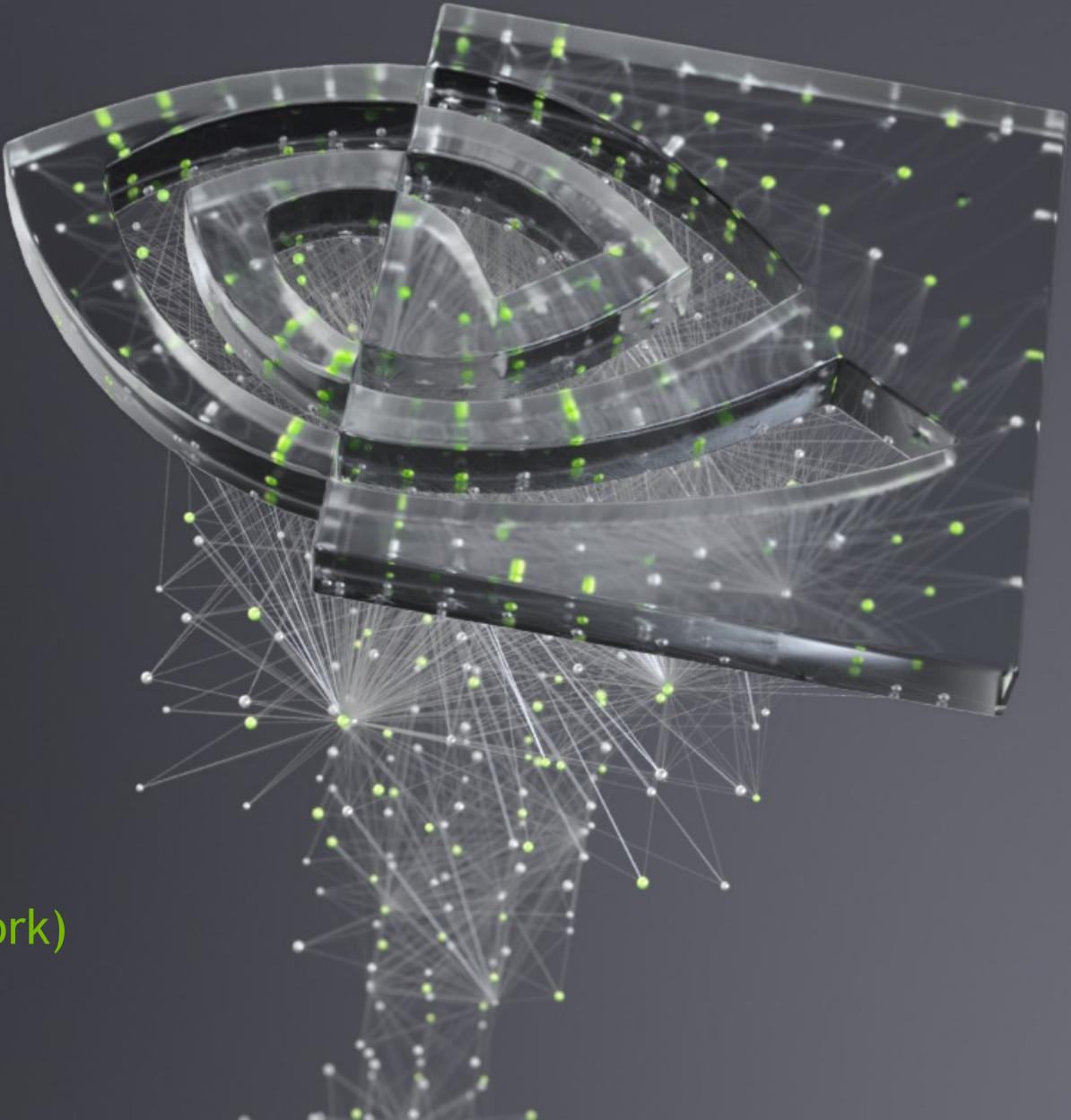




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딥러닝의 기초

3부: CNN(Convolutional Neural Network)



목차

1부: 딥러닝 소개

2부: 뉴럴 네트워크의 트레이닝 방식

3부: CNN(Convolutional Neural Network)

4부: 데이터 증강 및 배포

5부: 사전 트레이닝된 모델

6부: 고급 아키텍처

목차 – 3부

- 커널과 합성곱
- 커널과 뉴럴 네트워크
- 모델의 다른 레이어

HANDS-ON 요약

밀집(Fully-connected) 뉴럴 네트워크 모델 학습

트레이닝 정확도가 높음

검증 정확도가 낮음

과적합의 증거



커널과 합성곱 KERNELS AND CONVOLUTION

커널과 합성곱 (KERNELS AND CONVOLUTION)



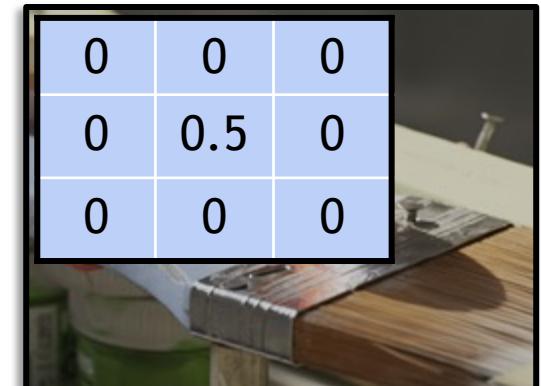
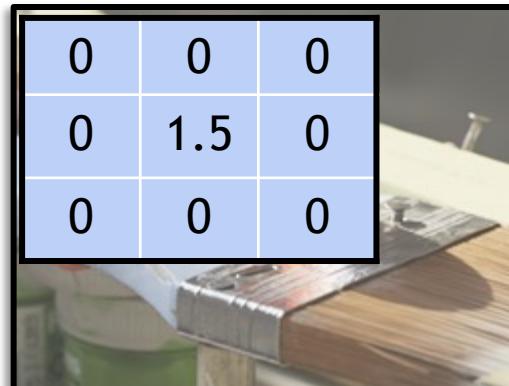
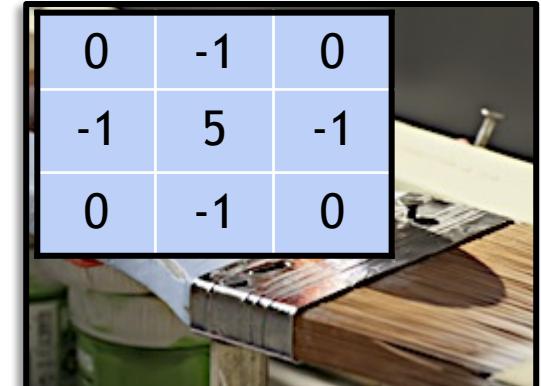
이미지 원본



커널과 합성곱 (KERNELS AND CONVOLUTION)



이미지 원본



커널과 합성곱 (KERNELS AND CONVOLUTION)

흐리게 하기
커널

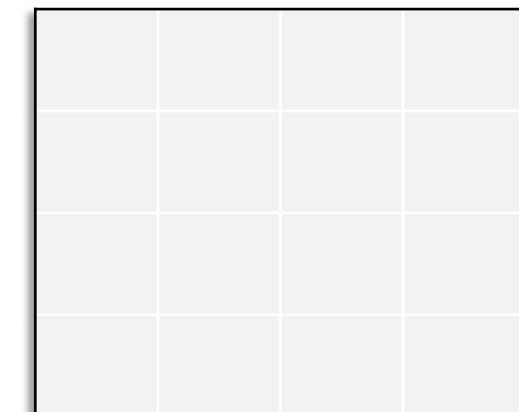
.06	.13	.06
.13	.25	.13
.06	.13	.06

*

이미지 원본

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

합성곱이 수행된
이미지



커널과 합성곱 (KERNELS AND CONVOLUTION)

흐리게 하기
커널

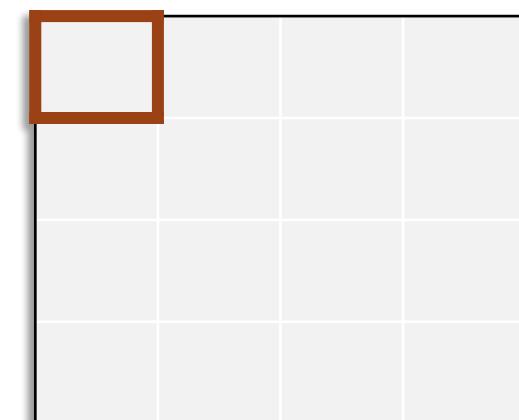
.06	.13	.06
.13	.25	.13
.06	.13	.06

*

이미지 원본

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

합성곱이 수행된
이미지



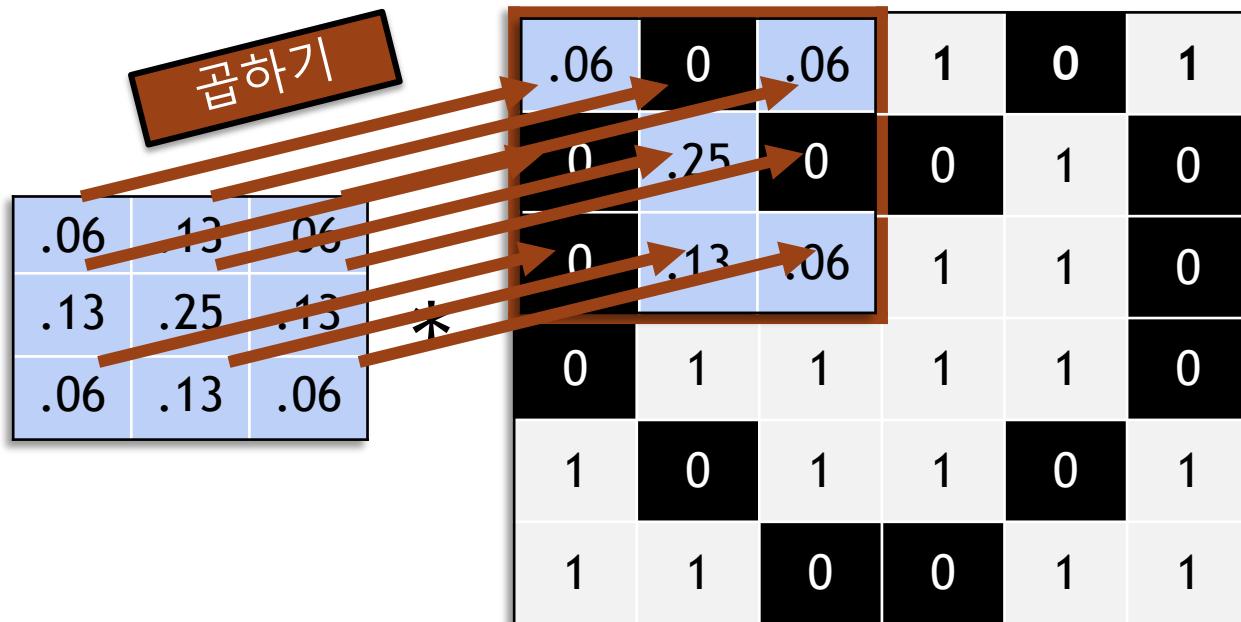
=

커널과 합성곱 (KERNELS AND CONVOLUTION)

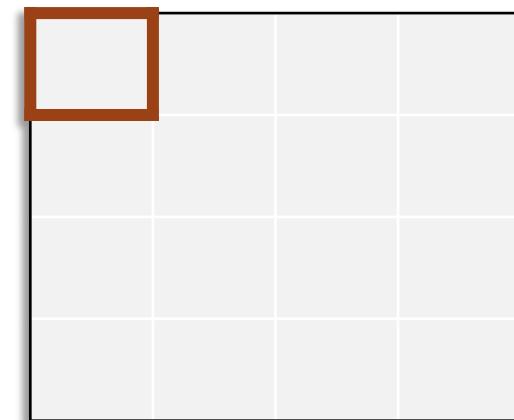
흐리게 하기
커널

이미지 원본

합성곱이 수행된
이미지



=



커널과 합성곱 (KERNELS AND CONVOLUTION)

흐리게 하기
커널

$$\begin{matrix} .06 & .13 & .06 \\ .13 & .25 & .13 \\ .06 & .13 & .06 \end{matrix}$$

이미지 원본

*

$$\begin{matrix} .06 & 0 & .06 & 1 & 0 & 1 \\ 0 & .25 & 0 & 0 & 1 & 0 \\ 0 & .13 & .06 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 \end{matrix}$$

합성곱이 수행된
이미지

$$= \begin{matrix} .56 \end{matrix}$$

총

커널과 합성곱 (KERNELS AND CONVOLUTION)

흐리게 하기
커널

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

*

이미지 원본

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

합성곱이 수행된
이미지

.56	.57

커널과 합성곱 (KERNELS AND CONVOLUTION)

흐리게 하기
커널

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

*

이미지 원본

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

합성곱이 수행된
이미지

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

커널과 합성곱 (KERNELS AND CONVOLUTION)

The diagram illustrates a convolution operation between an input tensor and a kernel tensor.

Input Tensor (4x4):

0	3	2	1
2	1	0	2
1	3	2	0
2	0	3	3

Kernel (Filter) (3x3):

1	0	1
0	1	0
1	0	1

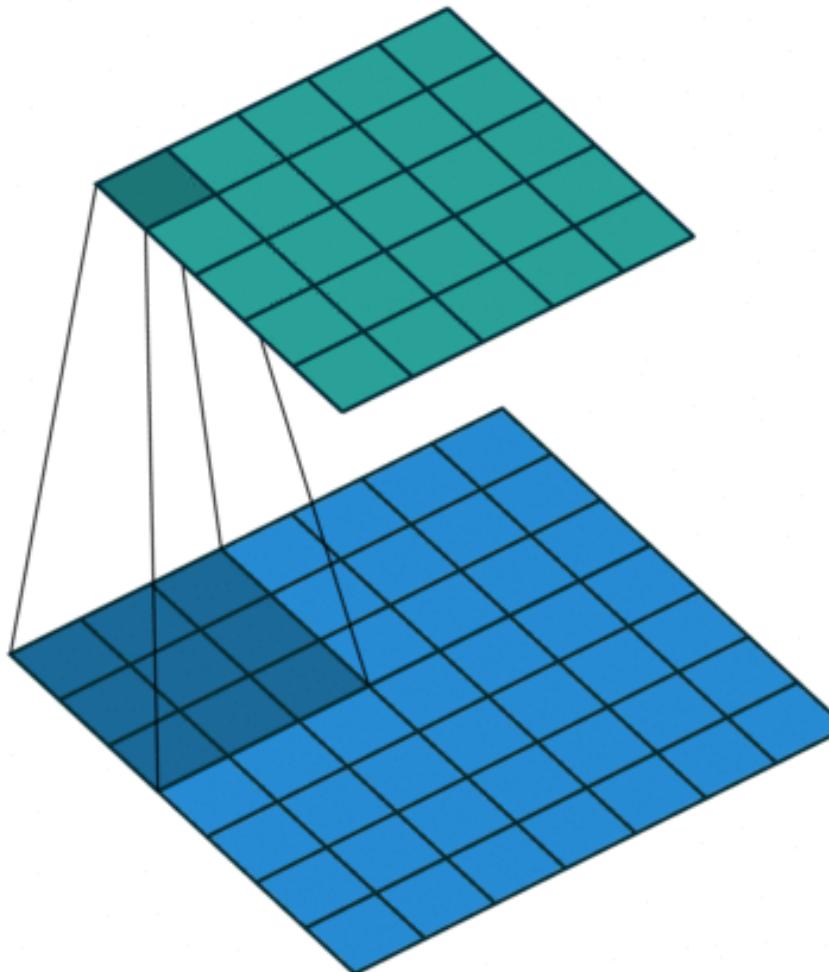
Output Tensor (Feature Map) (2x2):

6	7
10	8

Calculation:

$$0 \times 1 + 3 \times 0 + 2 \times 1 \quad (2) + \\ + 2 \times 0 + 1 \times 1 + 6 \times 0 \quad (1) + \\ + 1 \times 1 + 3 \times 0 + 2 \times 1 \quad (3)$$

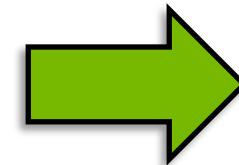
커널과 합성곱 (KERNELS AND CONVOLUTION)



스트라이드 (STRIDE)

스트라이
드 1

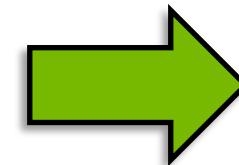
1	0	1	1	0	1
0	1	0	0	1	0
0	1	1	1	1	0



.56	.57	.57	.56
-----	-----	-----	-----

스트라이
드 2

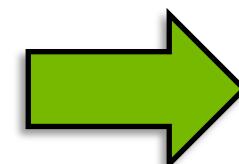
1	0	1	1	0	1
0	1	0	0	1	0
0	1	1	1	1	0



.56	.57
-----	-----

스트라이
드 3

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



.56	.56
-----	-----

패딩 (PADDING)

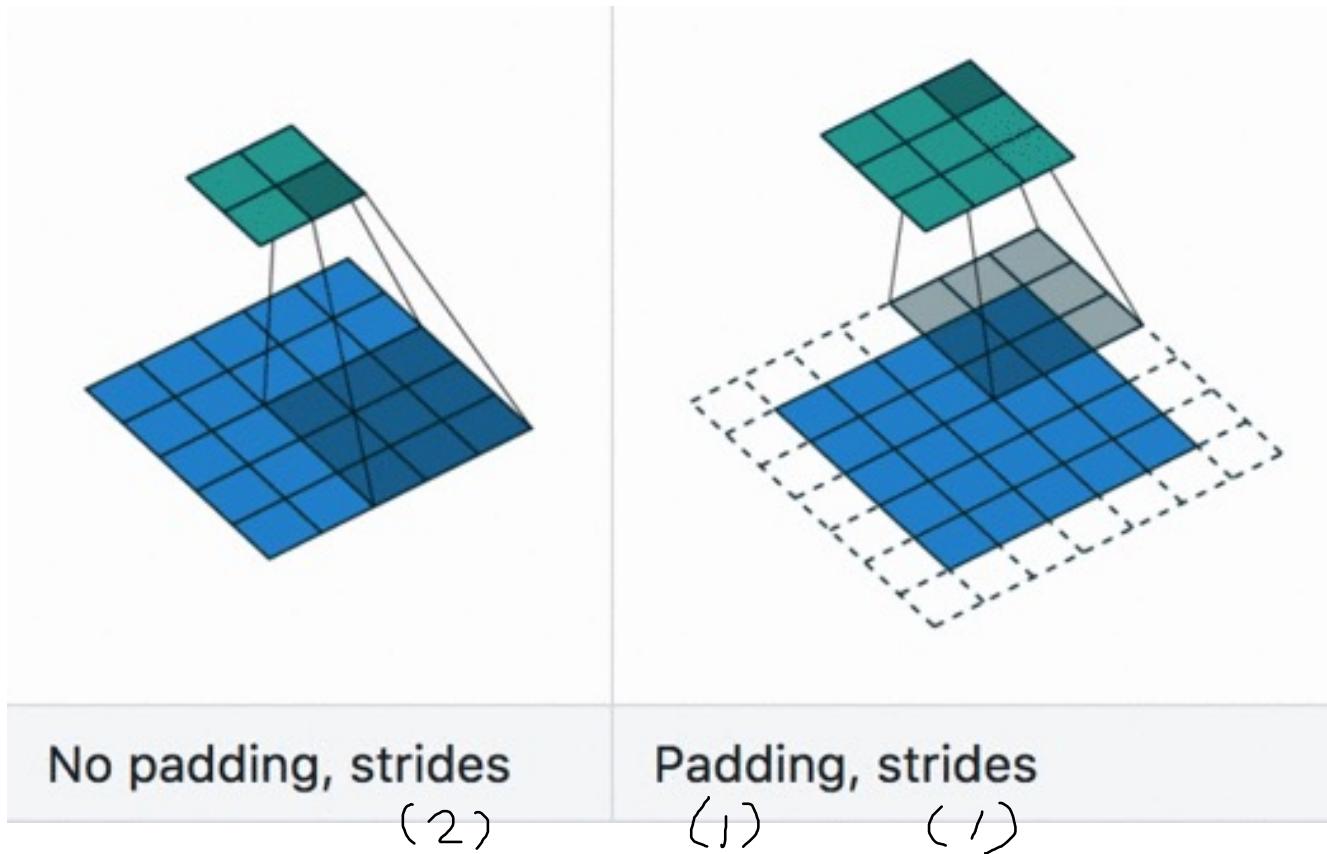
이미지 원본

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

제로 패딩 (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

합성곱(CONV), 패딩(PADDING), 스트라이드(STRIDE)





커널과 뉴럴 네트워크 KERNELS AND NEURAL NETWORKS

커널과 뉴럴 네트워크

커널
(Kernel)

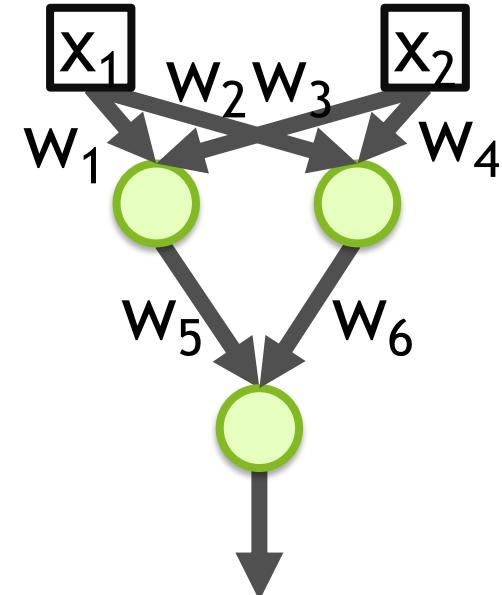
w_1	w_2	w_3
w_4	w_5	w_6
w_7	w_8	w_9

커널과 뉴럴 네트워크

커널
(Kernel)

w_1	w_2	w_3
w_4	w_5	w_6
w_7	w_8	w_9

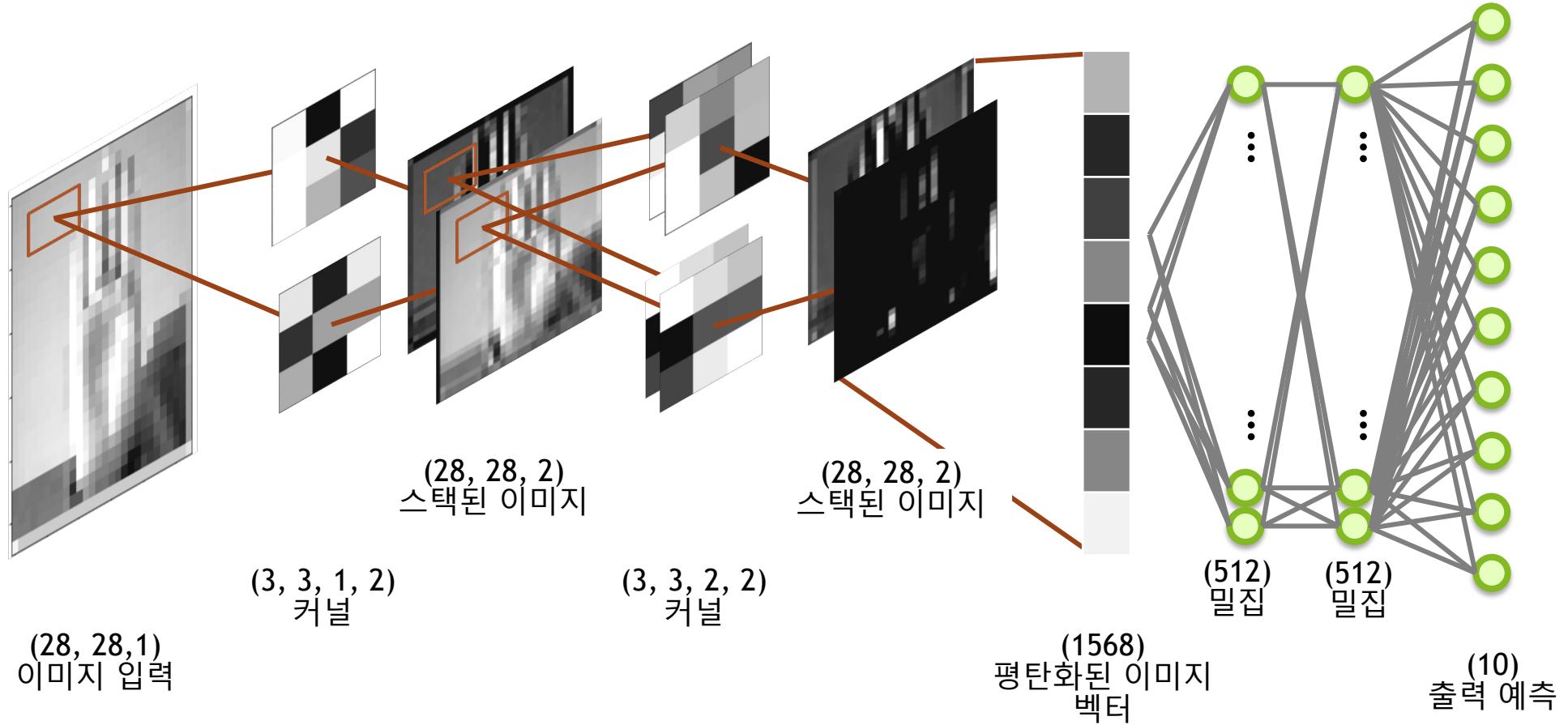
뉴런
(Neuron)



CNN backpropagation :

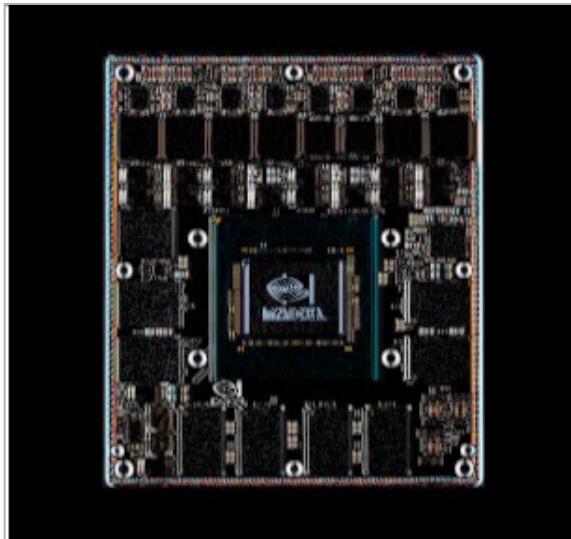
<https://www.jefkine.com/general/2016/09/05/backpropagation-in-convolutional-neural-networks/>

커널과 뉴럴 네트워크



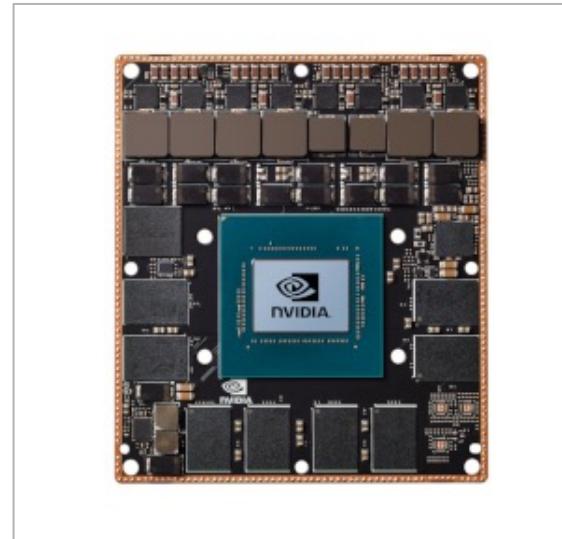
엣지(EDGE) 찾기

수직 엣지



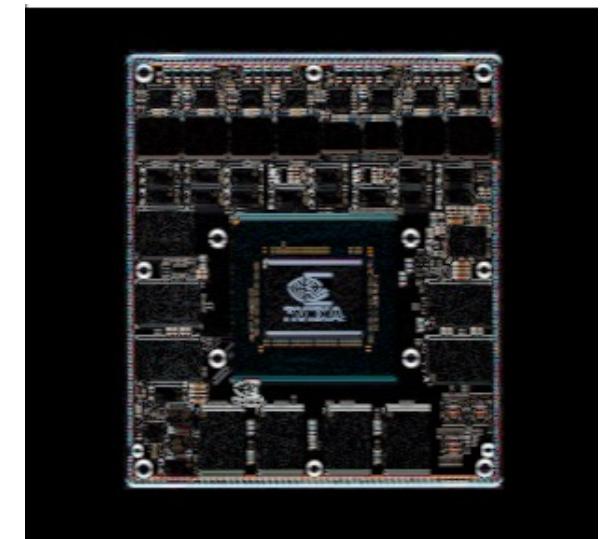
1	0	-1
2	0	-2
1	0	-1

이미지 원본



0	0	0
0	1	0
0	0	0

수평 엣지



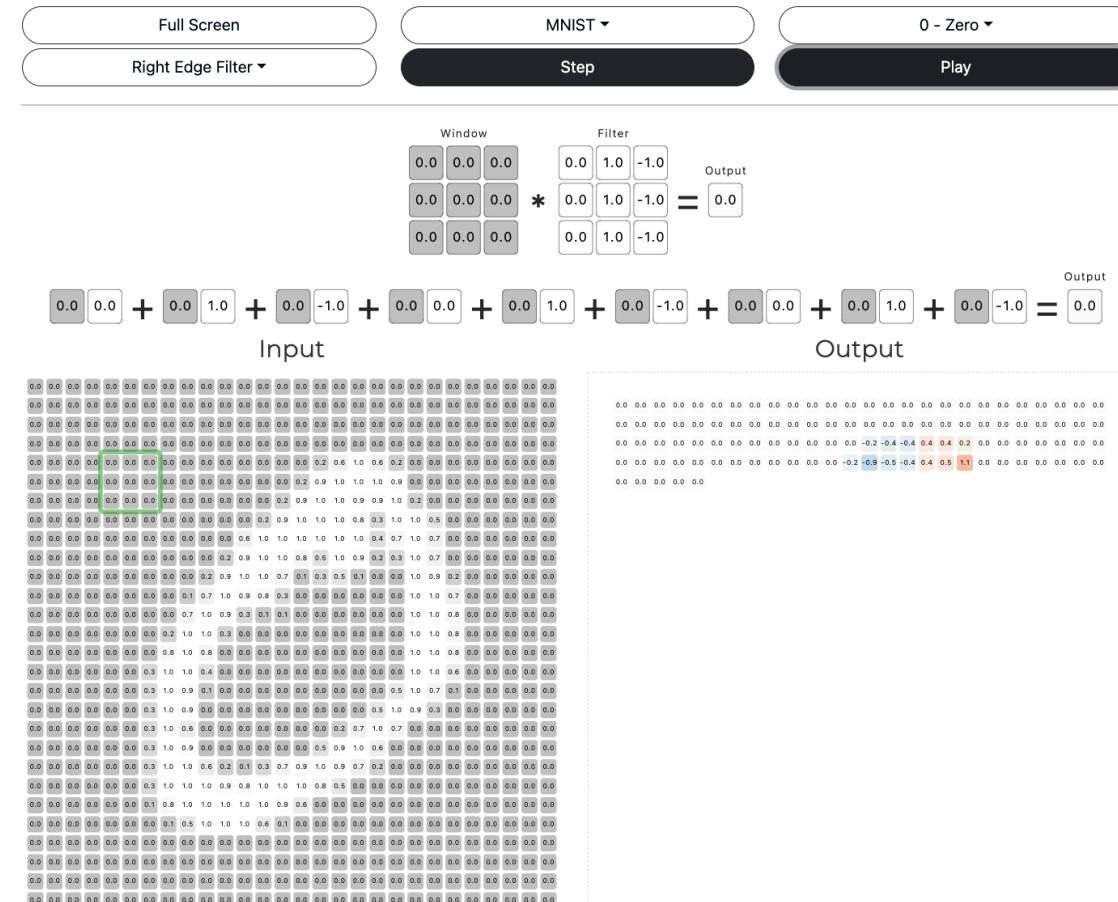
1	2	1
0	0	0
-1	-2	-1

Image Kernel : <https://setosa.io/ev/image-kernels/>

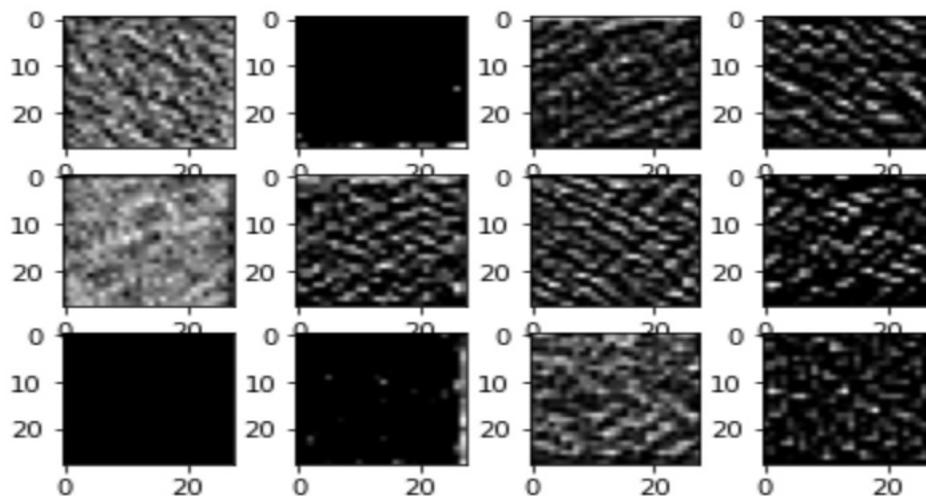
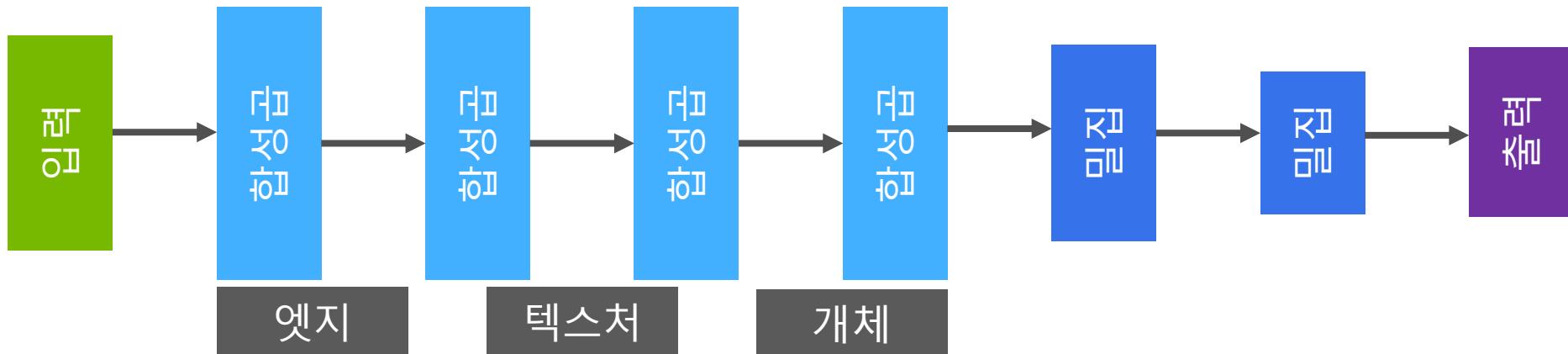
Stanford cs 데모 사이트 : <https://cs.stanford.edu/people/karpathy/convnetjs/demo/cifar10.html>

합성곱 연산(CONVOLUTION OPERATION)

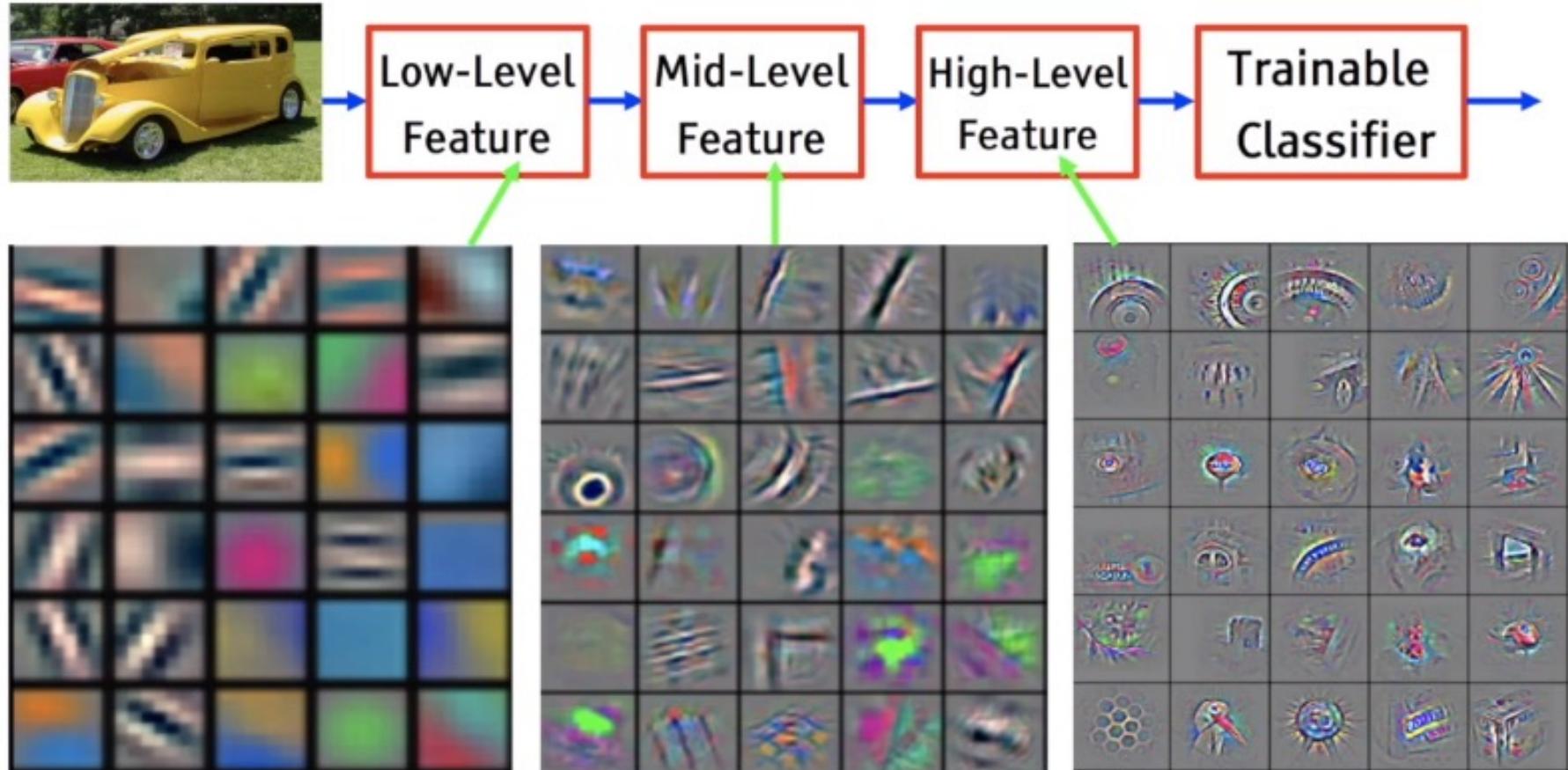
- 데모 사이트 : <https://deeplizard.com/resource/pavq7noze2>



뉴럴 네트워크 인식 (NEURAL NETWORK PERCEPTION)

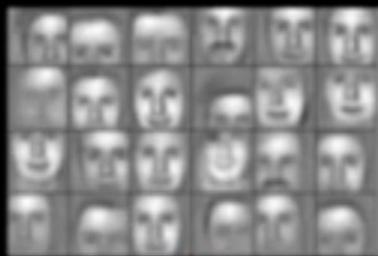


FEATURE MAP



FEATURE MAP

Face



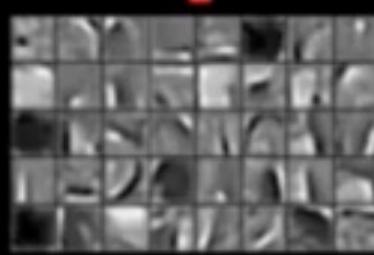
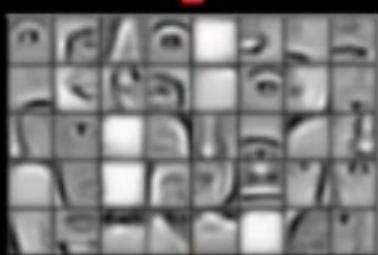
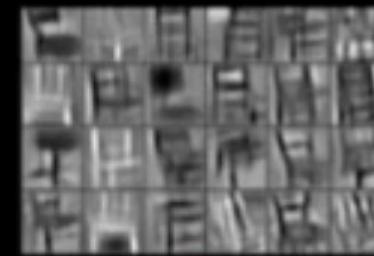
Car



Elephant



Chair



CNN 시각화(VISULATION)

VGG16

- 데이터 수집
- 모델 생성
- 모델 학습
- 이미지 분류 시각화
- <https://www.youtube.com/watch?v=RNnKtNrsrmg>

뉴럴 네트워크 인식 (NEURAL NETWORK PERCEPTION)



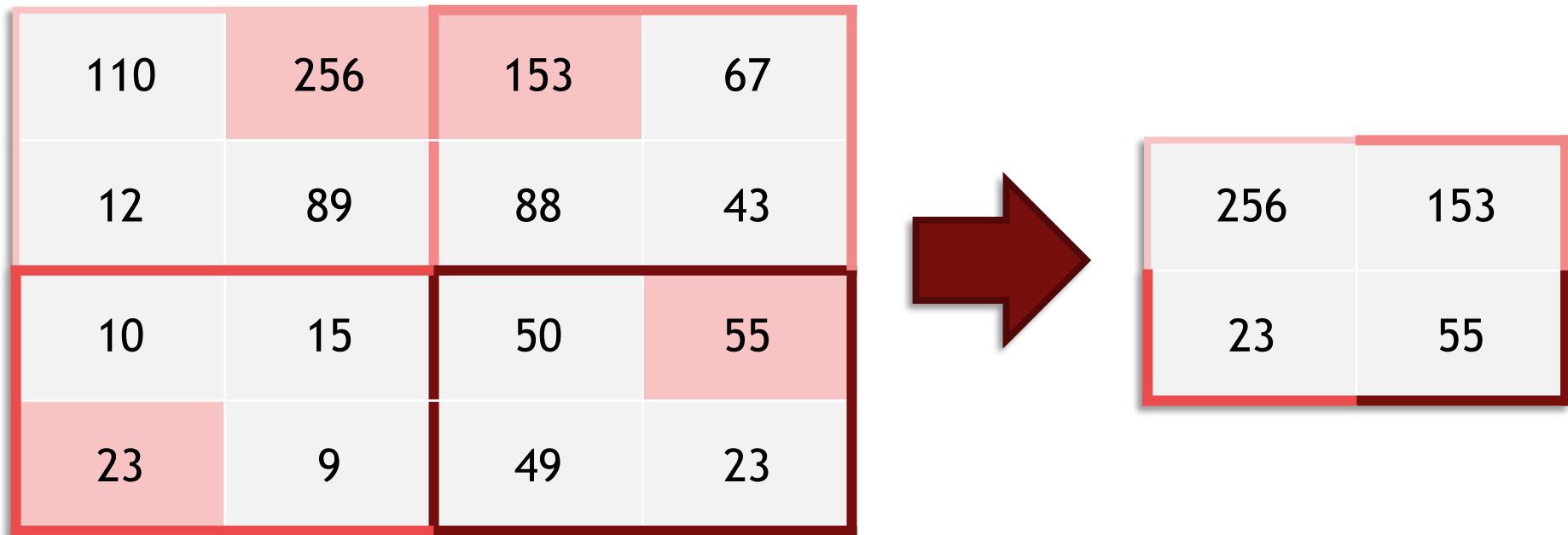
<https://deeplearninggenerator.com/>

<https://towardsdatascience.com/how-to-visualize-convolutional-features-in-40-lines-of-code-70b7d87b0030>  DEEP LEARNING INSTITUTE

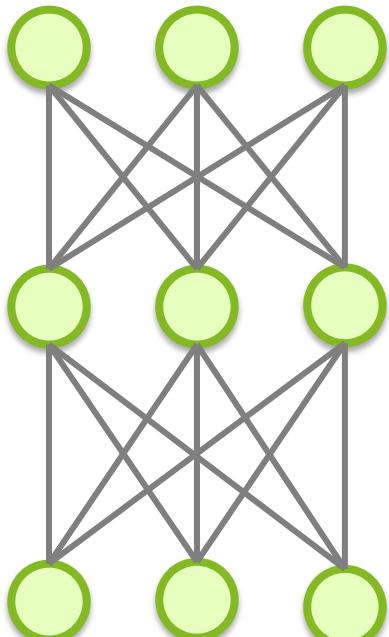


기타 레이어
OTHER LAYERS IN THE MODEL

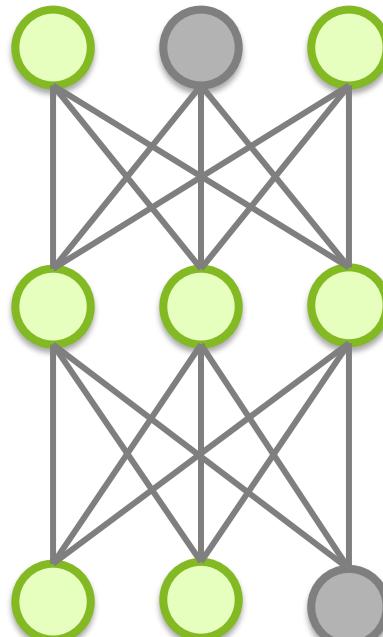
MAX POOLING



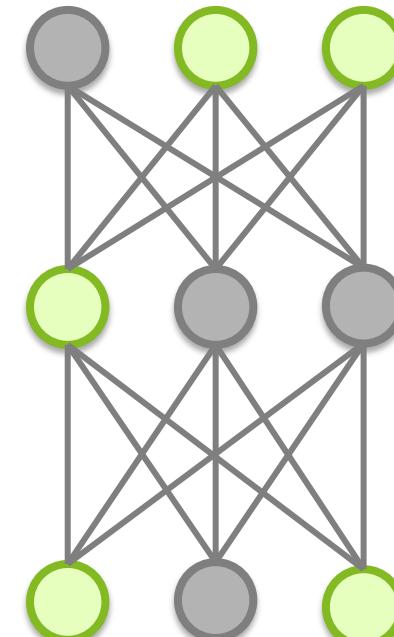
드롭아웃 (DROPOUT)



비율 = 0

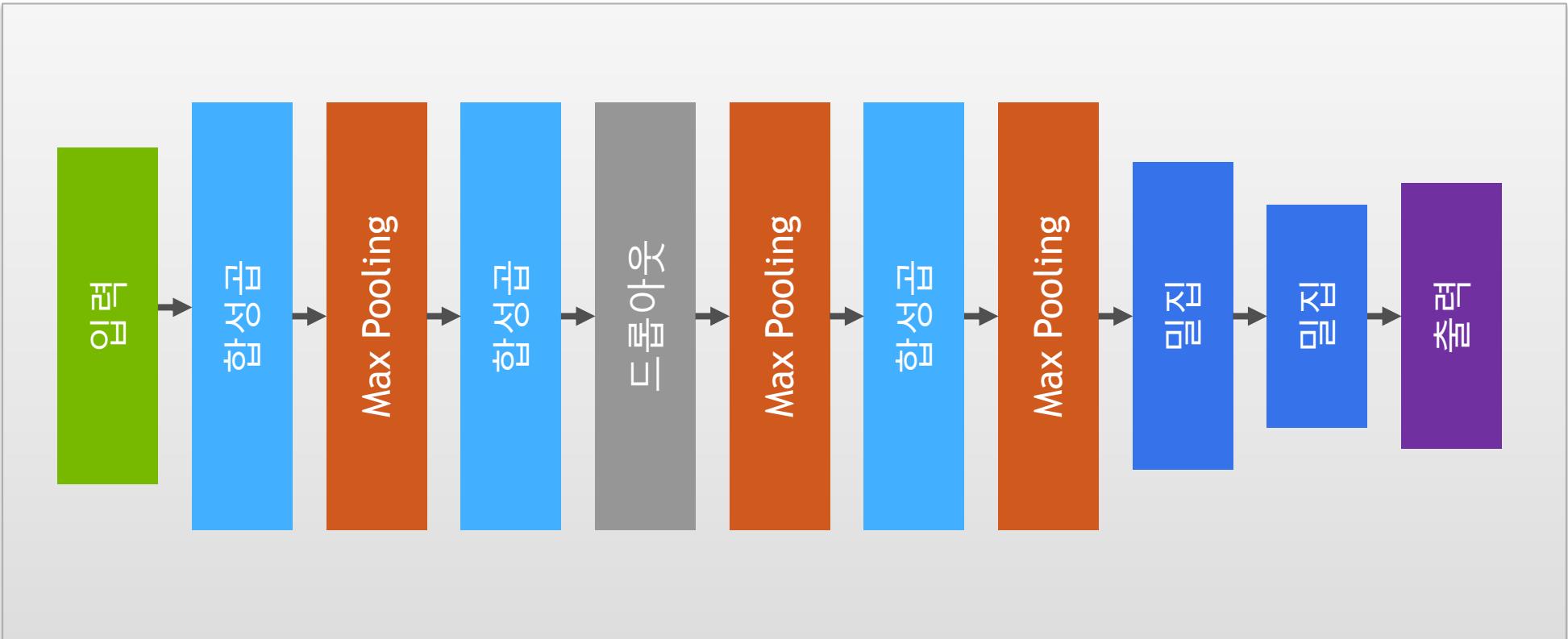


비율 = .2



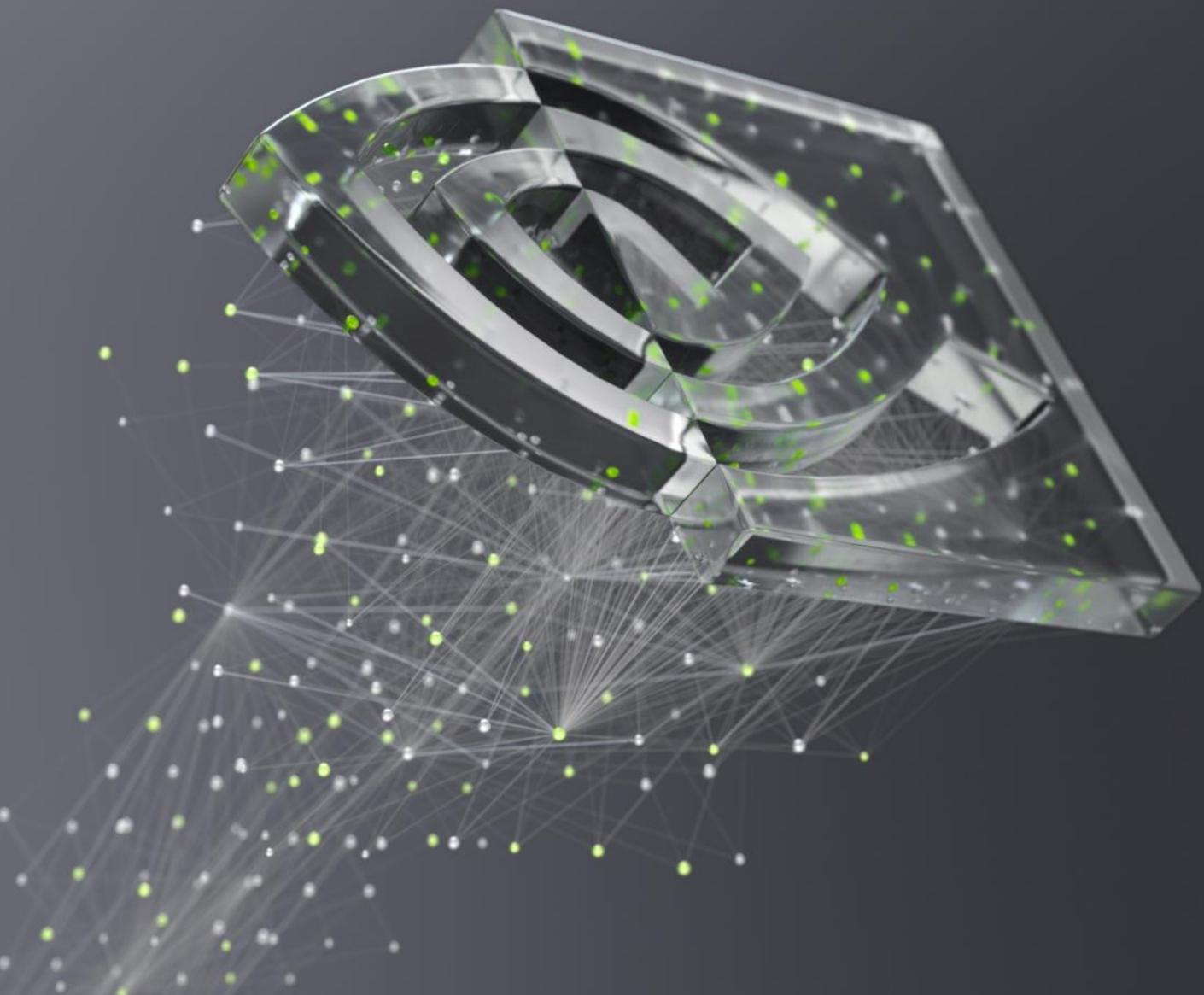
비율 = .4

전체 아키텍처





시작하겠습니다!



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