CNN

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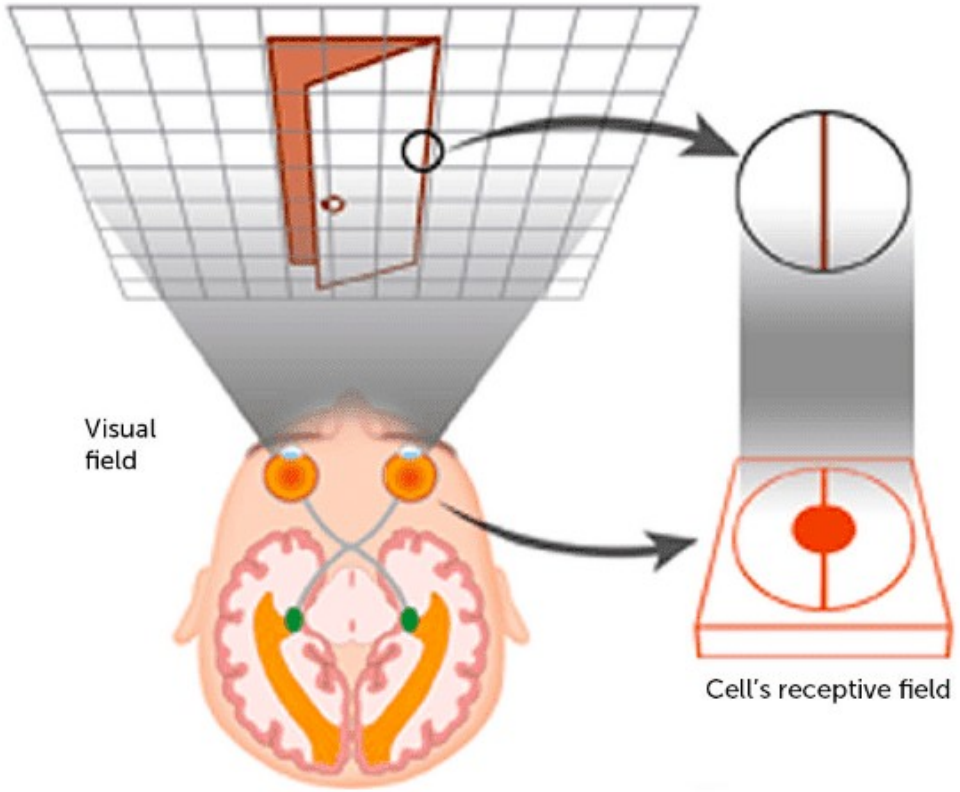
CNN

Convolutional Neural Network

Convolutional?

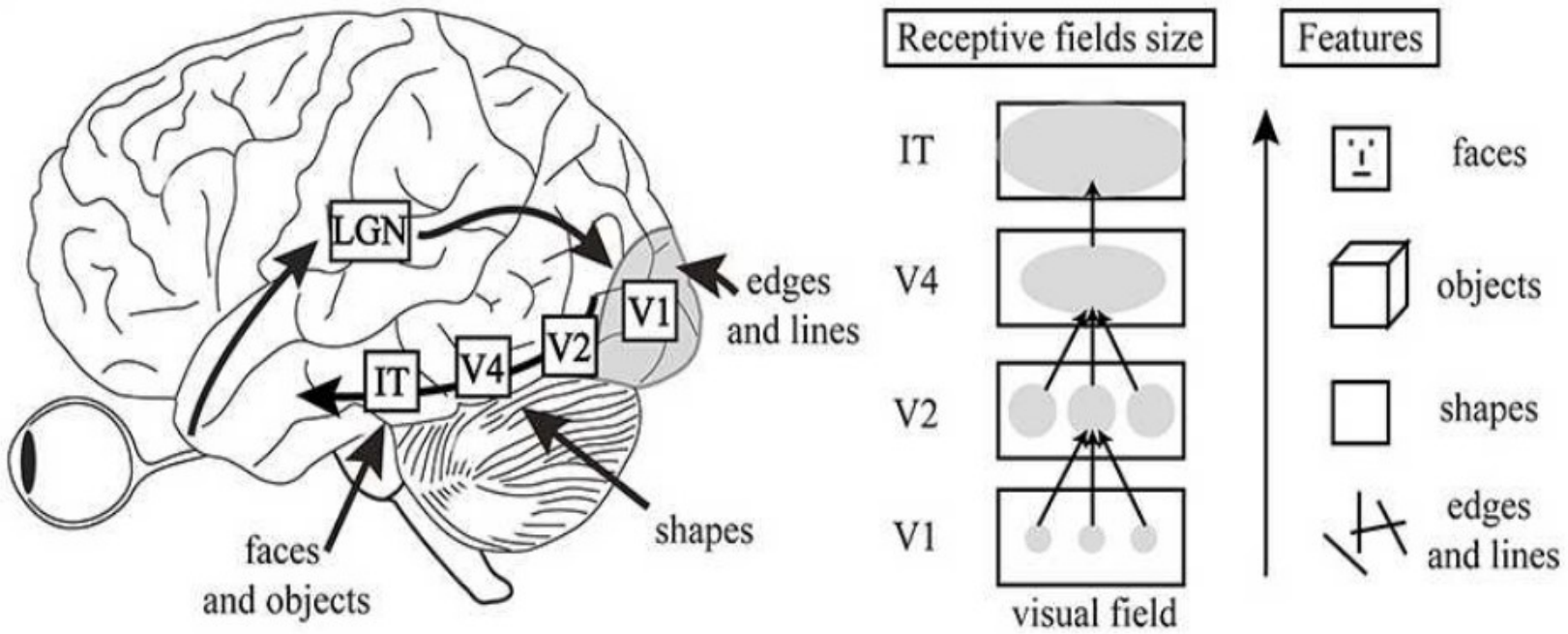
Receptive Field

한 뉴런이 수용하는 이미지 (감각) 정보 크기



Convolutional?

하나의 이미지를 여러 성분을 조합하여 생성한다 !



https://www.koreascience.or.kr/article/JAKO202007853262498.pd

Convolutional?

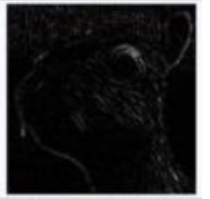
앞선 성질을 Deep Learning 에서 적용을 어떻게 할까 ?

--> **Convolution**

이미지 각 픽셀에 대해 필터의 값들을 곱한후 합치는 과정

== 필터의 weight 를 조작해서

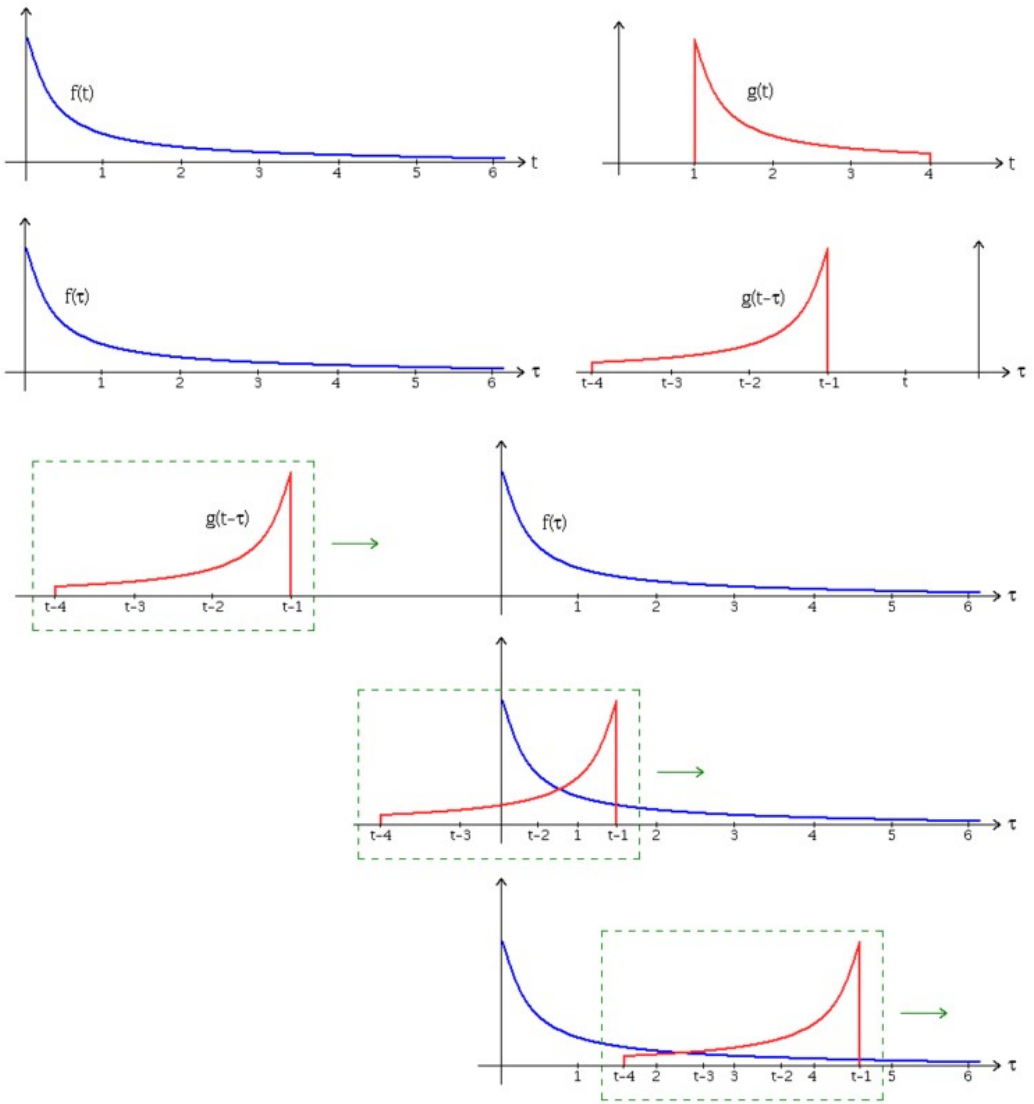
이미지에서 원하는 정보를 가져올 수 있다 !

Identity	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	
Edge detection	$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$	
	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$	
	$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$	

Convolutional?

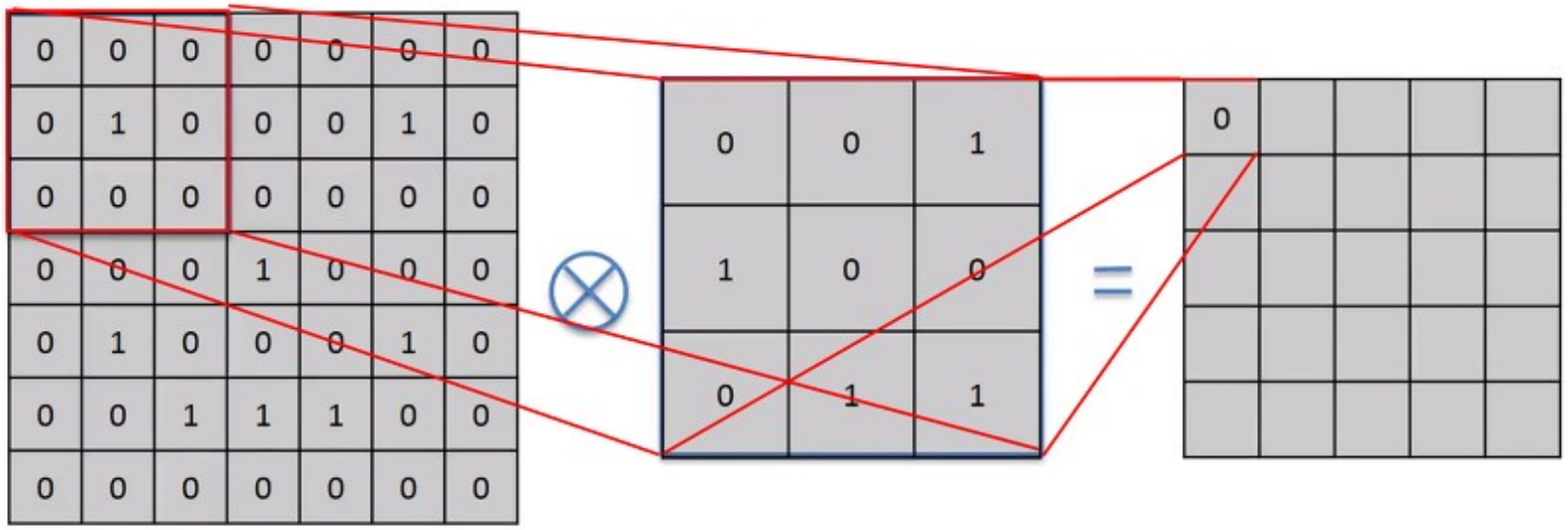
Convolution

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$$



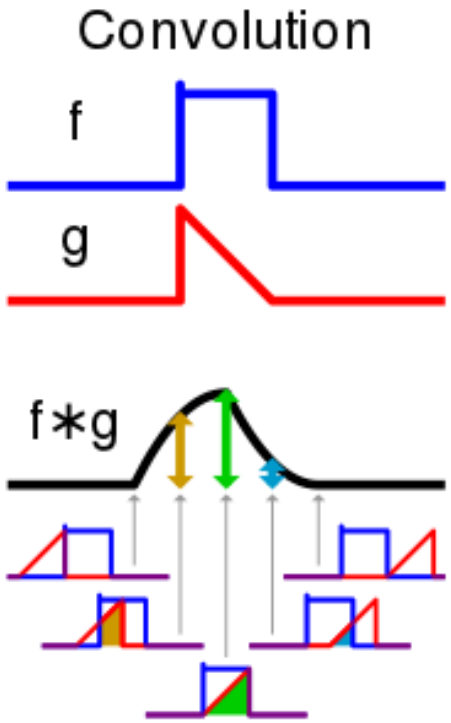
Convolutional?

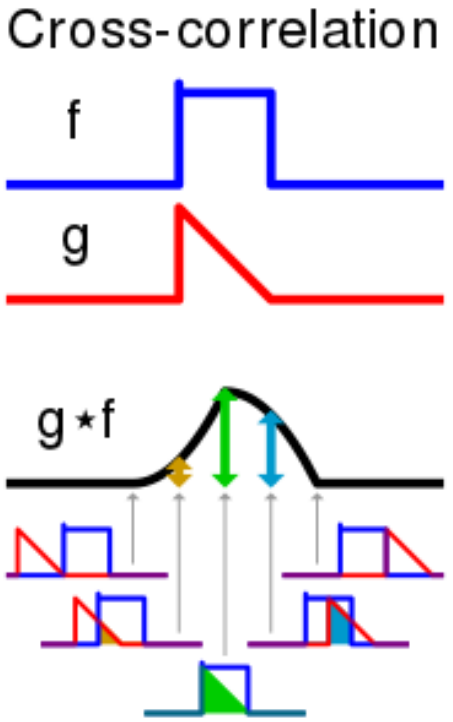
Convolution in Deep Learning



Convolutional?

Convolution





$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau)\, g(t - \tau)\, d\tau$$

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau)\, g(t + \tau)\, d\tau$$

Convolutional?

Convolution

실제 구현은 cross-correlation

Convolution

image

1	2	3
4	5	6
7	8	9

$*$

kernel

A	B	C
D	E	F
G	H	I

$$(1 * I) + (2 * H) + (3 * G) + (4 * F) + \dots + (9 * A)$$

Cross-correlation

image

1	2	3
4	5	6
7	8	9

$\otimes$

kernel

A	B	C
D	E	F
G	H	I

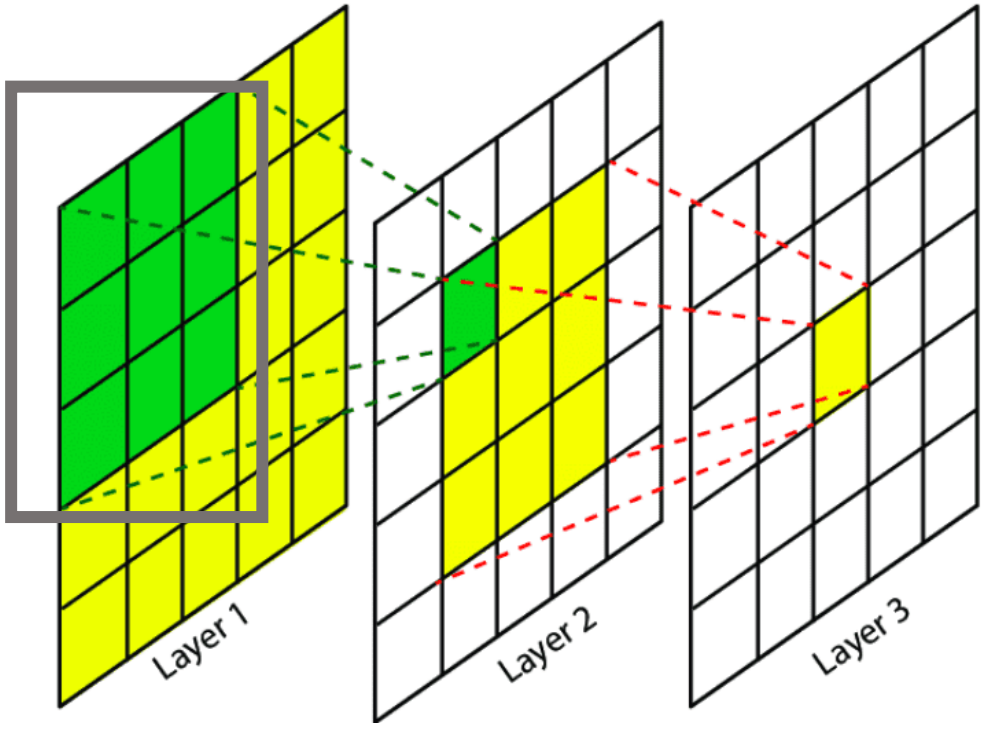
$$(1 * A) + (2 * B) + (3 * C) + (4 * D) + \dots + (9 * I)$$

Convolutional?

Receptive Field

한 뉴런이 수용하는 이미지 (감각) 정보 크기

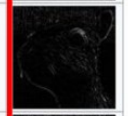
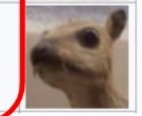
--> 어떤 feature 를 가져오는 영역의 크기



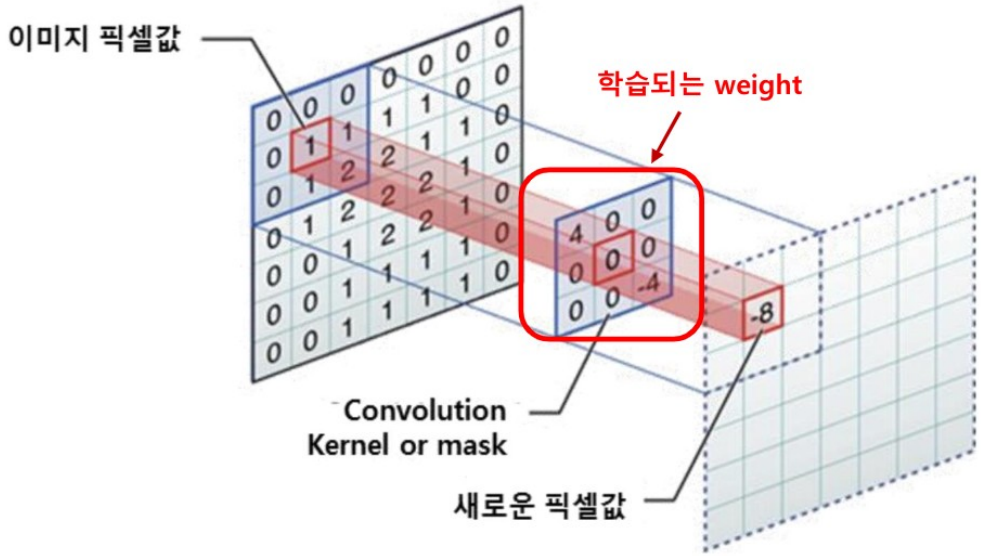
Convolutional?

Convolution

Convolution 과 CNN Convolution의 차이

Operation	Kernel	Image result
Identity	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	
Edge detection	$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$	
	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$	
	$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$	
Sharpen	$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$	
Box blur (normalized)	$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	

사람이 설계



신경망이 설계해줌

Convolutional Neural Network

LeNet (1998)

1. CNN layer
2. Pooling layer
3. FC layer

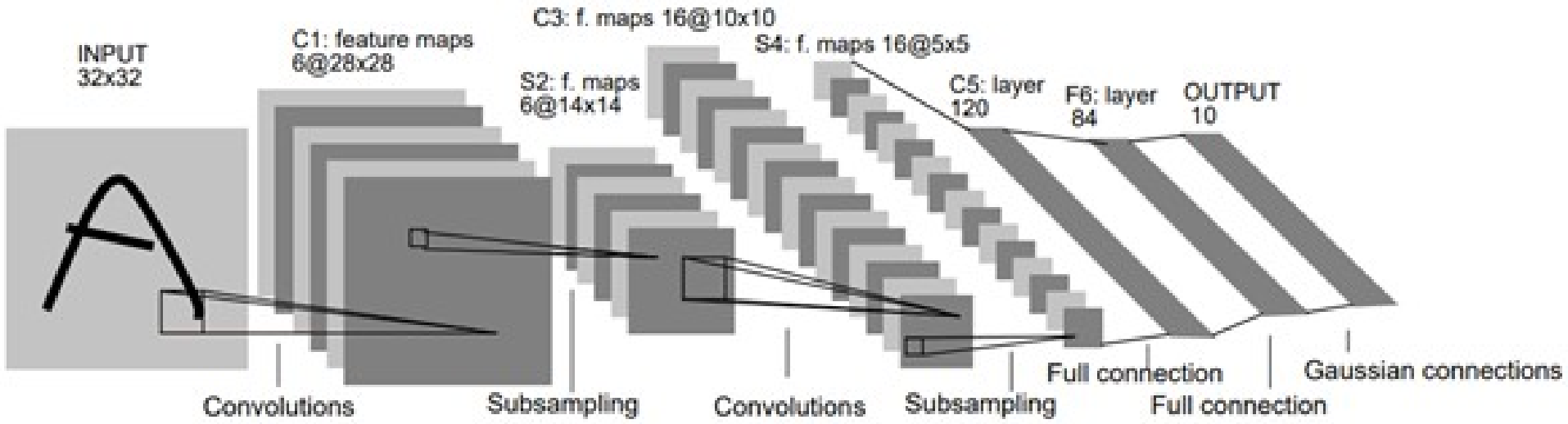
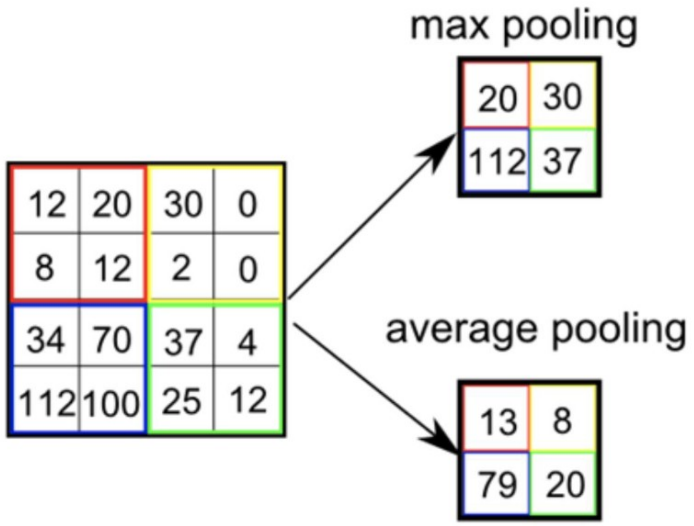


Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

Convolutional Neural Network

Pooling layer(Sub-sampling/Down-sampling)

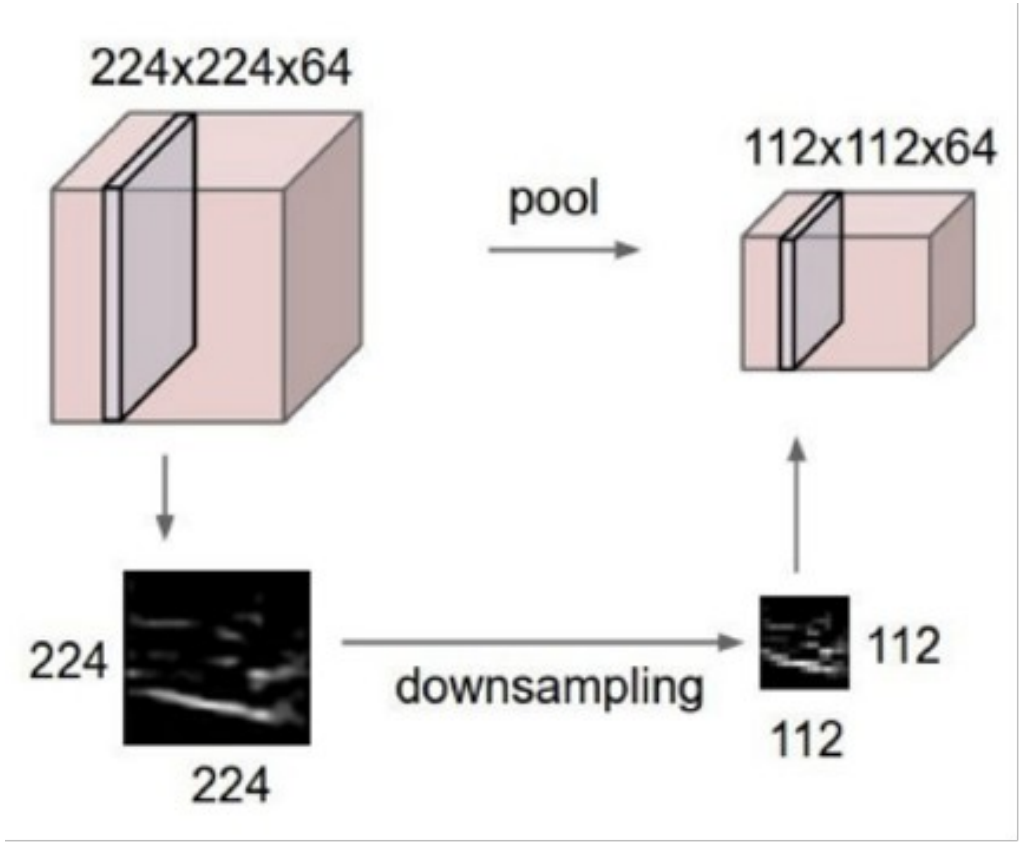


Feature map 사이즈 줄이기
Strong, Glabl feature 뽑아 중요한 invariance 얻기

Convolutional Neural Network

Pooling layer(Sub-sampling/Down-sampling)

정보는 유지된다 !



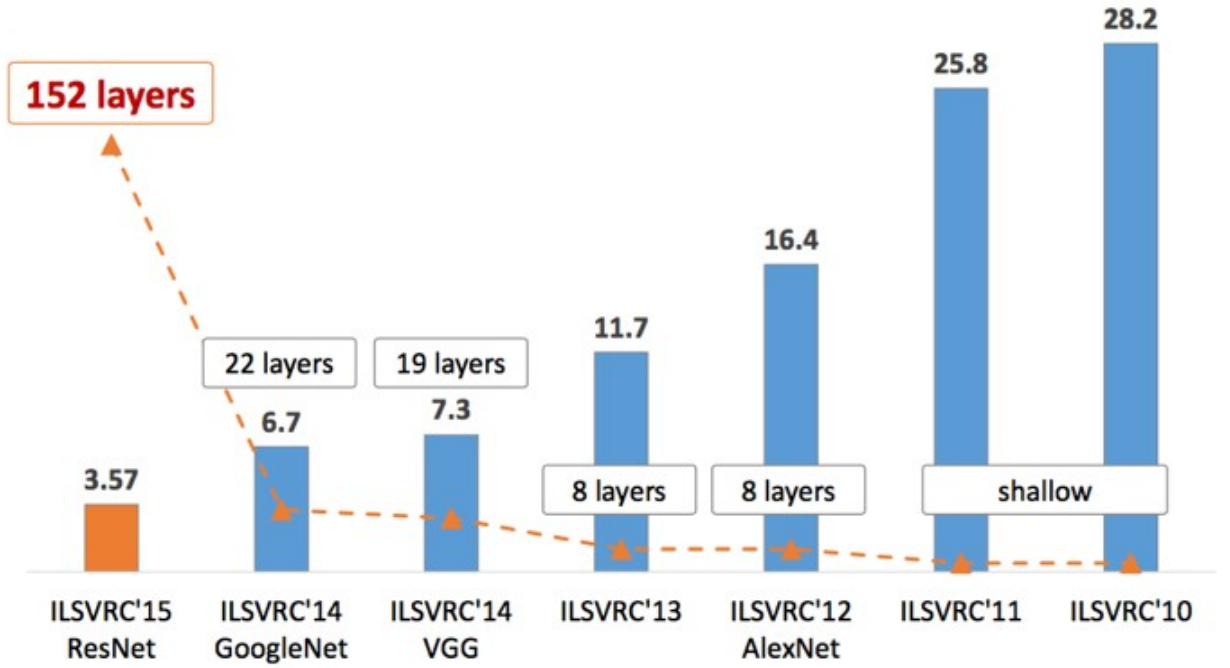
Convolutional Neural Network

AlexNet (2012)

LeNet 구조와 비슷

- 인풋 사이즈 (32x32 -> 224x224)
- 모델 사이즈 키움 , dropout 사용

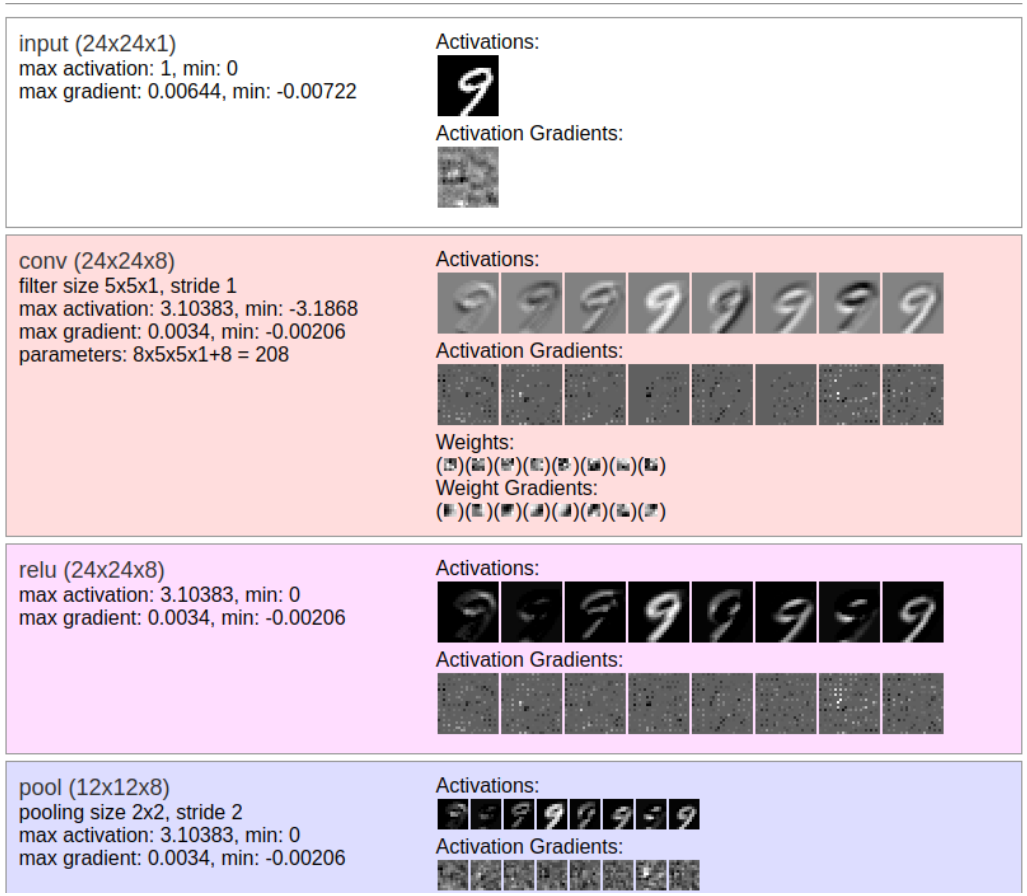
CNN 구조가 재조명됨



Convolutional Neural Network

ConvNetJS

CNN 학습과정 / Feature Map 보여주는 사이트



Ques-
tion?

Thank You!