KERNELS AND CONVOLUTION

KERNELS AND CONVOLUTION

Original Image

Blur

Sharpen

Brighten

Darken

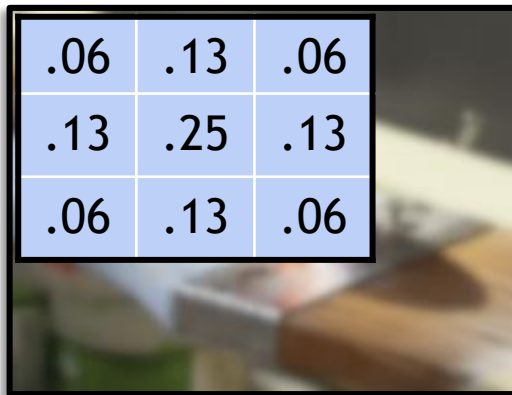# KERNELS AND CONVOLUTION
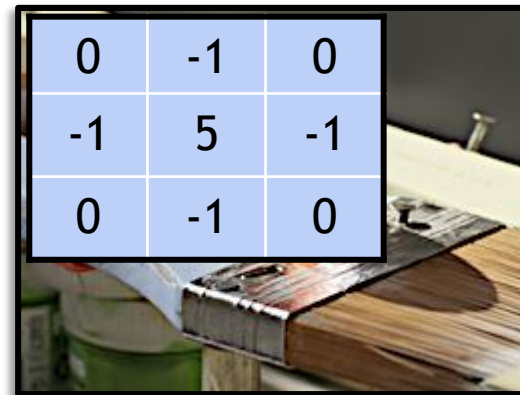
Original Image

Blur

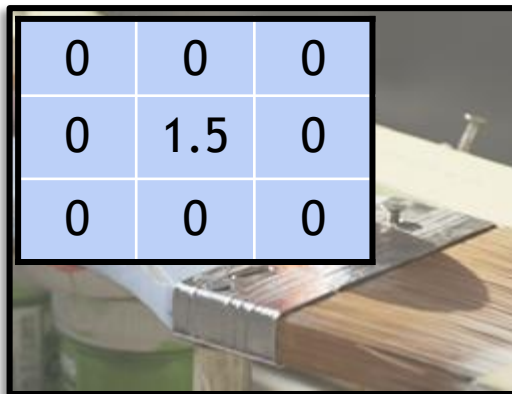| .06	.13	.06
.13	.25	.13
.06	.13	.06

Sharpen

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

Brighten

0	0	0
0	1.5	0
0	0	0

Darken

0	0	0
0	0.5	0
0	0	0

KERNELS AND CONVOLUTION

Blur Kernel	Original Image	Convolved Image

.06	.13	.06
.13	.25	.13
.06	.13	.06

*

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

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KERNELS AND CONVOLUTION

Blur Kernel

Original Image

Convolved Image

.06	.13	.06
.13	.25	.13
.06	.13	.06

*

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

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KERNELS AND CONVOLUTION

KERNELS AND CONVOLUTION

KERNELS AND CONVOLUTION

Blur Kernel		
.06	.13	.06
.13	.25	.13
.06	.13	.06

*

Original Image					
1	0	.13	.06	0	1
0	.13	0	0	1	0
0	.06	.13	.06	1	0
0	1	1	1	1	0
1	0	1	1	0	1
1	1	0	0	1	1

=

Convolved Image			
.56	.57		

KERNELS AND CONVOLUTION

Blur Kernel		
.06	.13	.06
.13	.25	.13
.06	.13	.06

*

Original Image					
1	0	1	1	0	1
0	1	0	0	1	0
0	1	1	1	1	0
0	1	1	1	1	0
1	0	1	1	0	1
1	1	0	0	1	1

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Convolved Image			
.56	.57	.57	.56
.7	.82	.82	.7
.69	.95	.95	.69
.64	.69	.69	.64

STRIDE
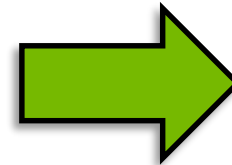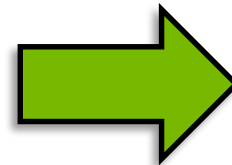
PADDING

Original Image

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

Zero Padding

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

PADDING

Original Image

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

Mirror Padding

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

KERNELS AND NEURAL NETWORKS

KERNELS AND NEURAL NETWORKS

Kernel

W_1	W_2	W_3
W_4	W_5	W_6
W_7	W_8	W_9

KERNELS AND NEURAL NETWORKS

KERNELS AND NEURAL NETWORKS

(28, 28, 1)
Image Input

(3, 3, 1, 2)
Kernels

(28, 28, 2)
Stacked Images

(3, 3, 2, 2)
Kernels

(28, 28, 2)
Stacked Images

(1568)
Flattened Image
Vector

(512)
Dense

(512)
Dense

(24)
Output Prediction
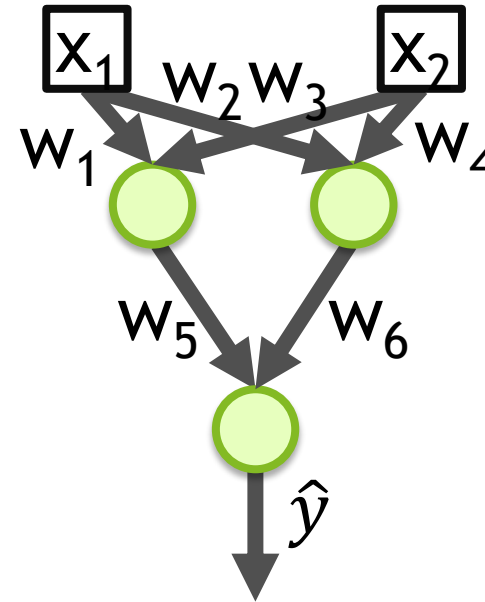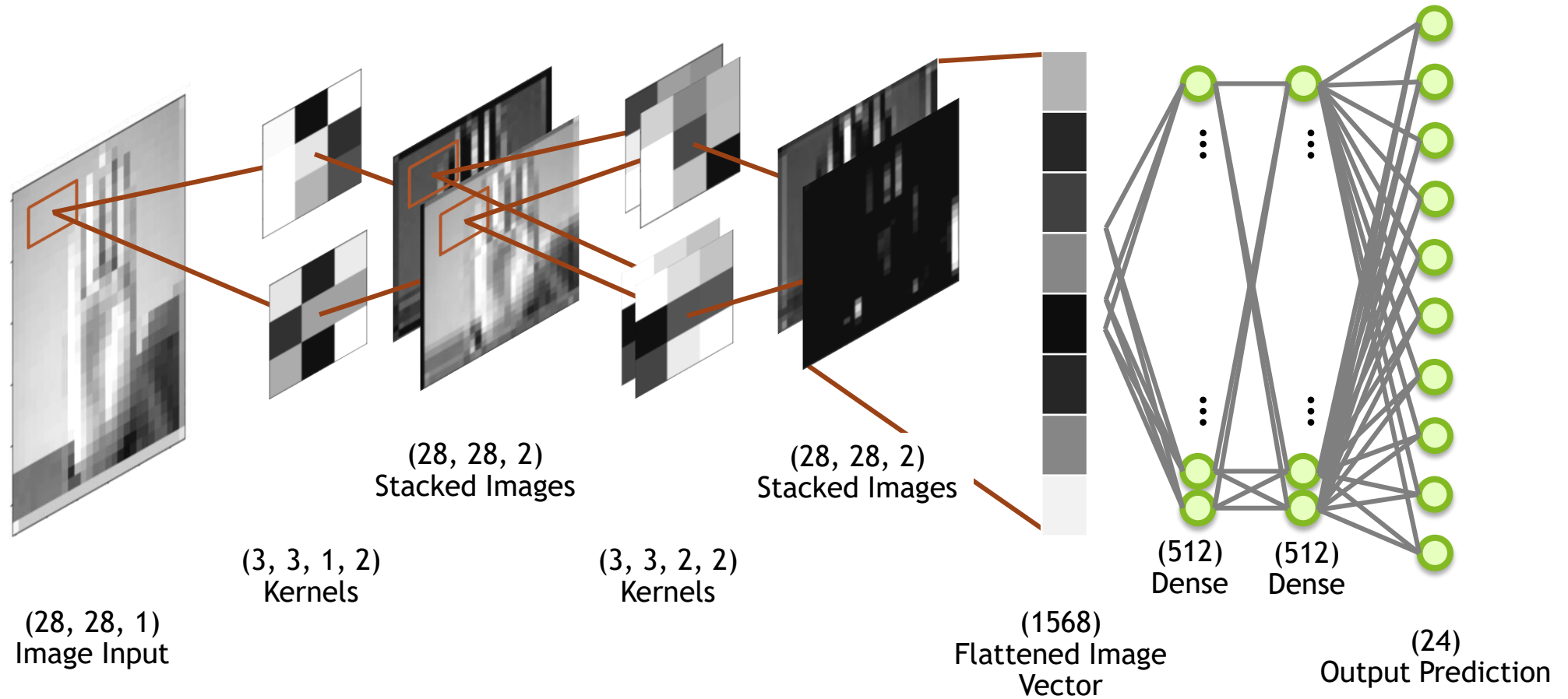
FINDING EDGES
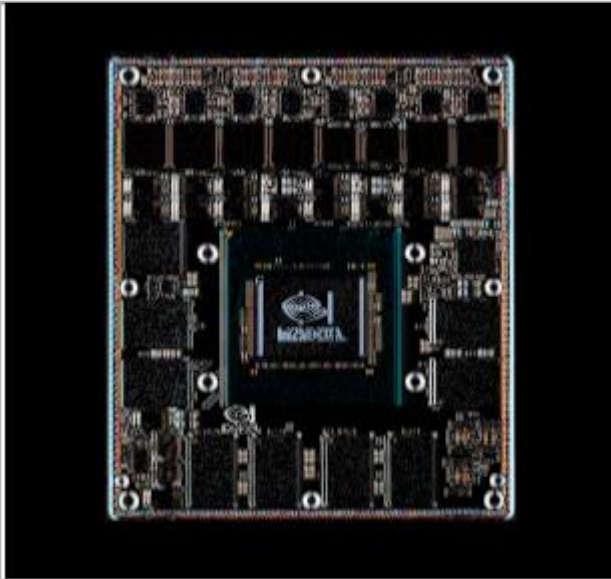
Vertical Edges	Original Image	Horizontal Edges

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

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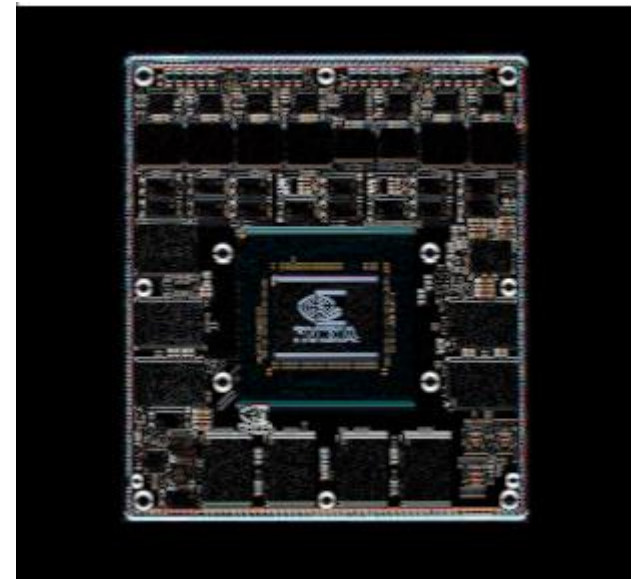
1	2	1
0	0	0
-1	-2	-1

NEURAL NETWORK PERCEPTION
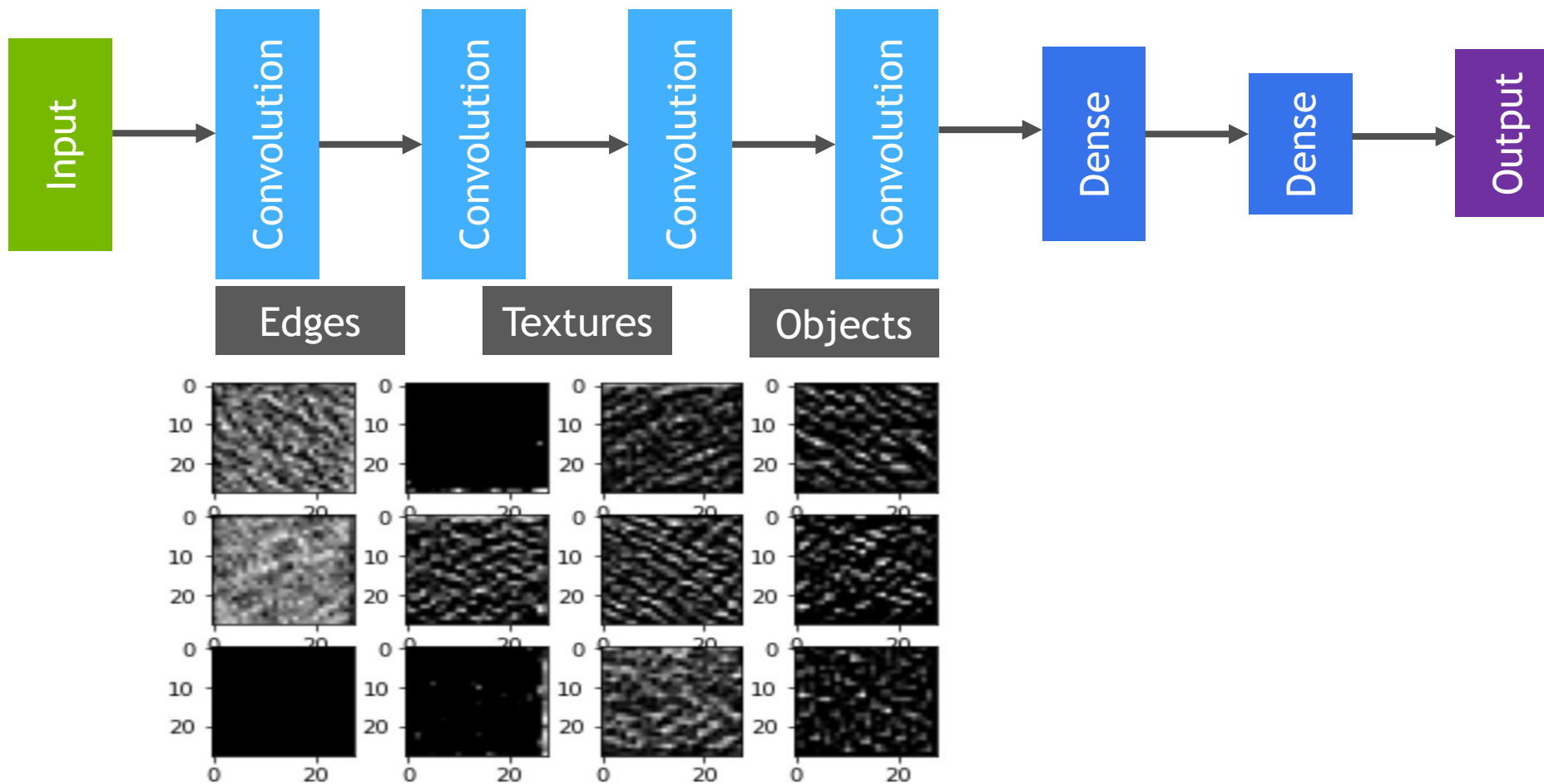
NEURAL NETWORK PERCEPTION

OTHER LAYERS IN THE MODEL

MAX POOLING
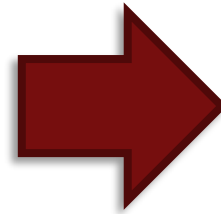
DROPOUT
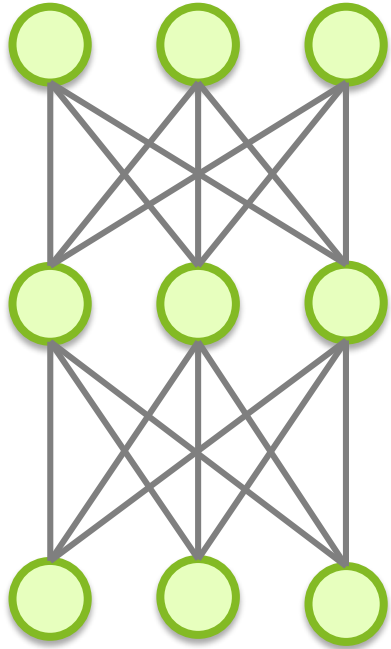
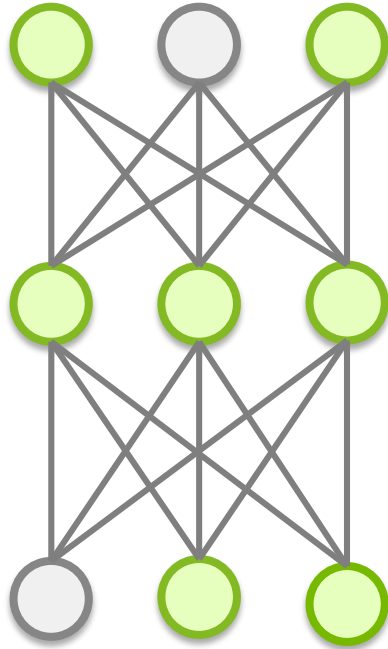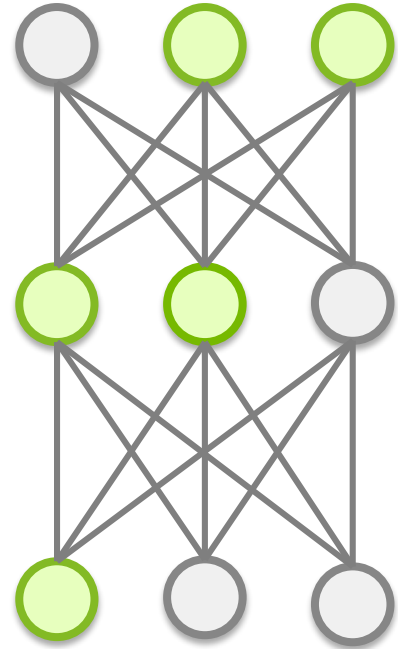rate = 0

rate = .2

rate = .4

WHOLE ARCHITECTURE