Deep Learning / Machine Learning Seminar

- MNIST to CNN-

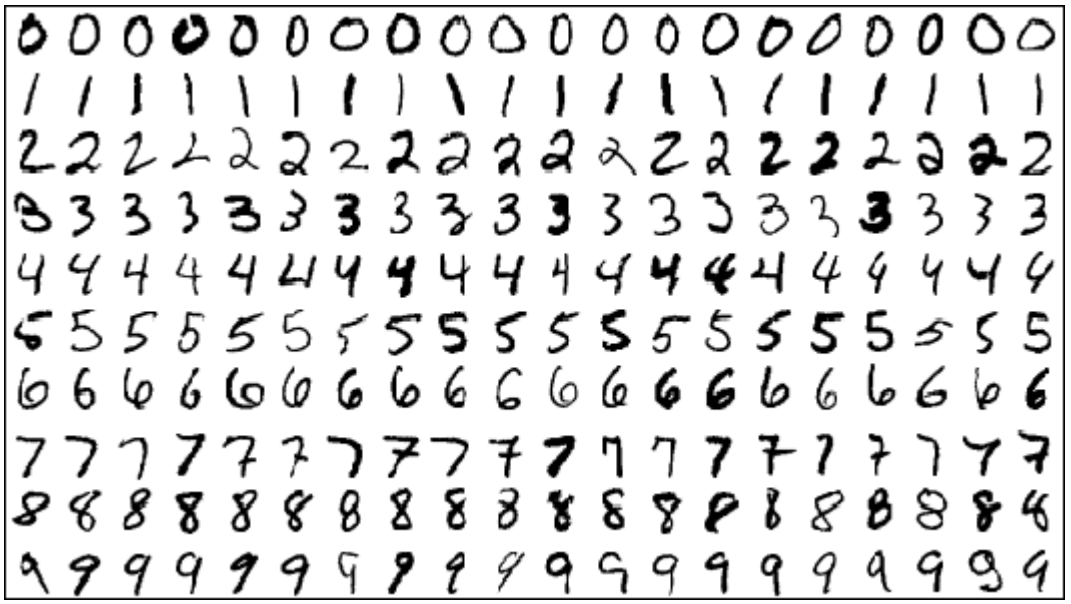
박성현

학습을 시켰으면 시험을 봐야지?

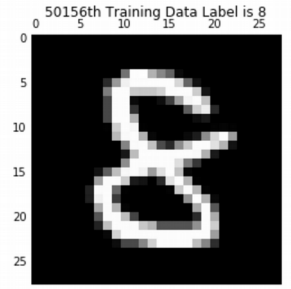
- 학습만 하고 끝? 그럼 왜 함 이걸 ㅎㅎ
- Training Data Set 과 Test Data Set을 분리해서 확인
- 간단하게 MNIST 데이터 셋을 통해서 이것을 해보자!

MNIST

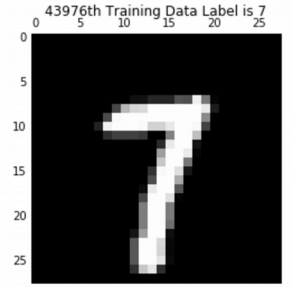
- MNIST ?
- Modified National Institute of Standards and Technology



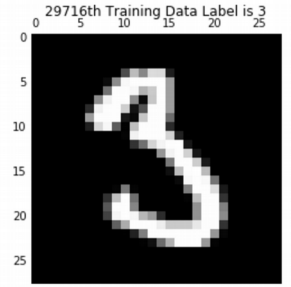
How does the training data look like?



50156th Training Data Label is 8



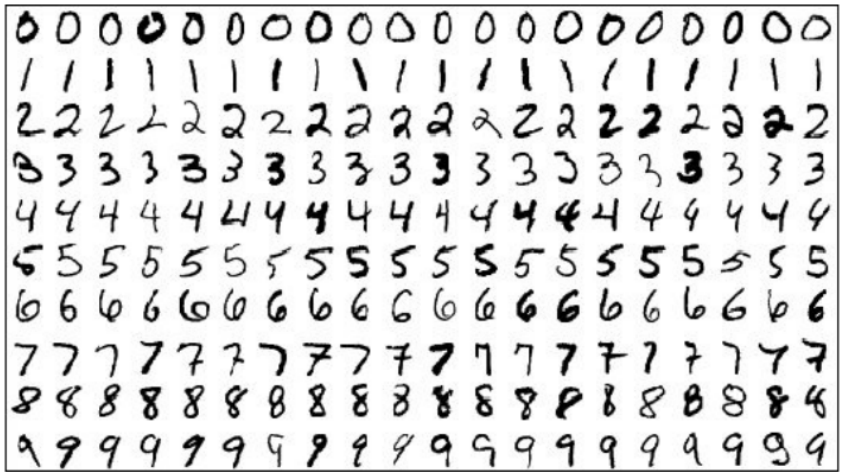
43976th Training Data Label is 7



29716th Training Data Label is 3

(python)>>from tensorflow.examples.tutorials.mnist import input_data

MNIST Dataset



train-images-idx3-ubyte.gz:	training set images (9912422 bytes)
train-labels-idx1-ubyte.gz:	training set labels (28881 bytes)
t10k-images-idx3-ubyte.gz:	test set images (1648877 bytes)
t10k-labels-idx1-ubyte.gz:	test set labels (4542 bytes)

http://yann.lecun.com/exdb/mnist/

Before testing MNIST...

복습합시다

1. tensorflow basic / One-hot encoding
2. Normalized Data / softmax
3. linear / logistic regression

이걸 알아봅니다

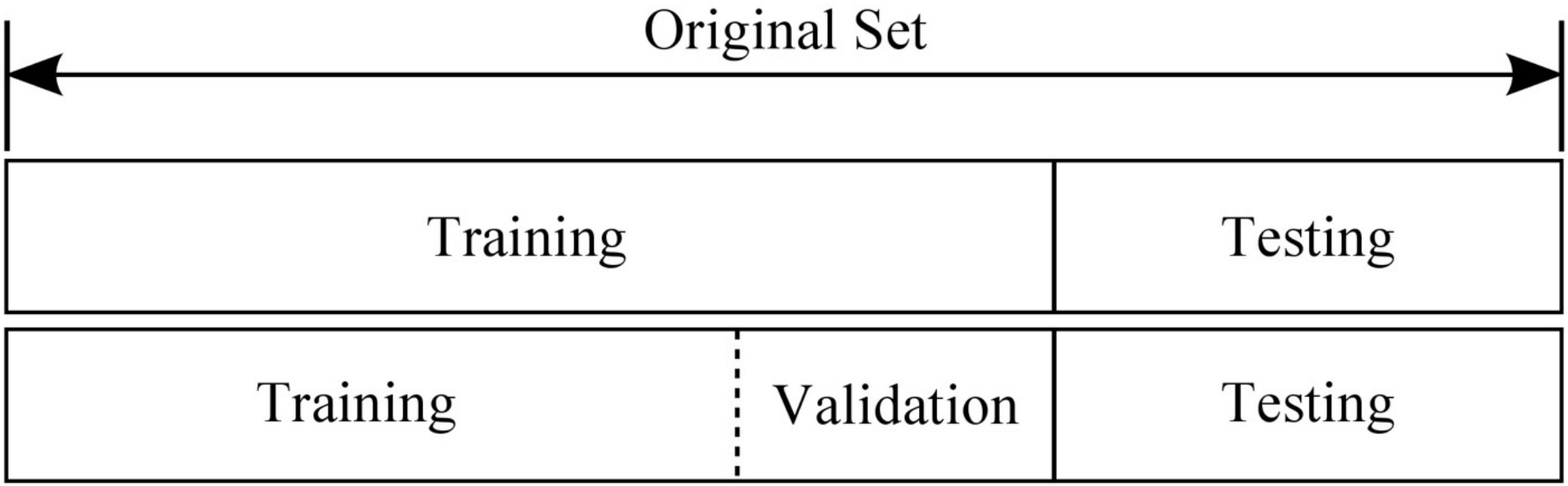
1. epoch? Batch?
2. training / test set
3. CNN
4. optimizer and initializer
5. tensorboard

epoch and batch

- epoch : 모든 훈련 데이터를 전부 학습하는데 걸리는 횟수
- batch : 한번 훈련 데이터를 학습할 때 학습하는 개수들
- 즉, 한번 학습할 때 걸리는 iteration 횟수는 epoch / batch

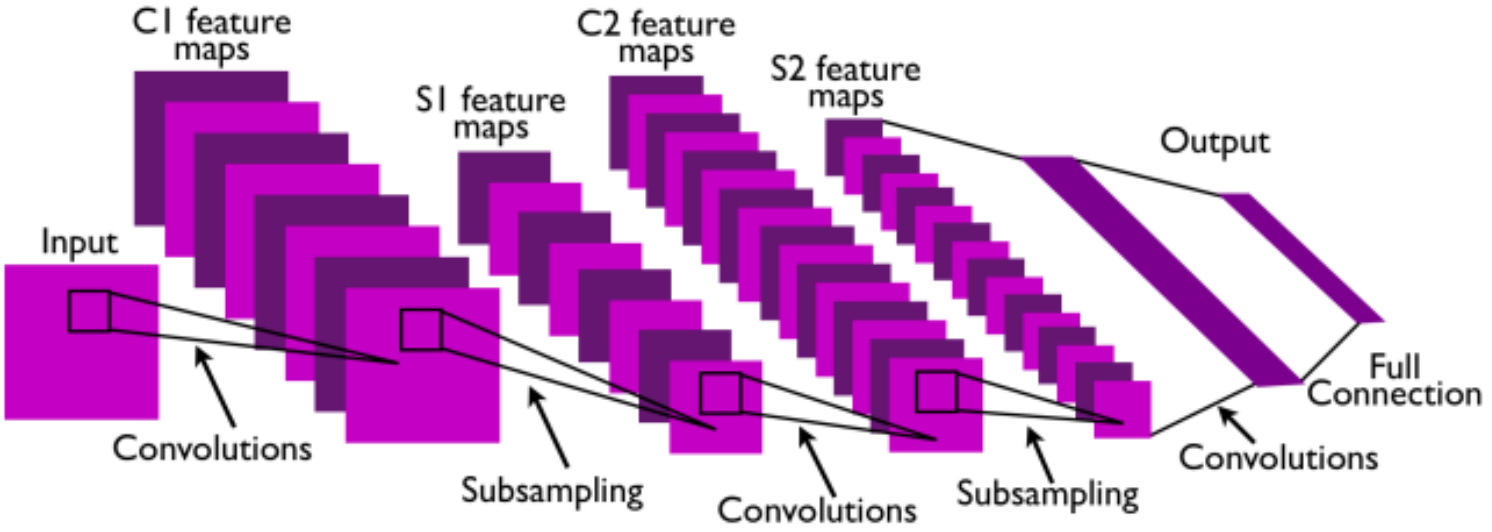
Training and Test Set

- Need to separate test set from training set



CNN

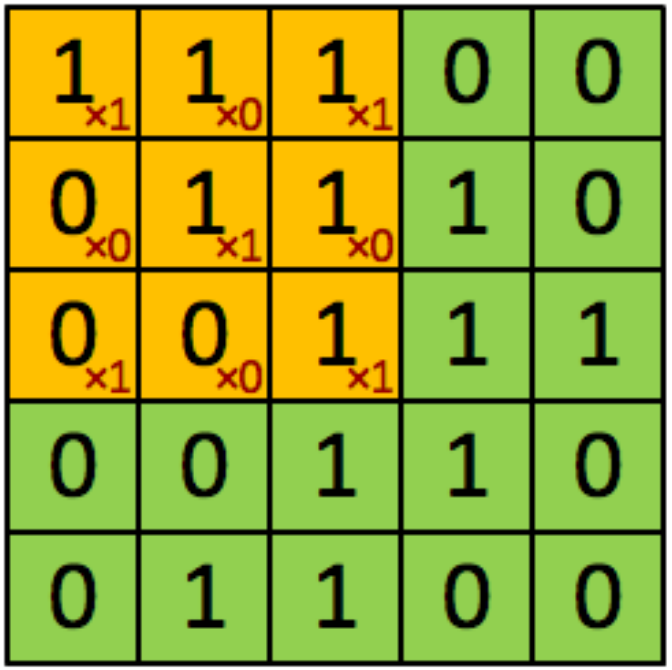
Convolutional **N**eural **N**etwork

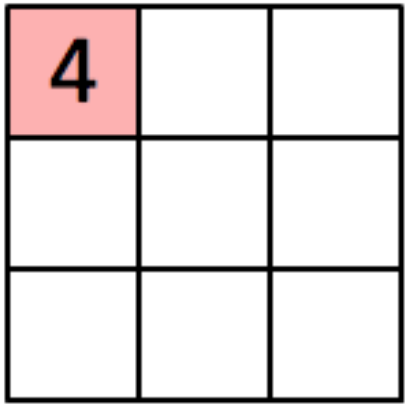


This is pretty much **everything** about the convolutional neural network.

Convolution + Subsampling + Full Connection

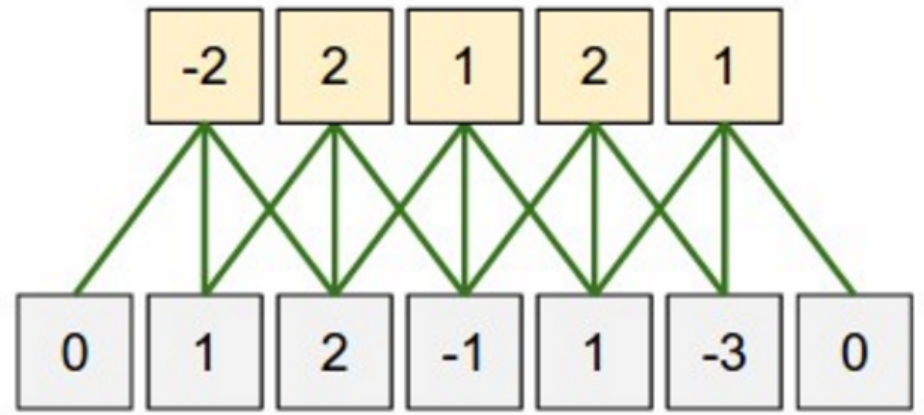
Convolution





http://deeplearning.stanford.edu/wiki/index.php/Feature_extraction_using_convolution

Zero-padding



What is the size of the input? $n_{in} = 5$

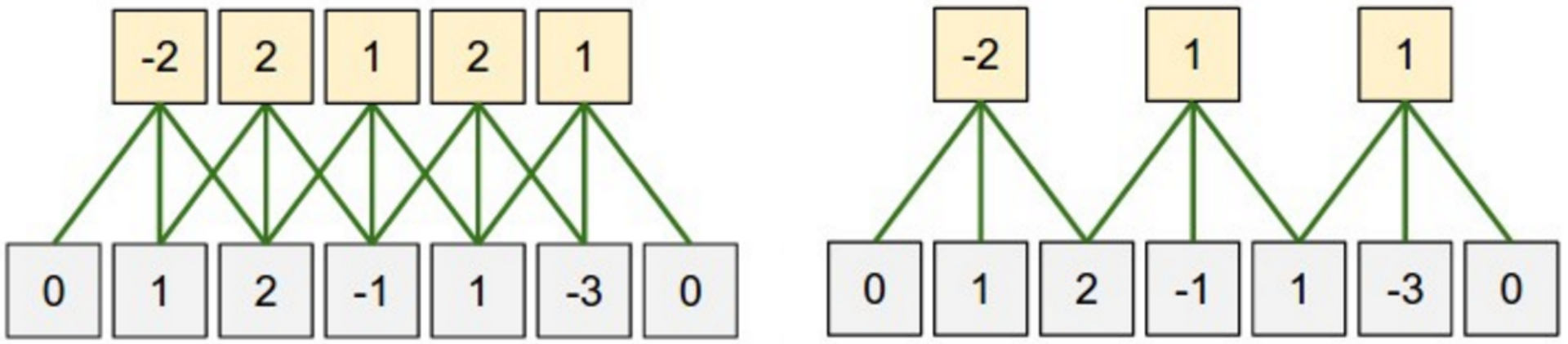
What is the size of the output? $n_{out} = 5$

What is the size of the filter? $n_{filter} = 3$

What is the size of the zero-padding? $n_{padding} = 1$

$$n_{out} = (n_{in} + 2 * n_{padding} - n_{filter}) + 1 \qquad 5 = (5 + 2 * 1 - 3) + 1$$

Stride



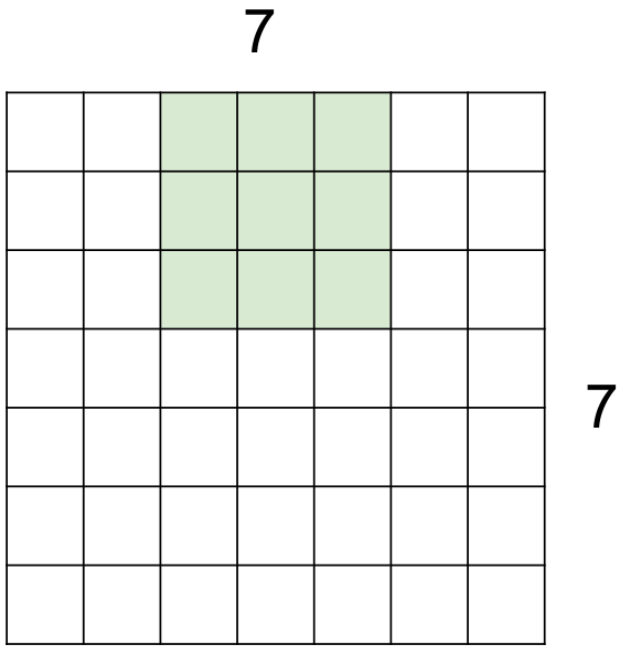
(Left) Stride size: 1

(Right) Stride size: 2

If stride size equals the filter size, there will be **no over-lapping.**

Stride and Zero-padding in CNN

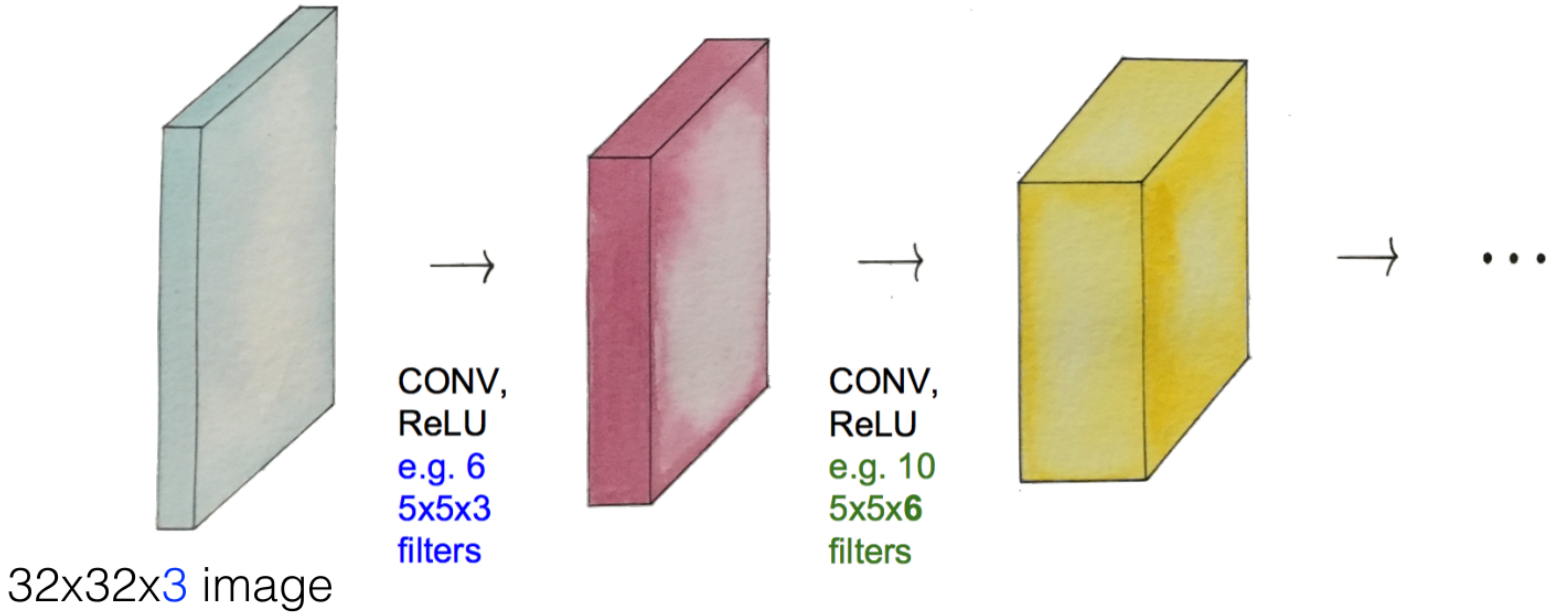
- Output size = [N-F] / stride + 1
  A closer look at spatial dimensions:



7x7 input (spatially)
assume 3x3 filter
applied **with stride 2**

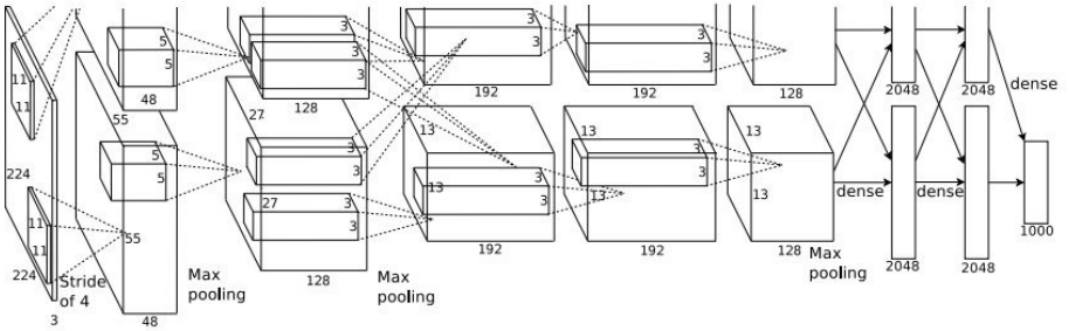
CNN in process

- 32 x 32 x 3 → [5 x 5 x 3] * 6 → [5 x 5 x 6] * 10 → ?



Case Study: AlexNet

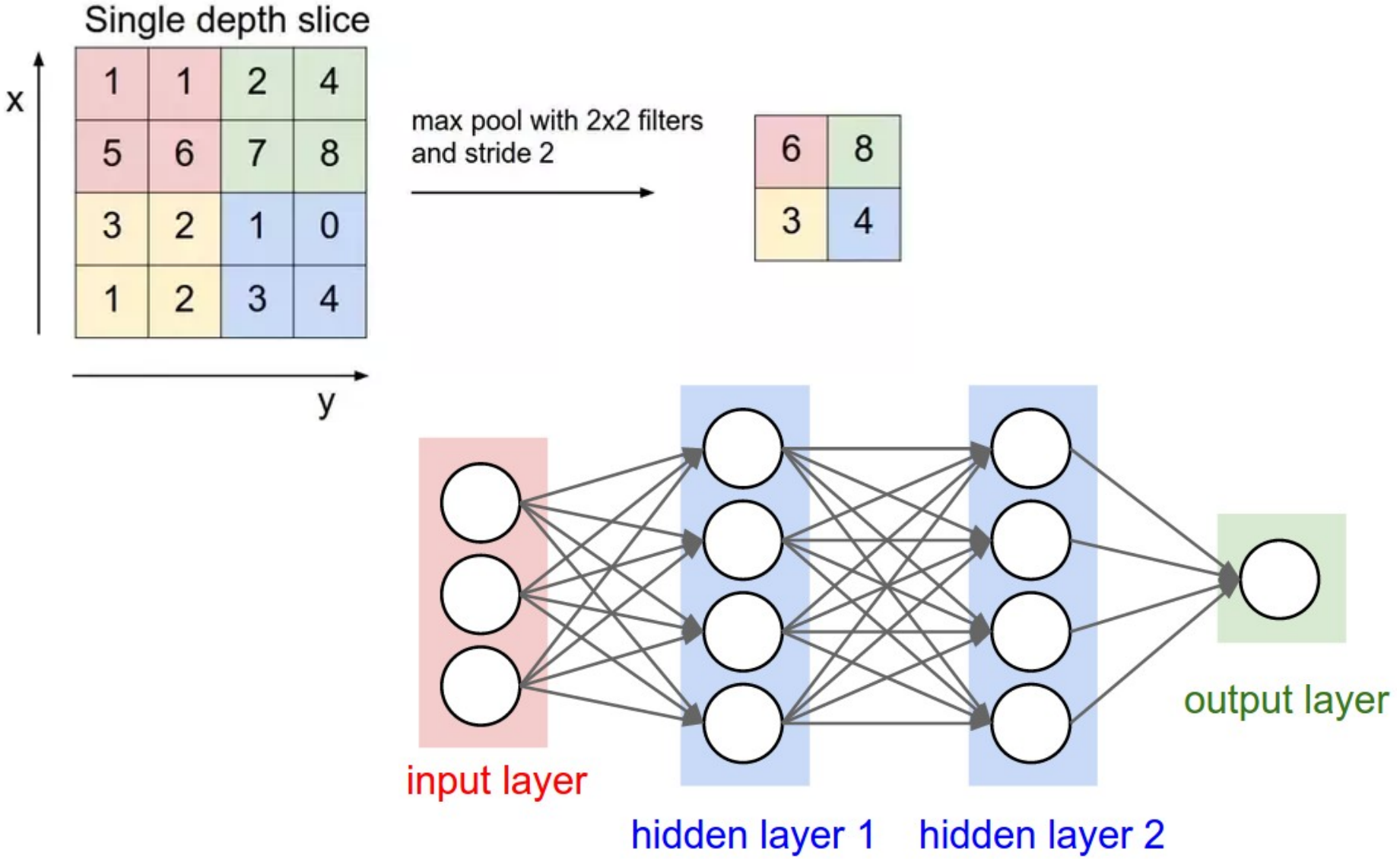
[Krizhevsky et al. 2012]



Full (simplified) AlexNet architecture:
[227x227x3] INPUT
[55x55x96] CONV1: 96 11x11 filters at stride 4, pad 0
[27x27x96] MAX POOL1: 3x3 filters at stride 2
[27x27x96] NORM1: Normalization layer
[27x27x256] CONV2: 256 5x5 filters at stride 1, pad 2
[13x13x256] MAX POOL2: 3x3 filters at stride 2
[13x13x256] NORM2: Normalization layer
[13x13x384] CONV3: 384 3x3 filters at stride 1, pad 1
[13x13x384] CONV4: 384 3x3 filters at stride 1, pad 1
[13x13x256] CONV5: 256 3x3 filters at stride 1, pad 1
[6x6x256] MAX POOL3: 3x3 filters at stride 2
[4096] FC6: 4096 neurons
[4096] FC7: 4096 neurons
[1000] FC8: 1000 neurons (class scores)

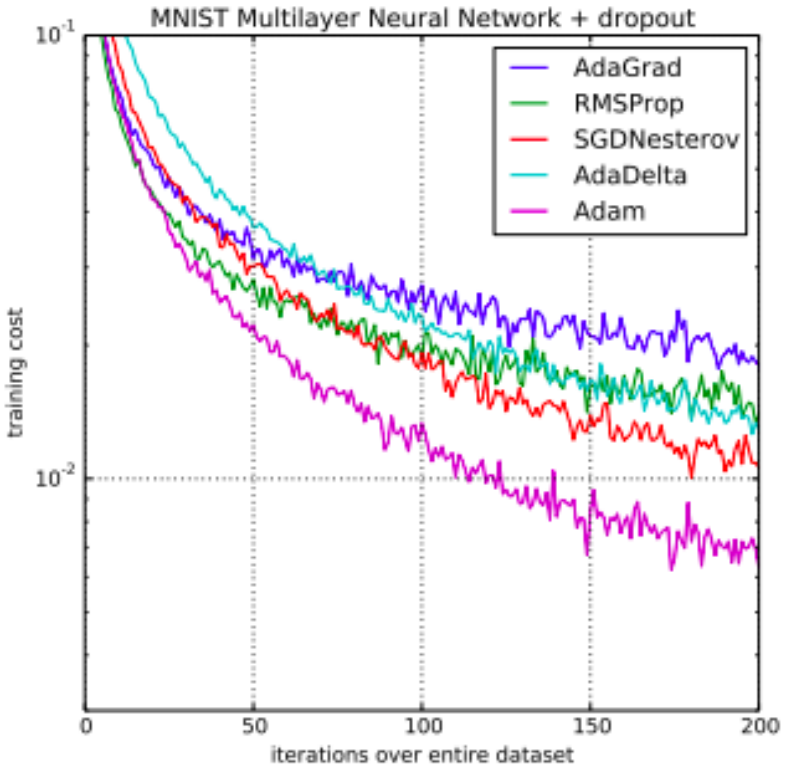
Details/Retrospectives:
- first use of ReLU
- used Norm layers (not common anymore)
- heavy data augmentation
- dropout 0.5
- batch size 128
- SGD Momentum 0.9
- Learning rate 1e-2, reduced by 10 manually when val accuracy plateaus
- L2 weight decay 5e-4
- 7 CNN ensemble: 18.2% -> 15.4%

Max pooling / FC network



Adam Optimizer

- 압도적인 성능!!



- 어떻게 작동하는가?

- http://machinelearningmastery.com/adam-optimization-algorithm-for-deep-learning/

Xavier Initialization

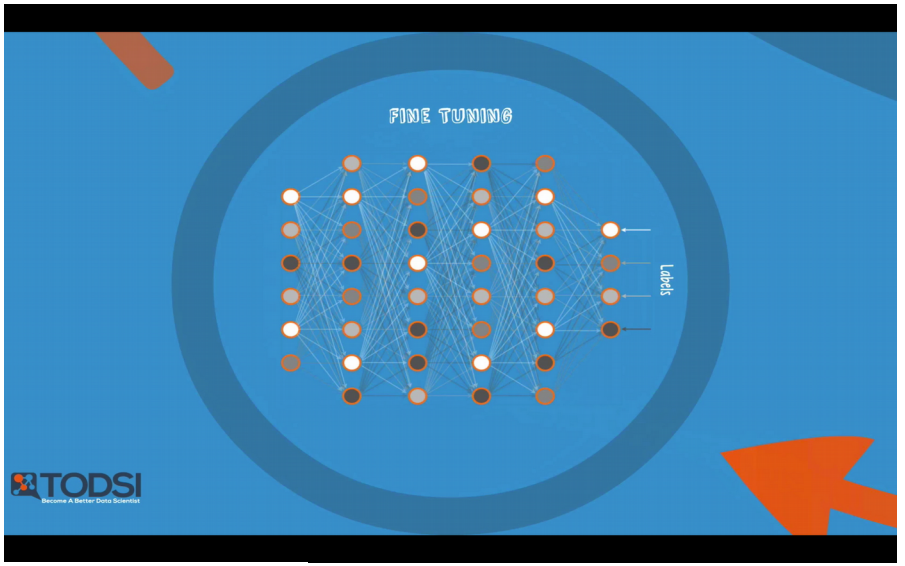
- 초창기의 대부분의 학습 실패 원인은 weight, bias 초기값 설정 실패에 따름
- 다양한 초기화 방법들이 등장: ex] RBM

RBM?

- 우리는 간단하게 합시다.

(

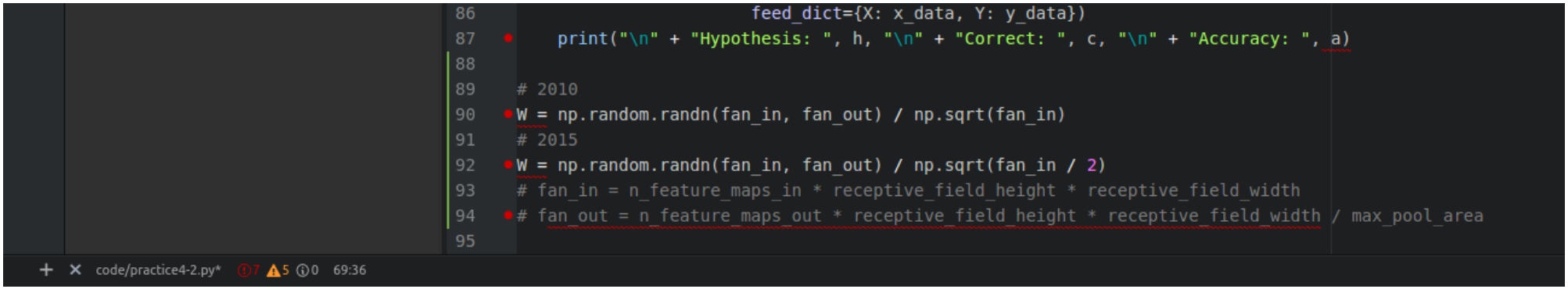
- Xavier Initialization



Init method	maxout	ReLU	VLReLU	tanh	Sigmoid
LSUV	**93.94**	**92.11**	92.97	89.28	n/c
OrthoNorm	93.78	91.74	92.40	89.48	n/c
OrthoNorm-MSRA scaled	–	91.93	**93.09**	–	n/c
Xavier	91.75	90.63	92.27	**89.82**	n/c
MSRA	n/c†	90.91	92.43	89.54	n/c

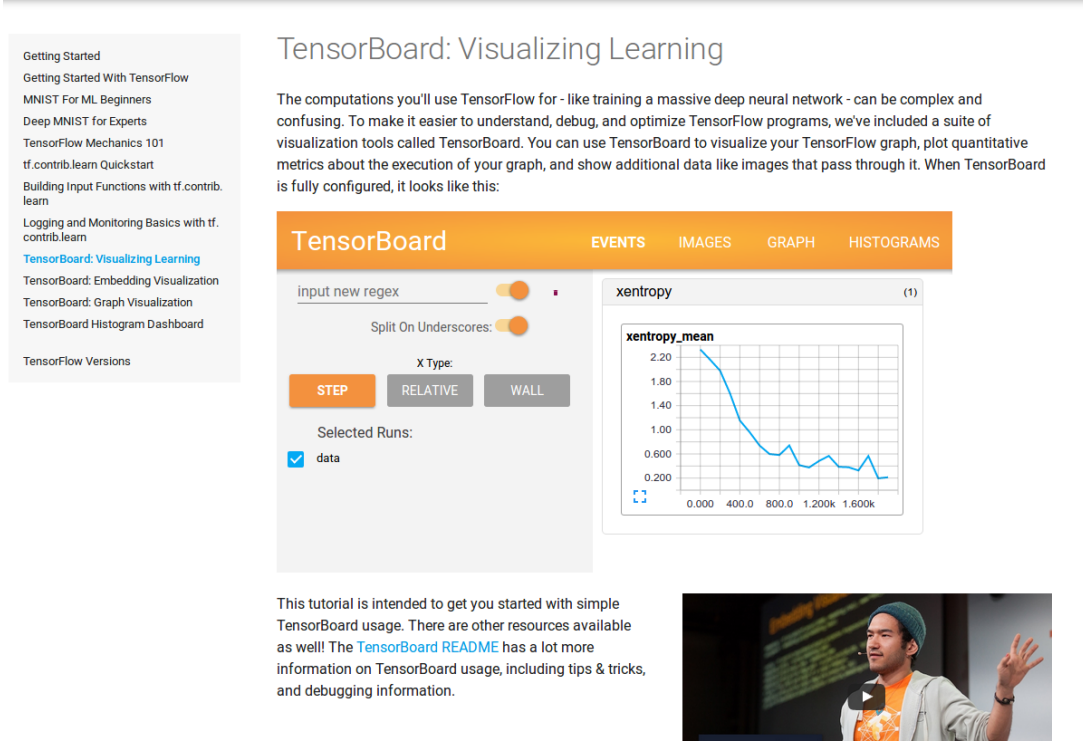
How to use?

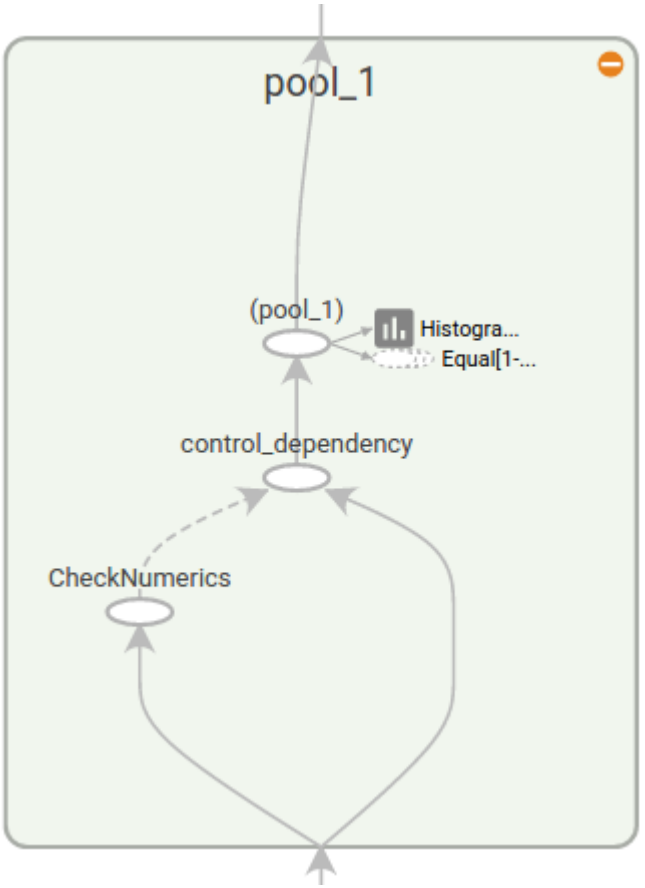
- np.random.rand(fan_in, fan_out) / np.sqrt(fan_in/2) <<- simple!!



tensorboard

- https://www.tensorflow.org/get_started/summaries_and_tensorboard
- For debugging / accuracy





Practice Lab

1. CNN with MNIST
2. xavier initialization / adam optimizer
3. tensorboard