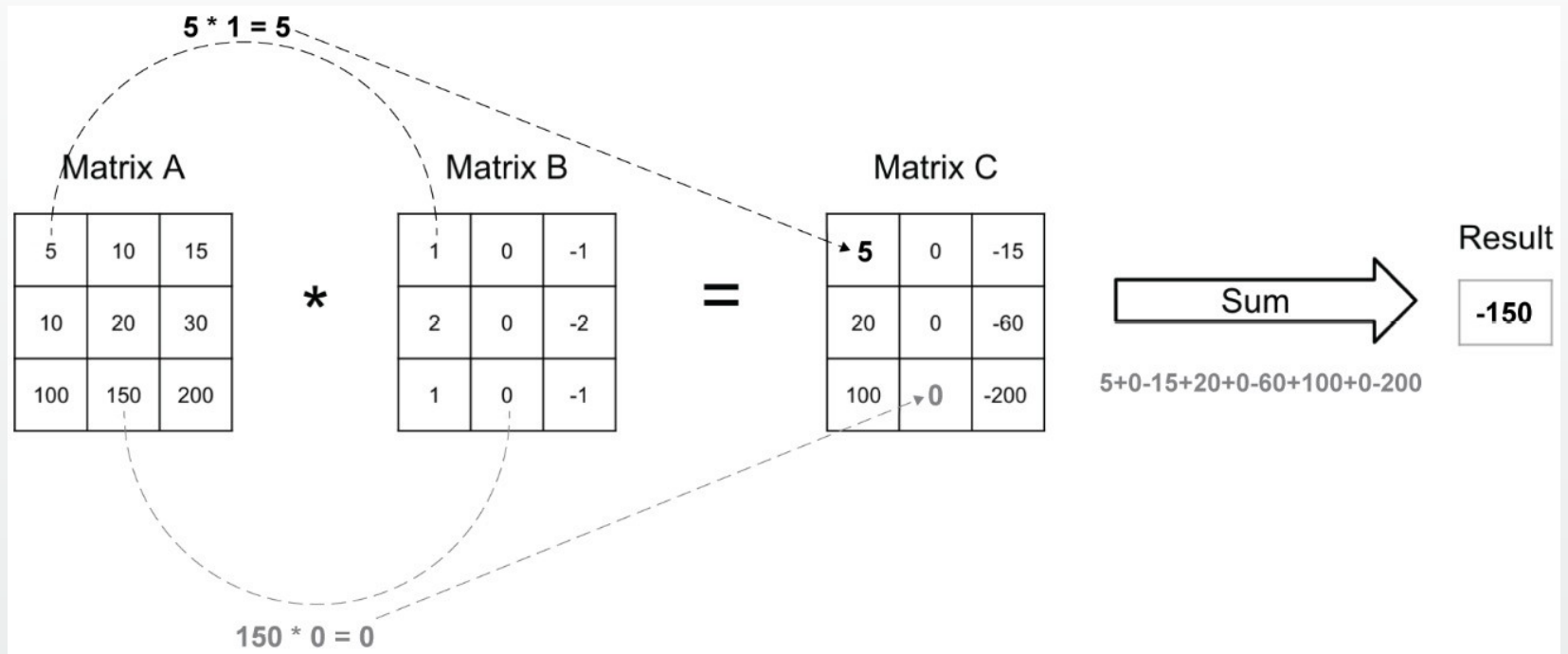




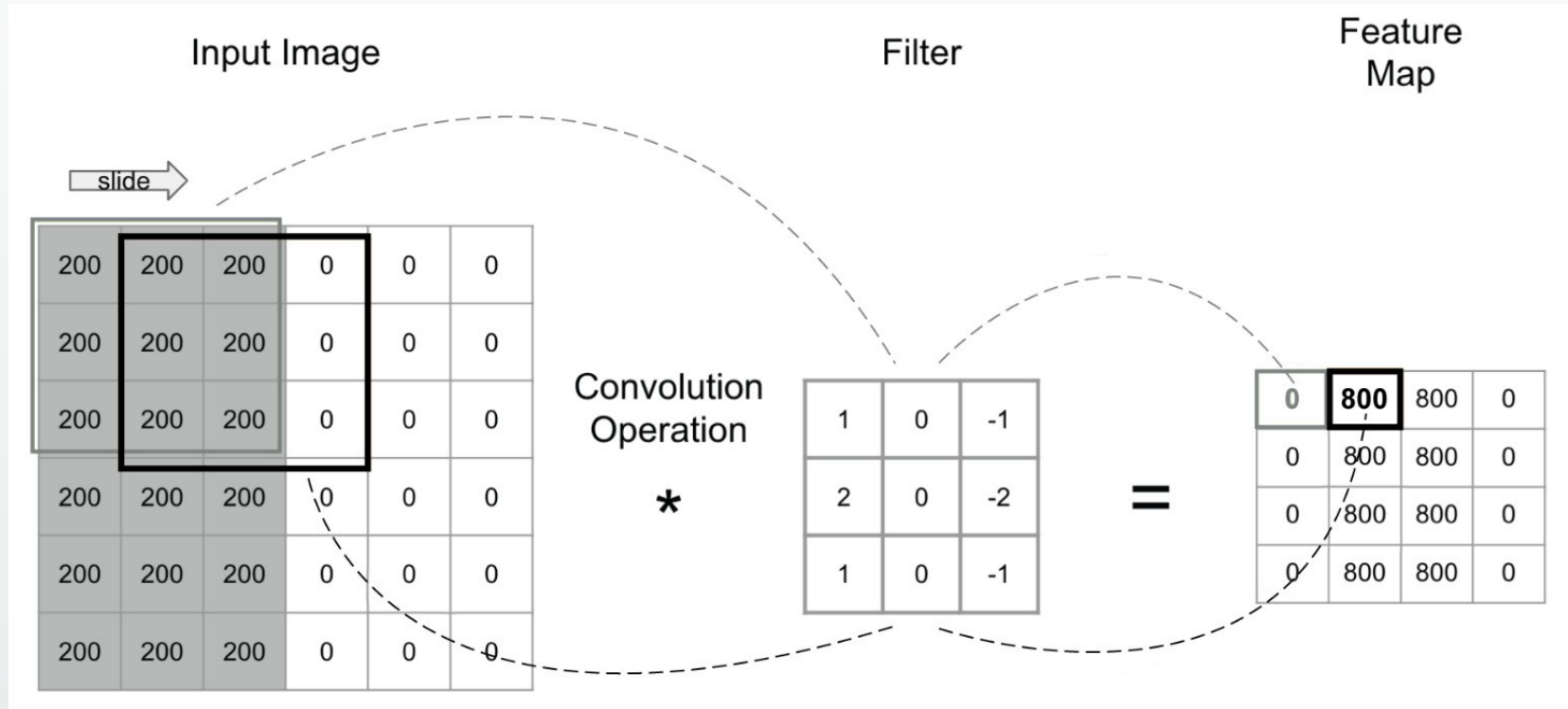
**CIS 8045**

# **Image Processing & CNN**

# Sequence of the convolution operation



# Striding



# Padding

Input Image

200	200	200	0	0	0
200	200	200	0	0	0
200	200	200	0	0	0
200	200	200	0	0	0
200	200	200	0	0	0
200	200	200	0	0	0

padding

Padded Image

0	0	0	0	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	0	0	0	0	0	0	0

# Padded Convolution

Input Image

0	0	0	0	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	200	200	200	0	0	0	0
0	0	0	0	0	0	0	0

Filter

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

Convolution  
Operation

\*

=

Feature Map

-600	0	600	600	0	0
-800	0	800	800	0	0
-800	0	800	800	0	0
-800	0	800	800	0	0
-800	0	800	800	0	0
-600	0	600	600	0	0

# Max Pooling with Stride 2

Input Image

6	8	6	1
1	2	7	4
9	8	1	2
8	9	3	2

with

Max pooling with  
stride 2

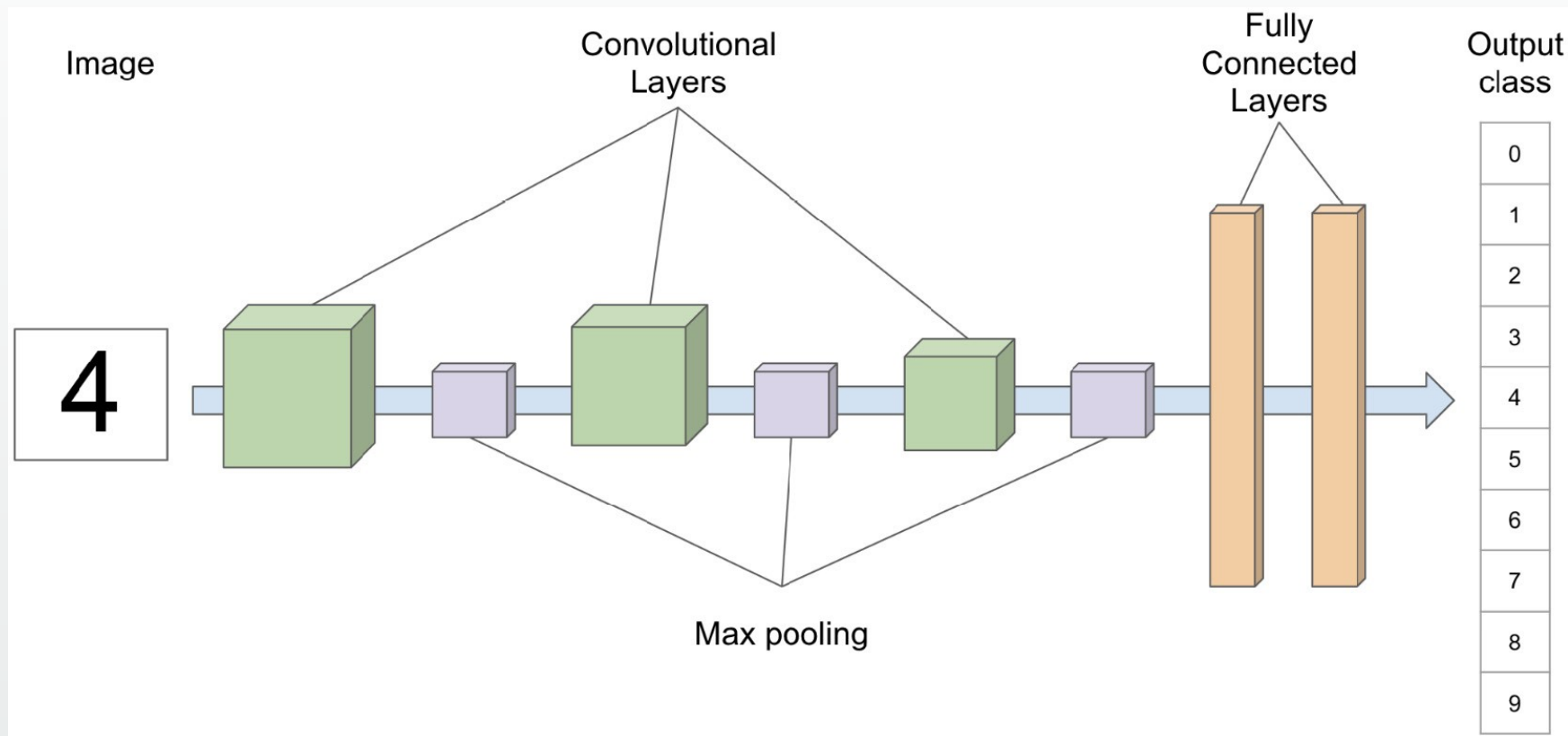
max	max
max	max

=

Result

8	7
9	3

# Structure of a CNN model



# Data Augmentation



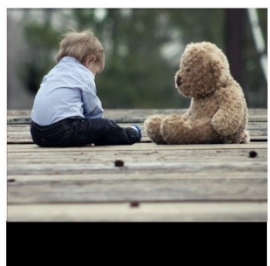
Horizontal  
flipping



Zoom



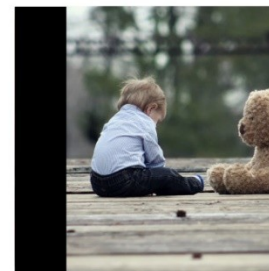
Vertical shifting



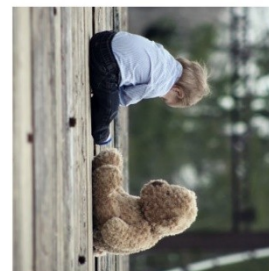
Vertical flipping



Horizontal  
shifting



Rotation



Shearing

