인공지능 개론

L10 Convolutional Neural Network

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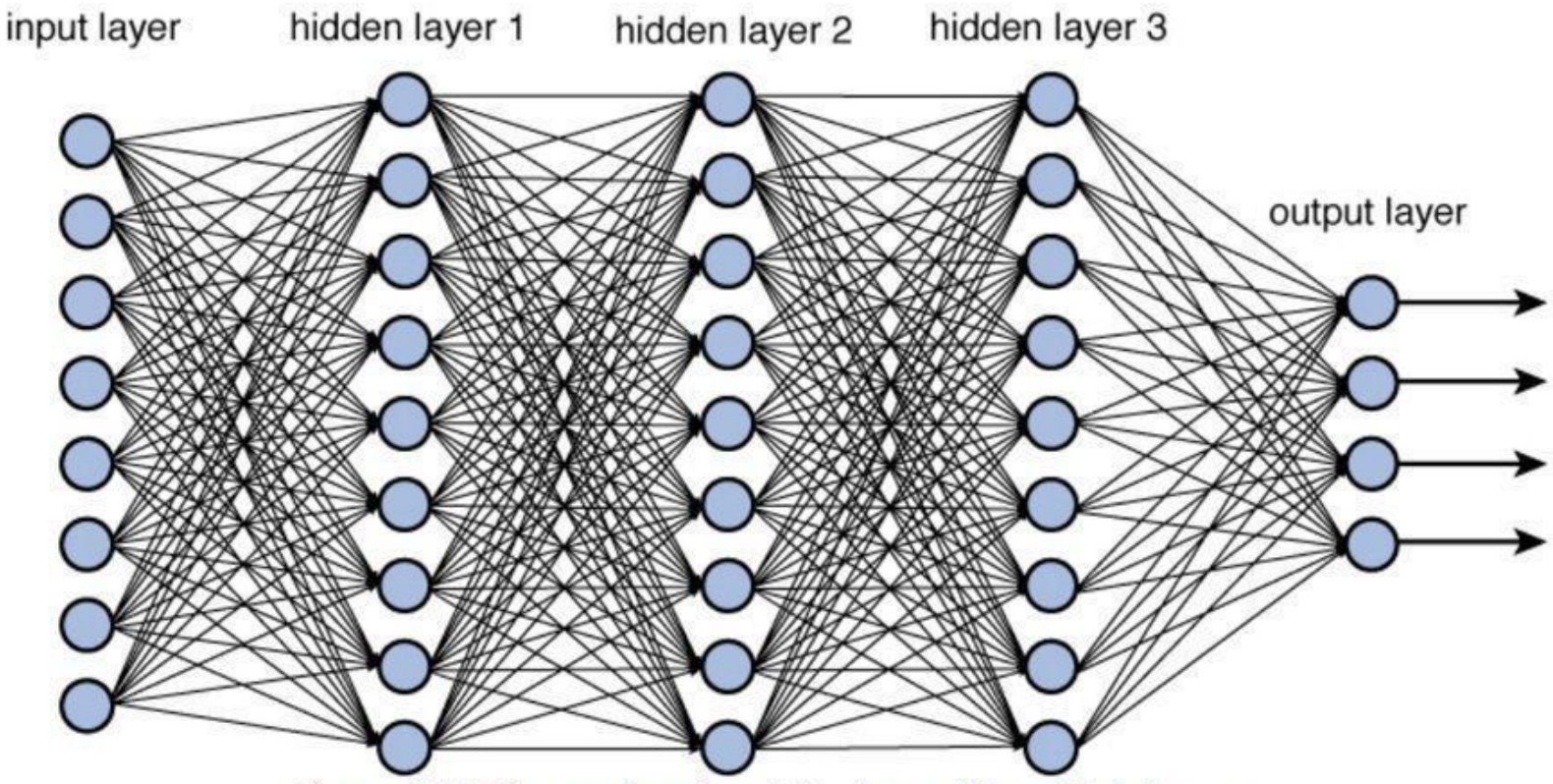
박하명

Fully Connected Layer

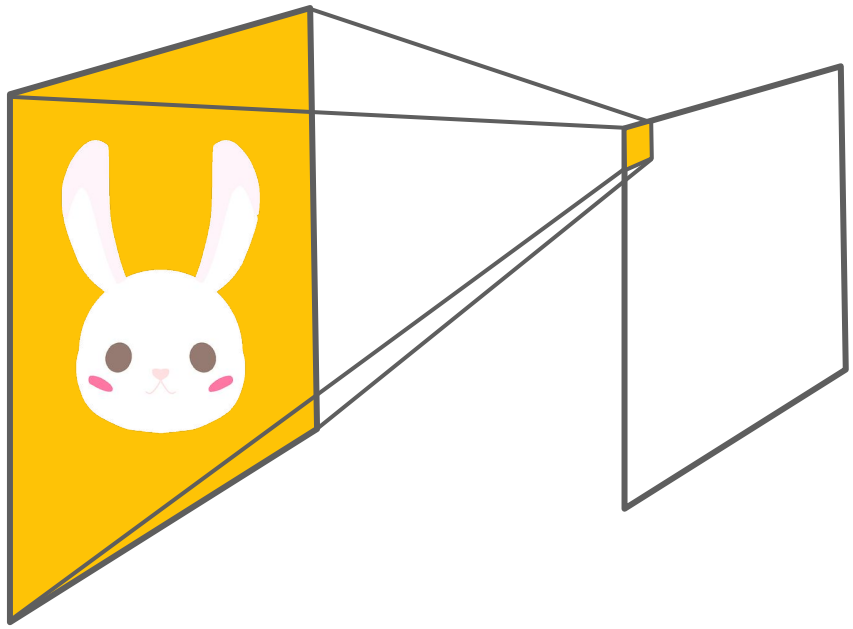
- DNN은 **파라미터**가 **너무 많다**.



Fully Connected Layer

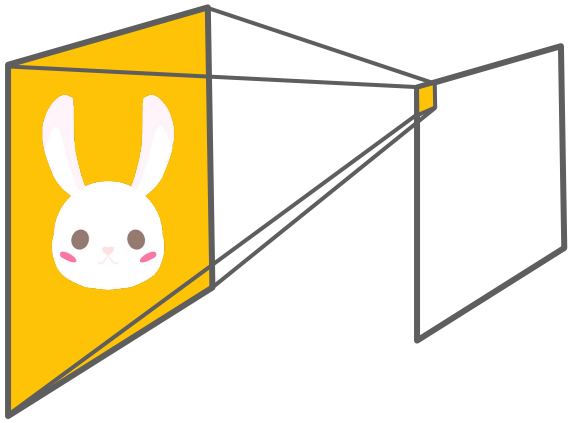
- DNN은 **파라미터**가 **너무 많다**.
- **DNN**은 하나의 출력을 위해 **이미지의 모든 영역을 사용**한다.

Q. 30x30 → 10x10 의 Fully Connected Layer에는 몇 개의 파라미터가 있을까?

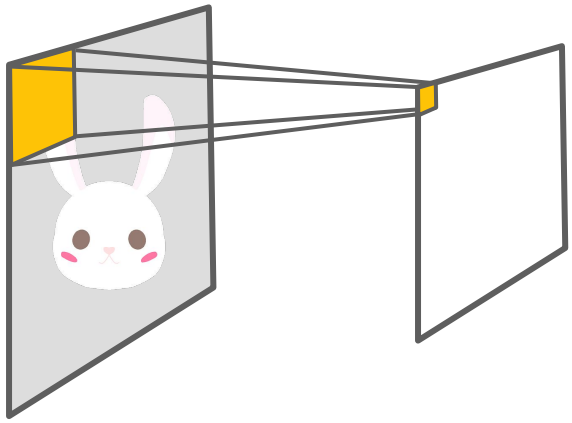


Fully Connected Layer

- DNN은 **파라미터**가 **너무 많다**.
- DNN은 하나의 출력을 위해 이미지의 모든 영역을 사용한다.
- 이미지에서는 가까운 점들끼리 서로 연관되는데, 이러한 **지역성**을 유지하려면? → Locally Connected Layer



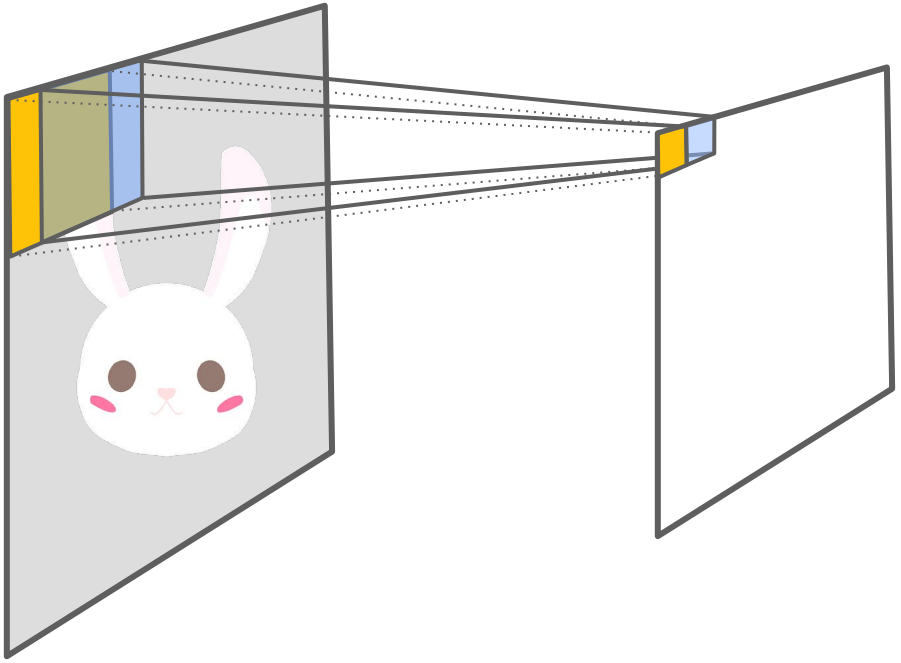
Fully Connected Layer



Locally Connected Layer

Locally Connected Layer

- Locally Connected Layer: **하나의 출력을 계산**하기 위해, 이미지 전체를 입력하는 대신에 **일부분만 입력**

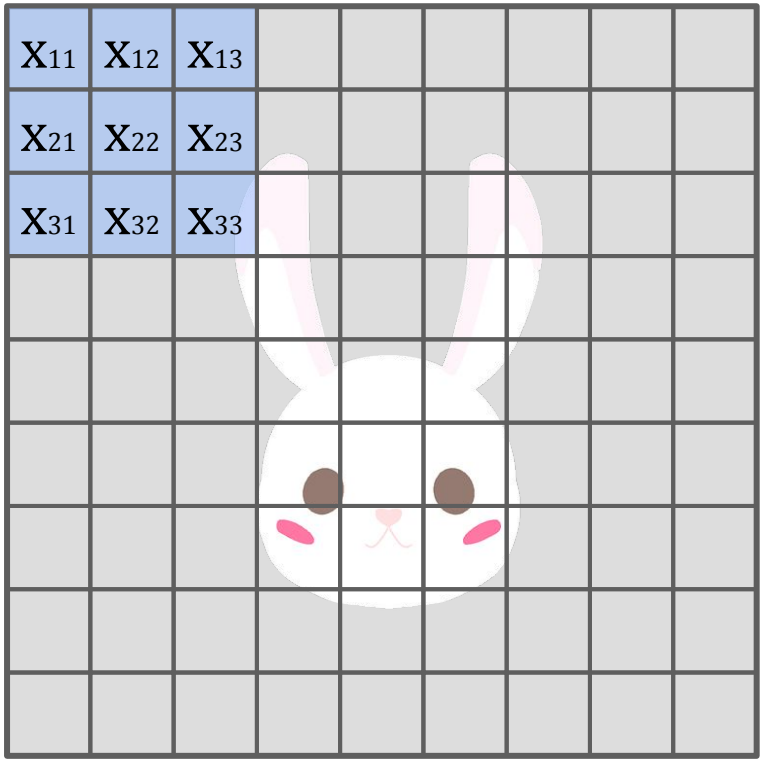


Locally Connected Layer or
Convolutional Layer

Convolutional Layer

Locally Connected Layer vs Convolutional Layer

파라미터를 공유하는가 vs 파라미터를 공유하지 않는가

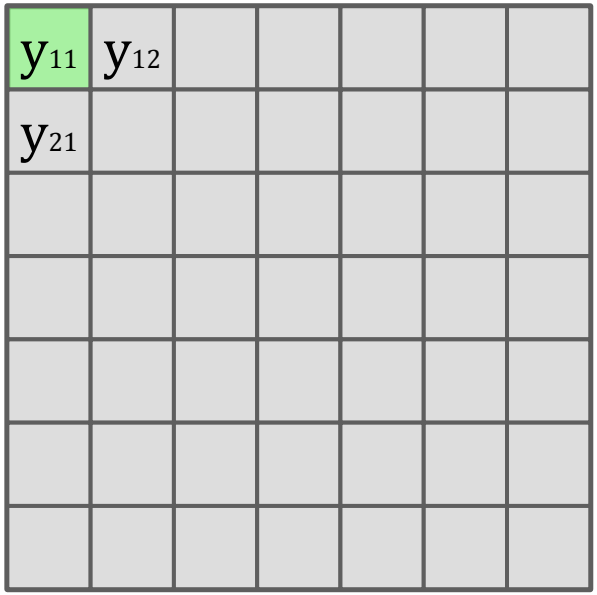


filter 또는 kernel

w_{11}	w_{12}	w_{13}
w_{21}	w_{22}	w_{23}
w_{31}	w_{32}	w_{33}

b

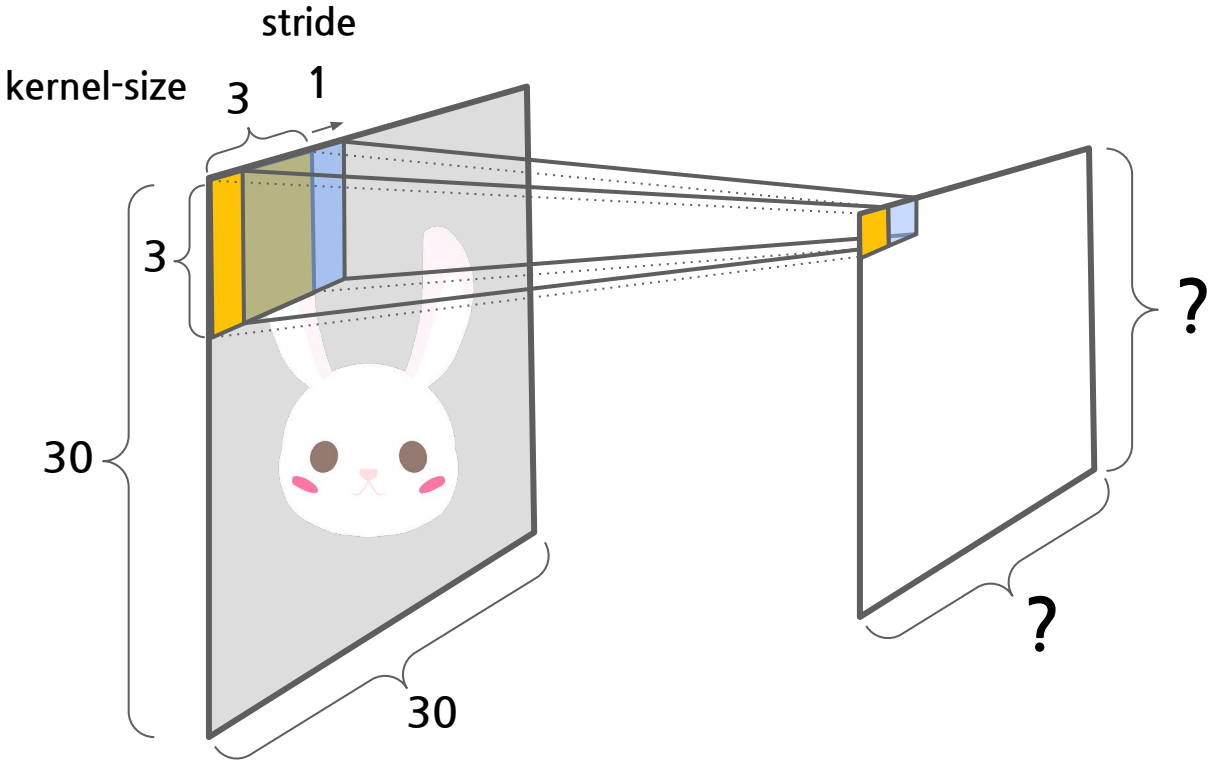
$$XW+b = y$$



Convolutional Layer

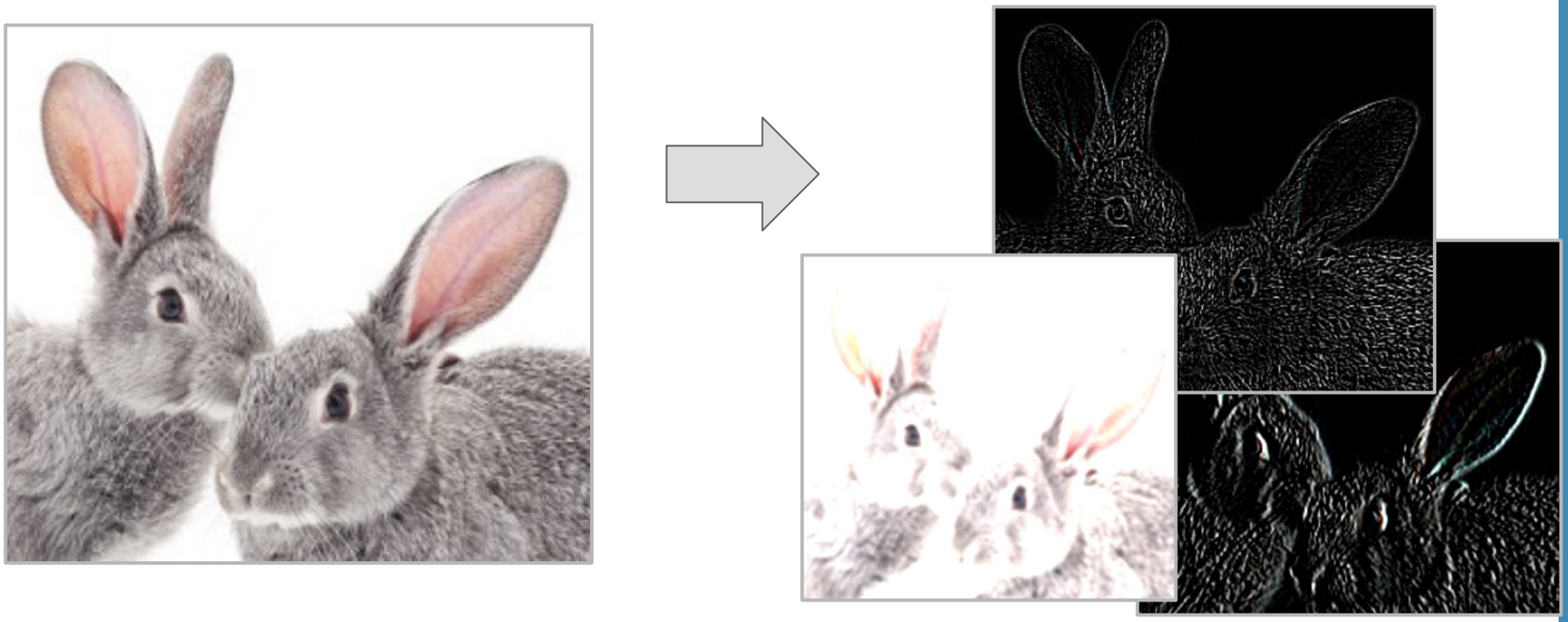
잠깐 산수 Time!

LCL 일 경우 파라미터 수?
CL 일 경우 파라미터 수?



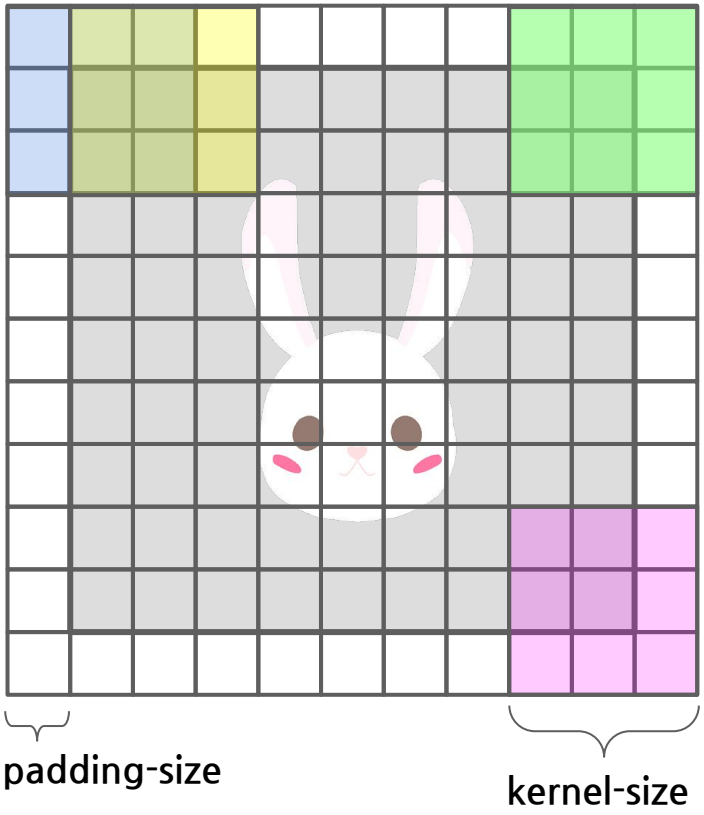
Convolution

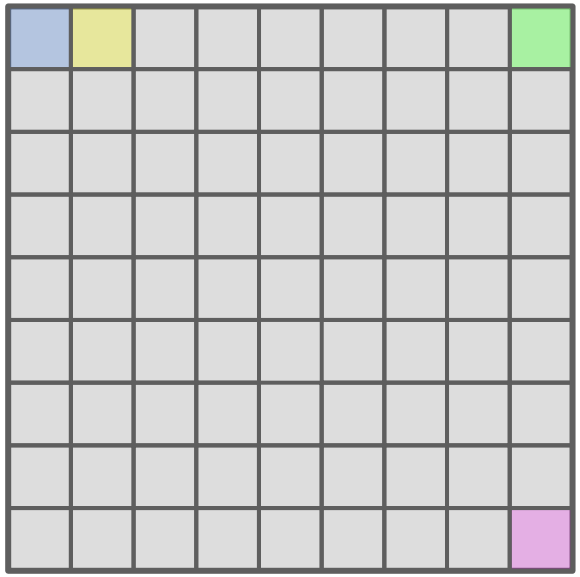
- 파라미터를 공유하면 어떤 효과가...? → 이미지 필터같은... 그런 효과!
- 필터먹인 이미지 = **Feature Map**
- 서로 다른 필터를 먹여서 Feature Map을 여러개 만들 수도 있음

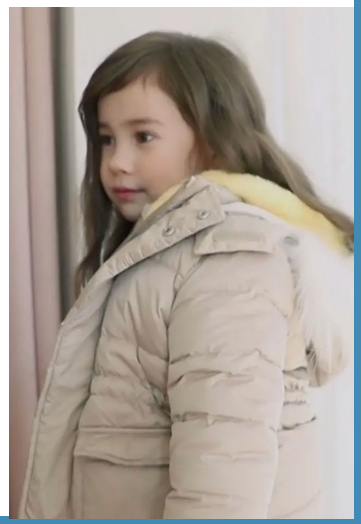


Padding

- Convolutional Layer를 거쳤더니 **이미지 크기가 줄어서 슬퍼요…**
  ⇒ 사이즈가 줄지 않도록 **패딩을 입히자**! (입히기 싫으면 말구)

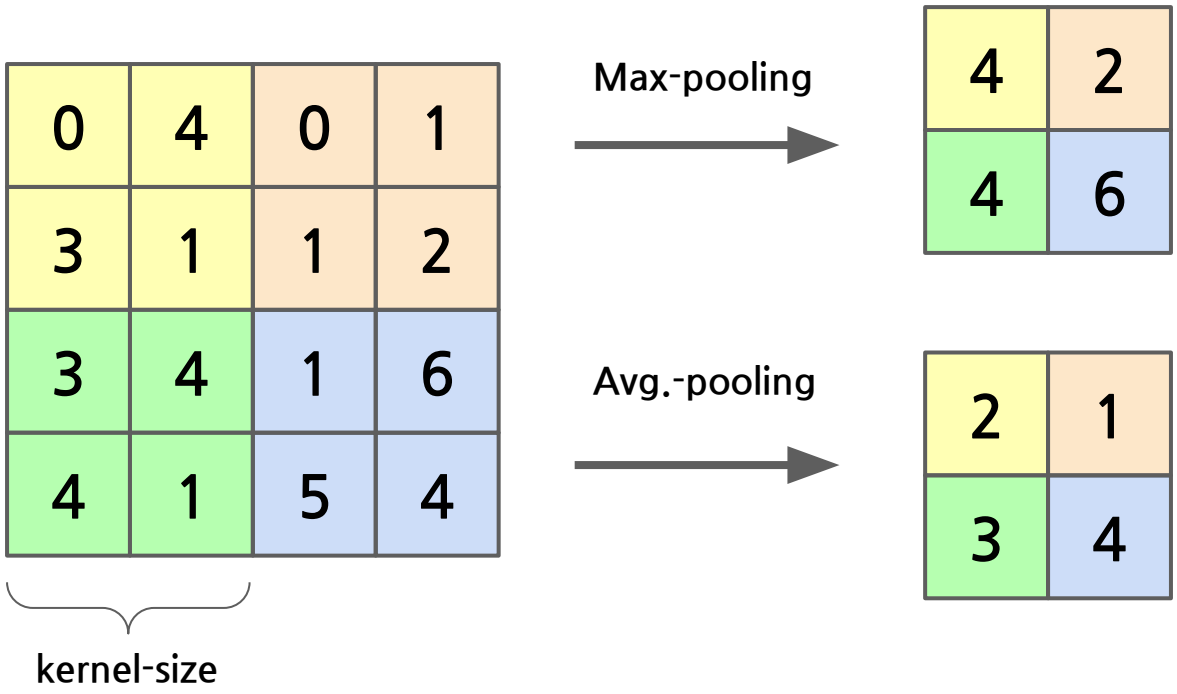




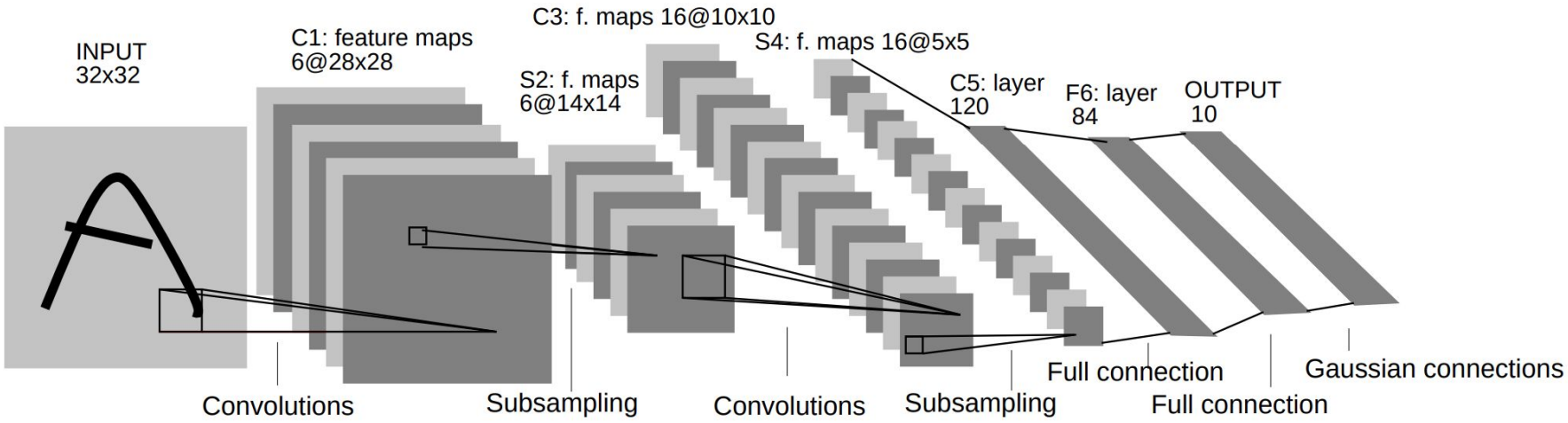


Pooling

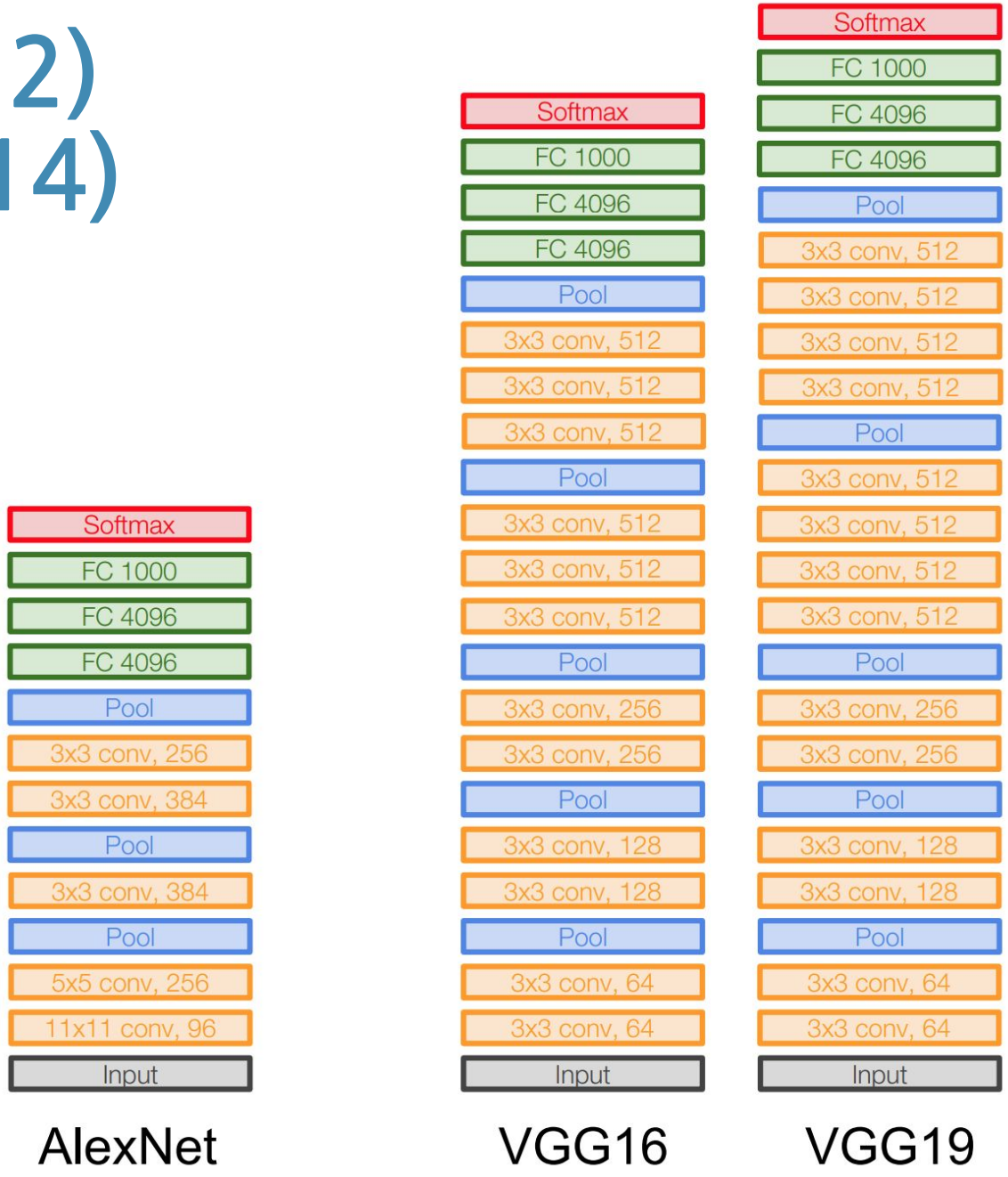
- 이미지가 너무 커요, 사이즈를 좀 줄이고 싶어요…
  ⇒ **구역마다 요약**해서 **하나의 점**으로 만들자! = pooling



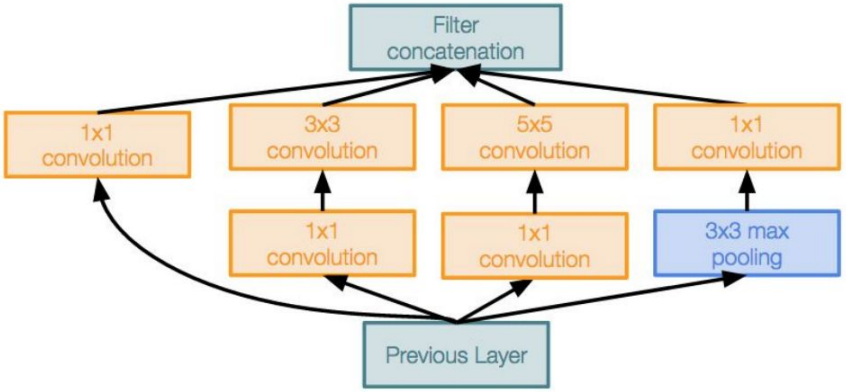
LeNet-5 (1998)


INPUT
32x32
C1: feature maps
6@28x28
S2: f. maps
6@14x14
C3: f. maps 16@10x10
S4: f. maps 16@5x5
C5: layer
120
F6: layer
84
OUTPUT
10
Convolutions
Subsampling
Convolutions
Subsampling
Full connection
Full connection
Gaussian connections

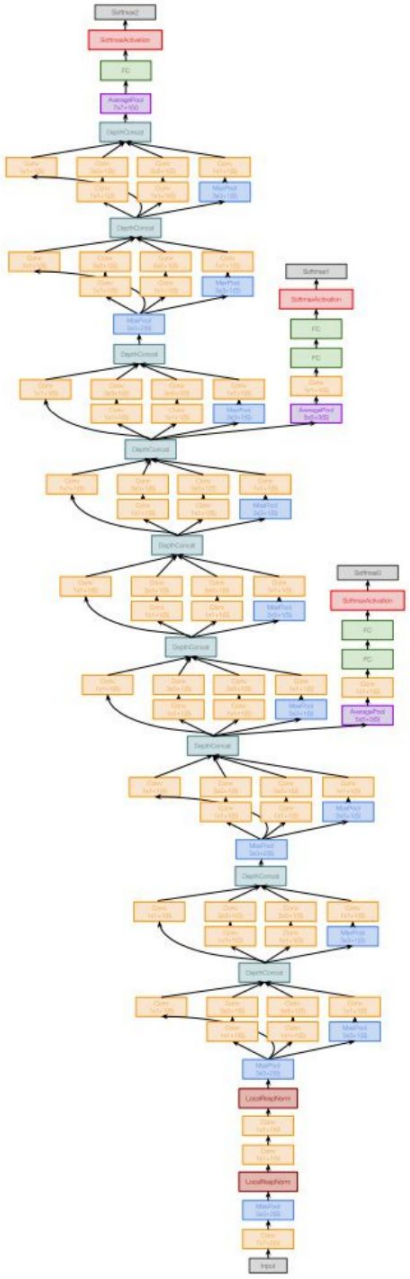
AlexNet (2012)
VGGNet (2014)



GoogleNet (2014)

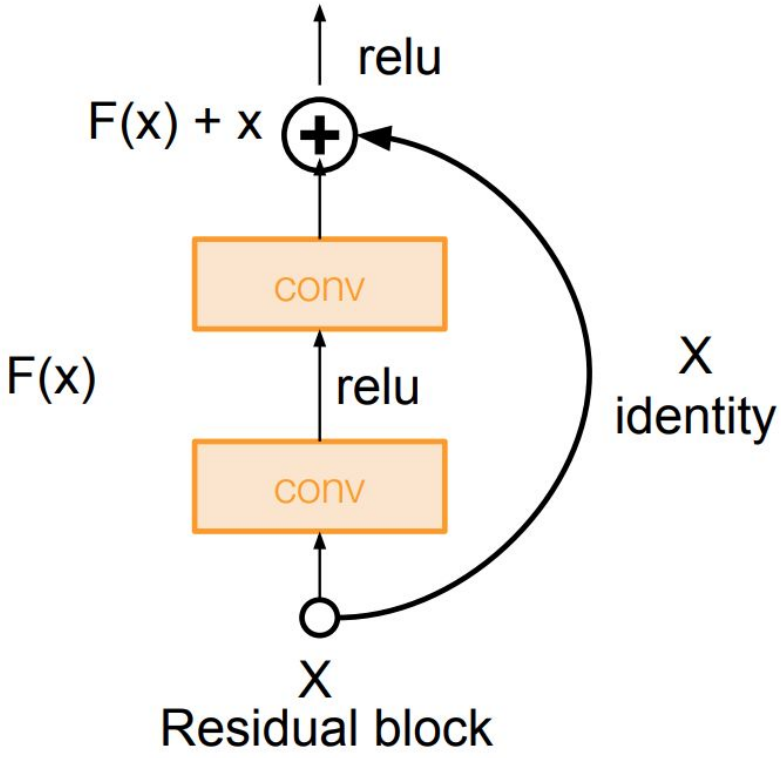


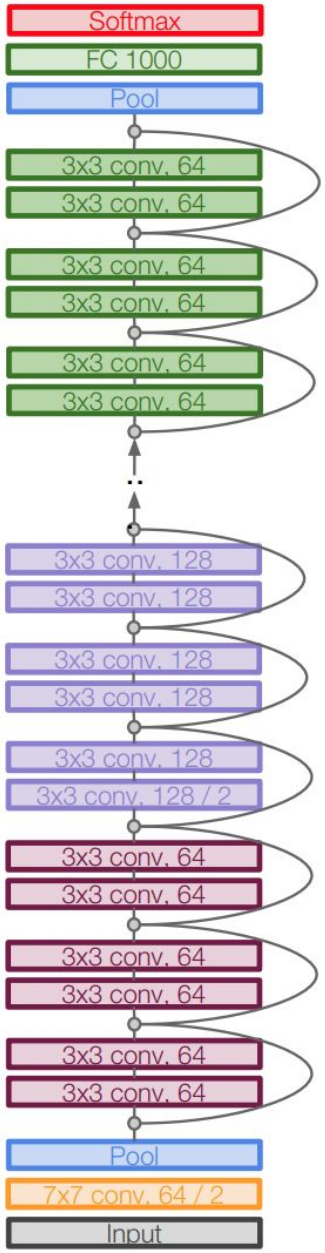
Inception module



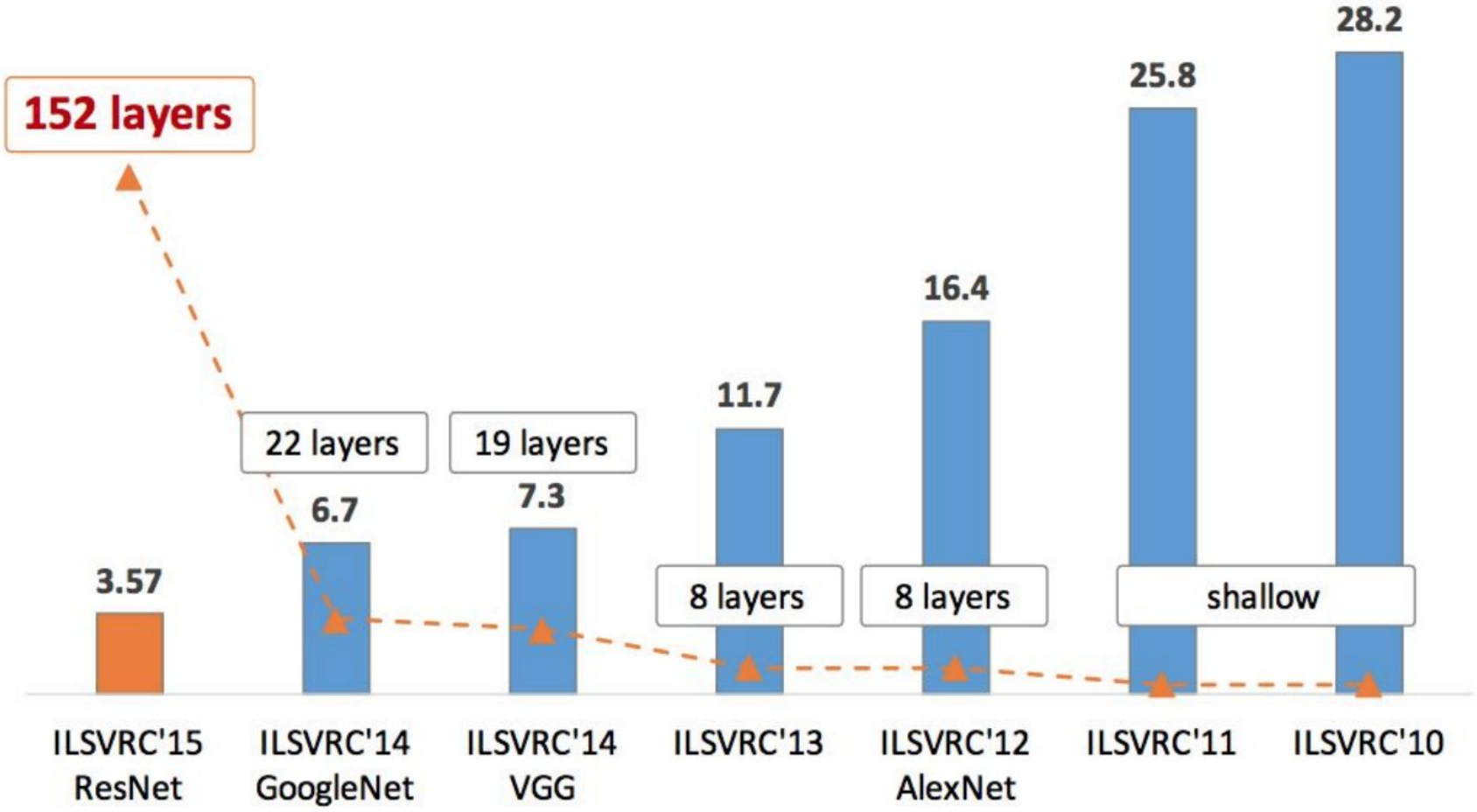
ResNet (2015)

Residual Connection을 이용한 매~~우 깊은 네트워크 구성





ILSVRC 이미지 인식 경진대회



Question?