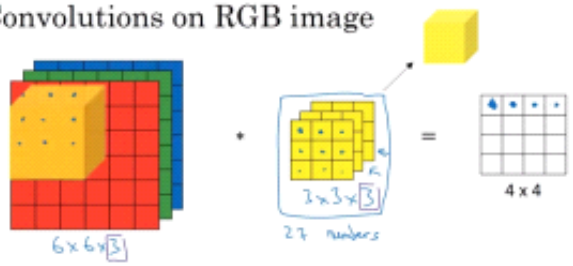
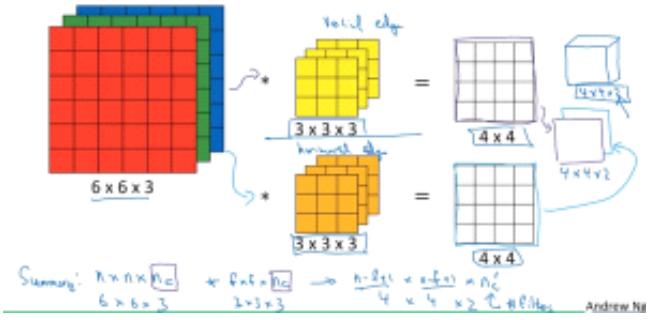
CNN

Tuesday, October 16, 2018 10:37 AM

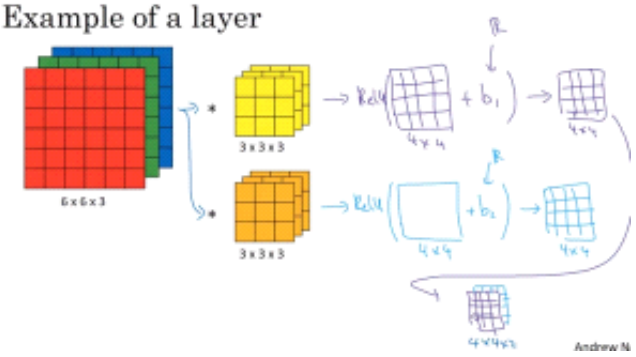
Convolutions on RGB image



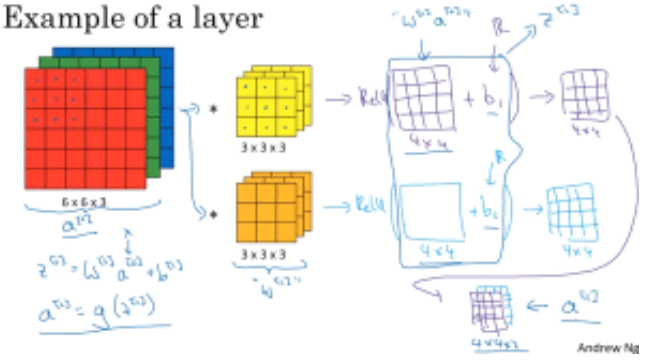
Multiple filters



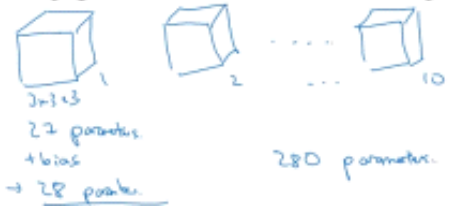
Example of a layer



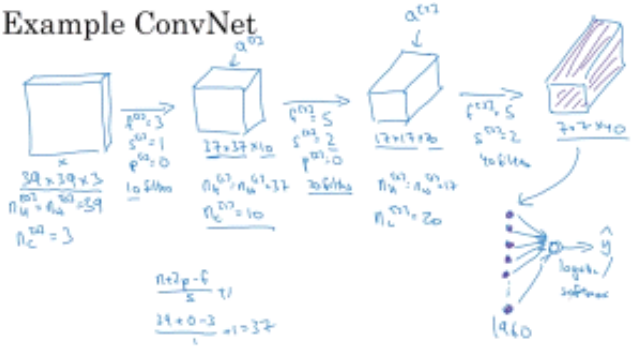
Example of a layer



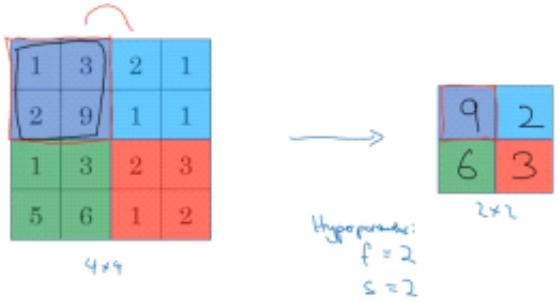
If you have 10 filters that are 3 x 3 x 3 in one layer of a neural network, how many parameters does that layer have?



Example ConvNet



Pooling layer: Max pooling



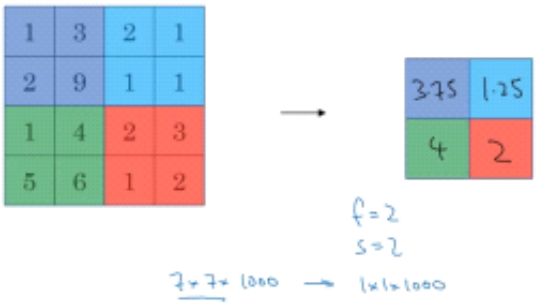
Types of layer in a convolutional network:

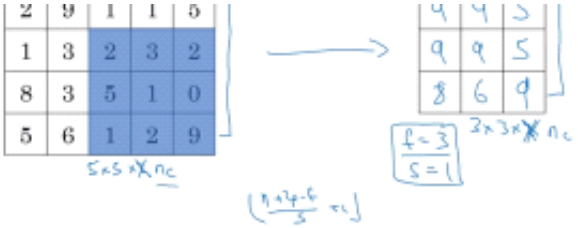
- Convolution (CONV) ←
- Pooling (POOL) ←
- Fully connected (FC) ←

Pooling layer: Average pooling

Pooling layer: Max pooling

Pooling layer: Average pooling

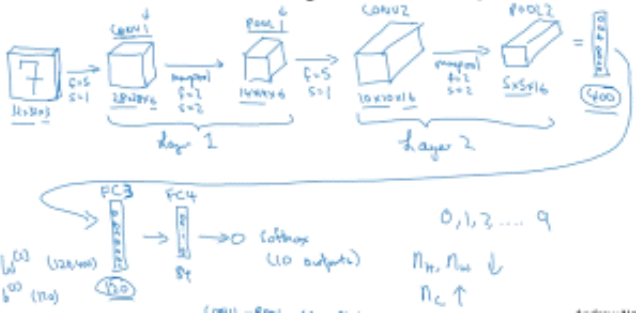




Neural network example

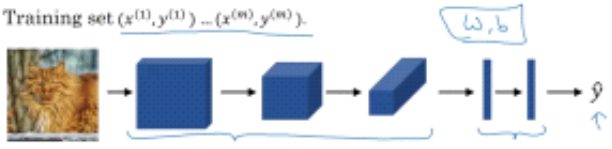
	Activation shape	Activation Size	# parameters
Input:	(32,32,3)	3,072	0
CONV1 (f=5, s=1)	(28,28,8)	6,272	208
POOL1	(14,14,8)	1,568	0
CONV2 (f=5, s=1)	(10,10,16)	1,600	416
POOL2	(5,5,16)	400	0
FC3	(120,1)	120	48,001
FC4	(84,1)	84	10,081
Softmax	(10,1)	10	841

Neural network example (LeNet-5)



Putting it together

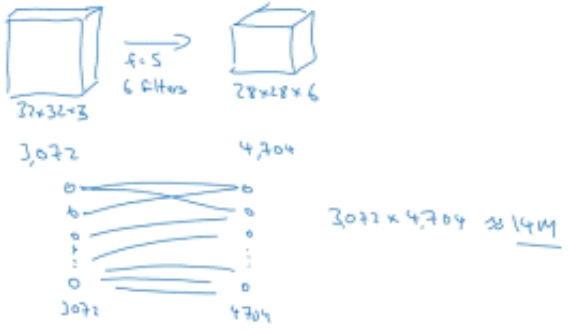
Training set $(x^{(1)}, y^{(1)}) \dots (x^{(m)}, y^{(m)})$.



Cost $J = \frac{1}{m}\sum_{i=1}^{m} \mathcal{L}(\hat{y}^{(i)}, y^{(i)})$

Use gradient descent to optimize parameters to reduce J

Why CNN



Convolutions has less parameters as parameter sharing is done

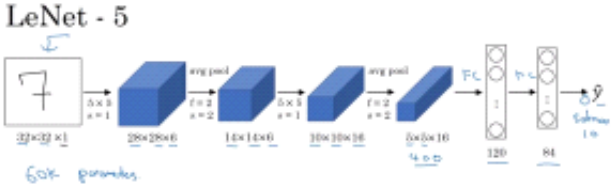
Parameter sharing: A feature detector (such as a vertical edge detector) that's useful in one part of the image is probably useful in another part of the image.

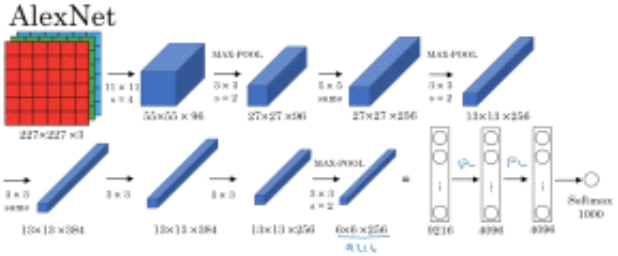
Sparsity of connections: In each layer, each output value depends only on a small number of inputs.

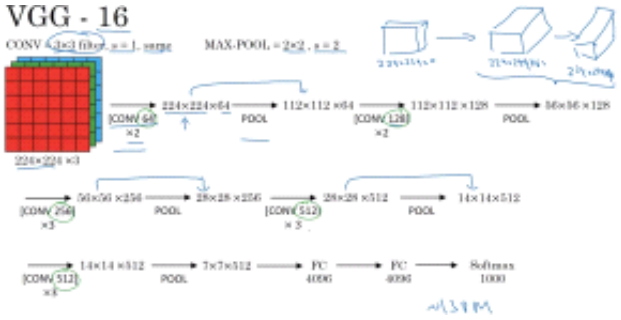
Classic networks:

- LeNet-5
- AlexNet
- VGG

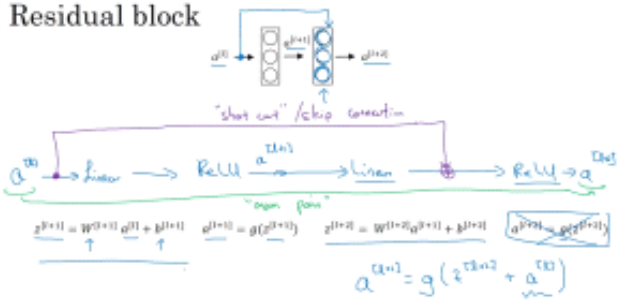
RESNET
INCEPTION

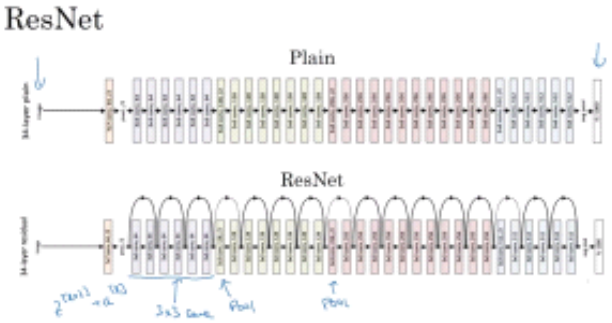





VGG - 16
CONV = 3×3 filter, s = 1, same
MAX-POOL = 2×2, s = 2
224×224×64
POOL
112×112×64
112×112×128
POOL
56×56×128
POOL
28×28×256
28×28×512
POOL
14×14×512
14×14×512
POOL
7×7×512
FC
4096
FC
4096
Softmax
1000

RESNET


Residual block
"short cut" / skip connection
Linear
ReLU
Linear
ReLU
"main path"


ResNet
Plain
ResNet
3×3 conv
Pool
Pool