Convolutional Neural Networks
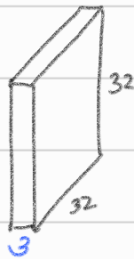
Hierarchical organization   1959 고양이 뇌 실험
    Simple cells — Complex cells — Hypercomplex cells

Image Net Classification with Deep CNN   2012 "AlexNet"

Convolutional Layer

ex.   32×32×3 image : spatial structure 보존

3×5×3 filter w

Convolve the *filter*
with the image
(덮장찍듯이)

Filters always extend the full depth of the input volume : 3
1 number : the result of taking a dot product btw
           the filter and a small 5×5×3 chunk of the img.
$$w^T x + b$$

모든 spatial location에 convolve 하면
28×28×1 activation map 생성
또 다른 filter로 다른 activation map 생성
예로 6개 maps 만들면 28×28×6

ConvNet 은 Convolution Layers 의 Sequence, interspersed with activation f.

ex. Conv Layer - RELU - Conv Layer - RELU - POOL - ⋯ - "FC"

Input img size : N
Filter size : F   일 때, Output map은 (N-F)/stride +1

                     (32 -5)/ 1 + 1 = 28

Zero Padding (in practice)
   pad with 1 pixel border
   ∴ maintain the same input size
   filter size >t 3×3 : zero pad with 1
                5×3 :   "   2
                7×3 :   "   3

Input volume : 32×32×3
         10 5×5 filters w/ stride 1, pad 2 일 때,
         # of params = (5×5×3 +1)×10 = 760
                                 └─ bias

Pooling layer : downsample
   - makes the representations smaller and more manageable
   - operates over each activation map independently
   - depth is the same

Max Pooling

1	1	2	4
5	6	7	8
3	2	1	0
1	2	3	4

→

6	8
3	4

max pooled with
2×2 filters and stride 2