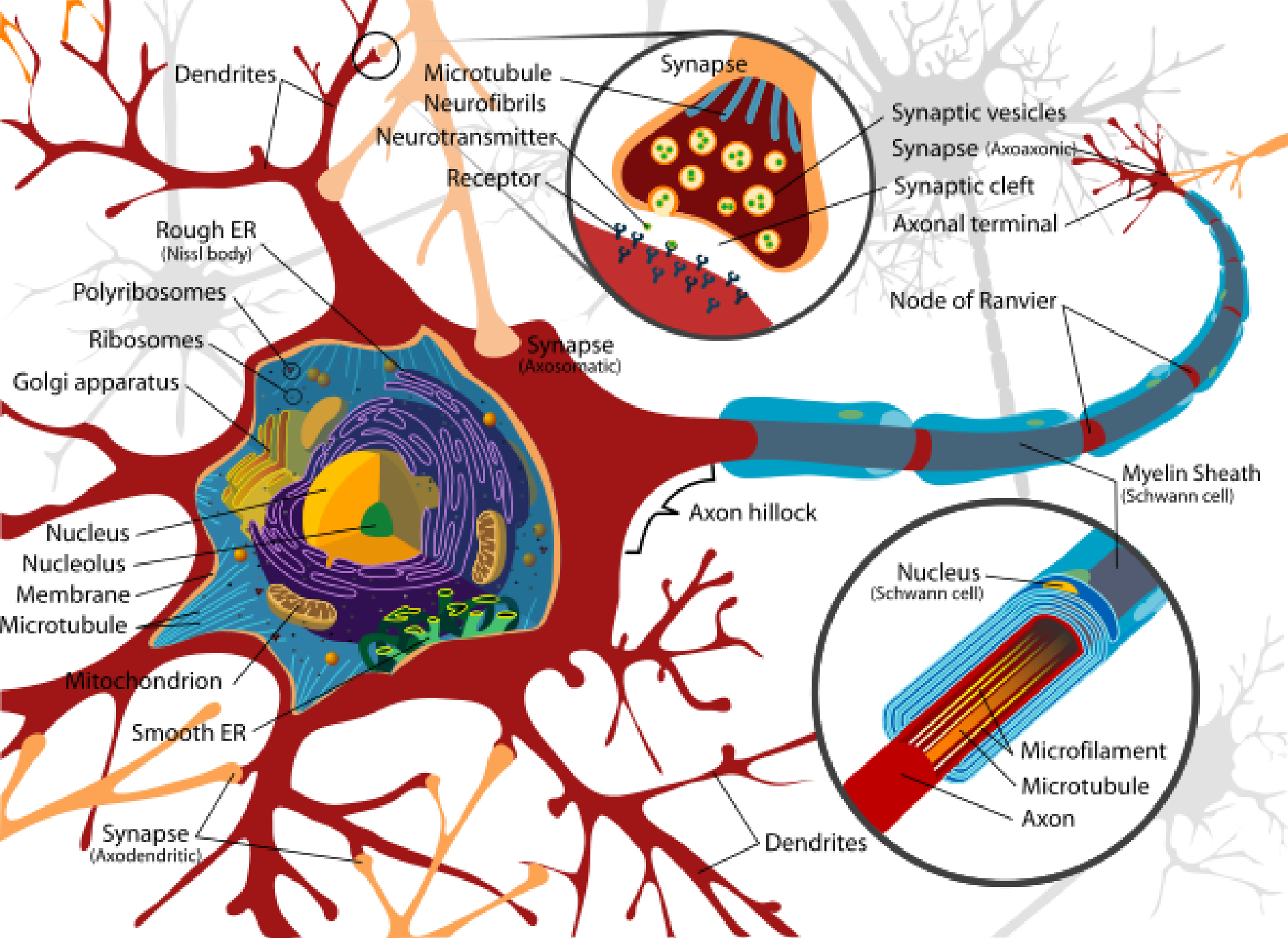
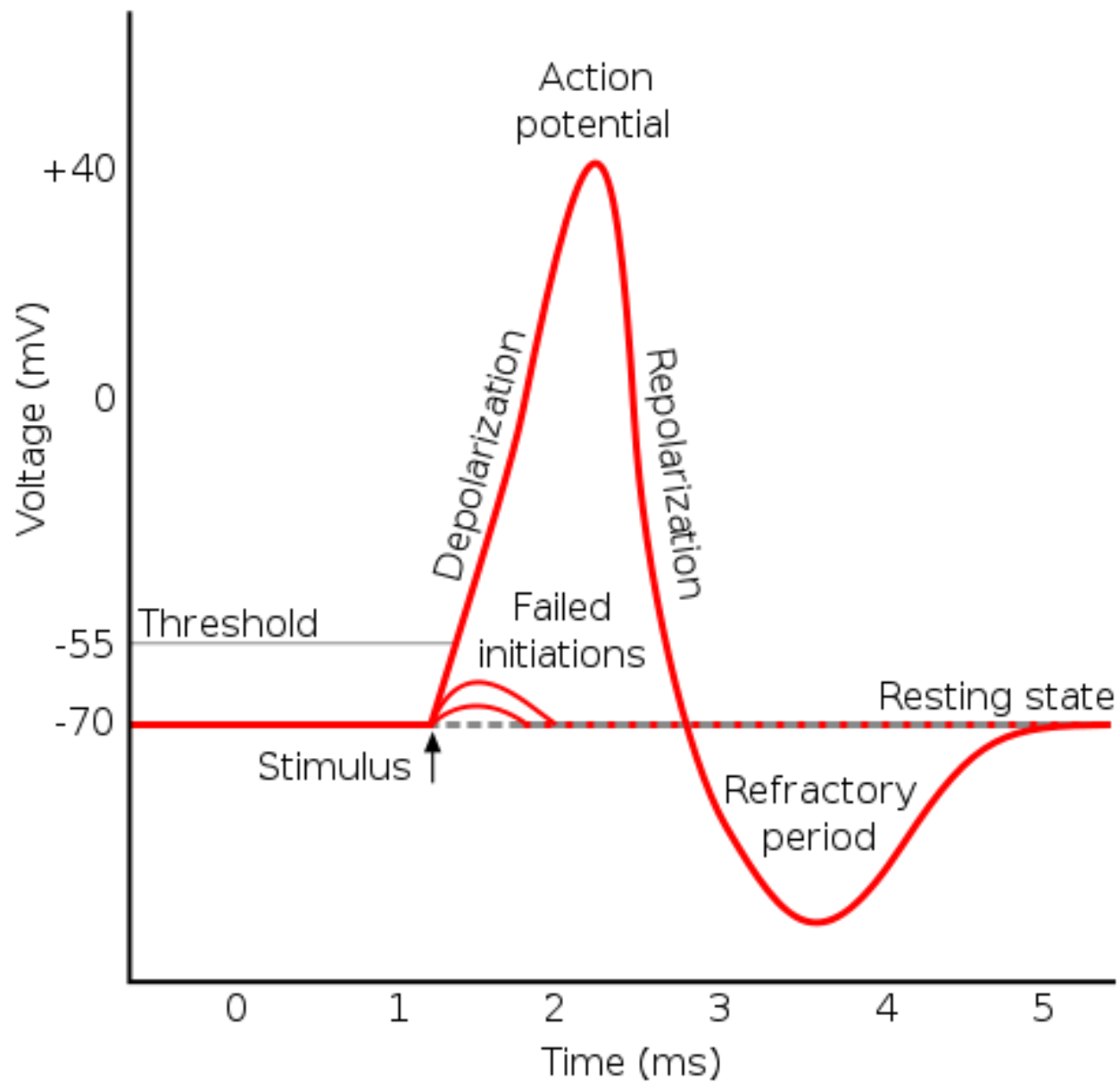
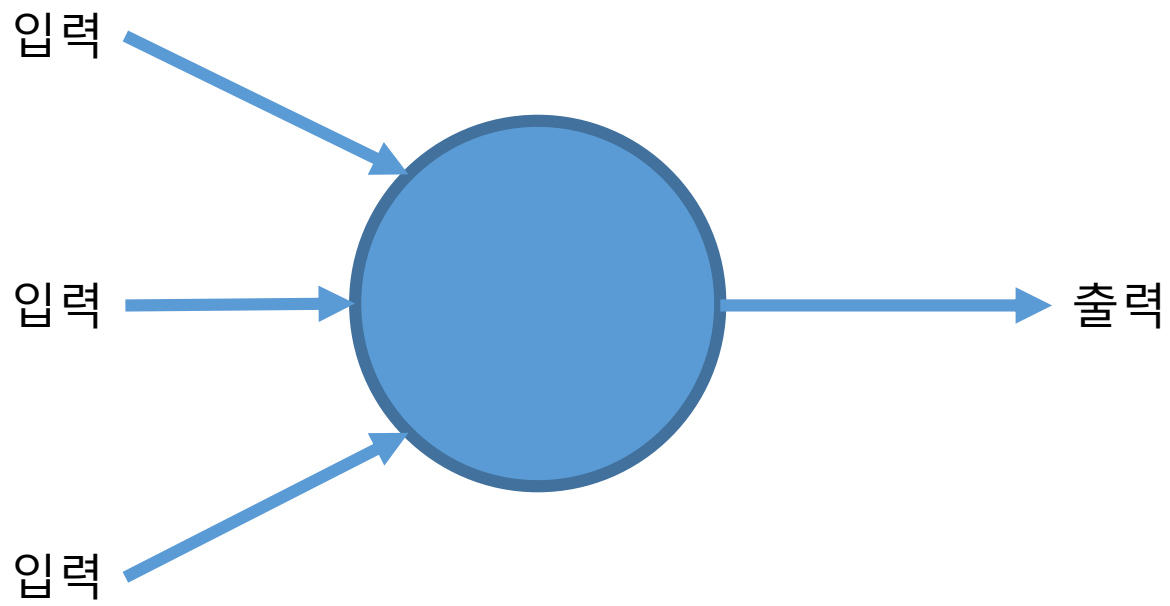


Neural Networks & Deep Learning

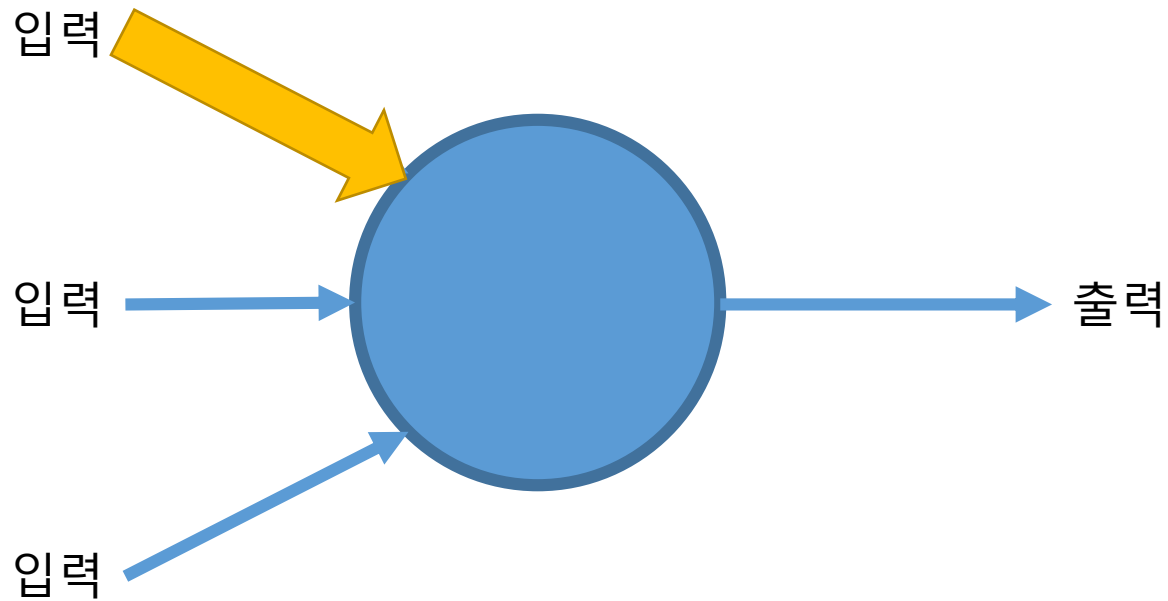






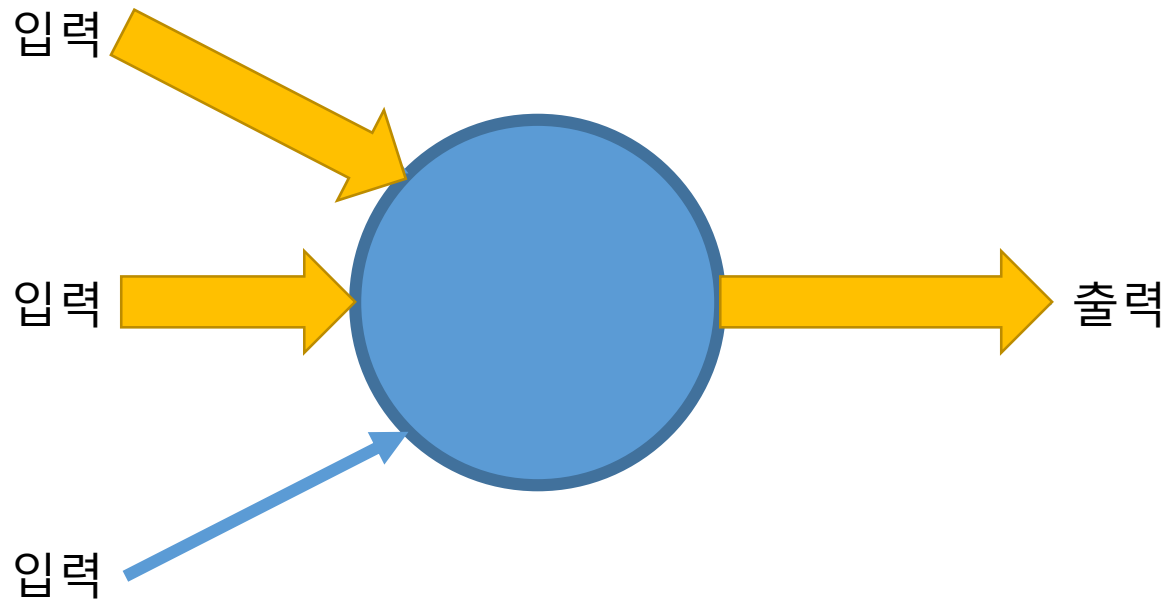
입력 신호가 역치를 넘지 못하면

출력 신호를 내보내지 않는다



입력 신호가 역치를 넘어서면

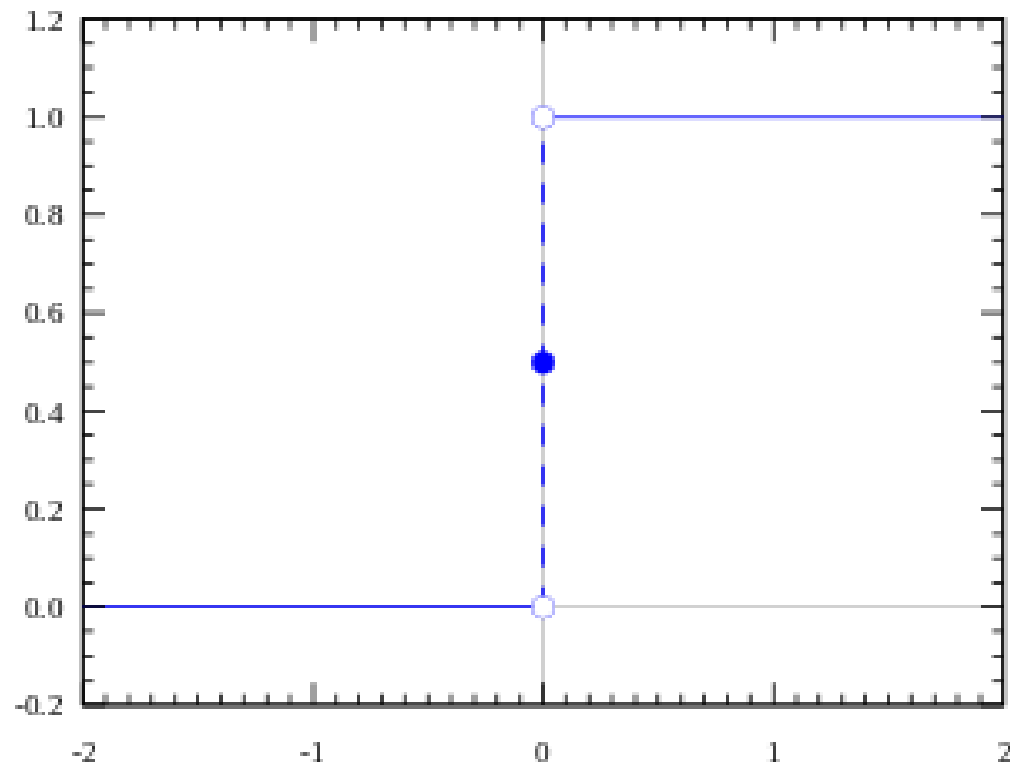
출력 신호를 내보낸다



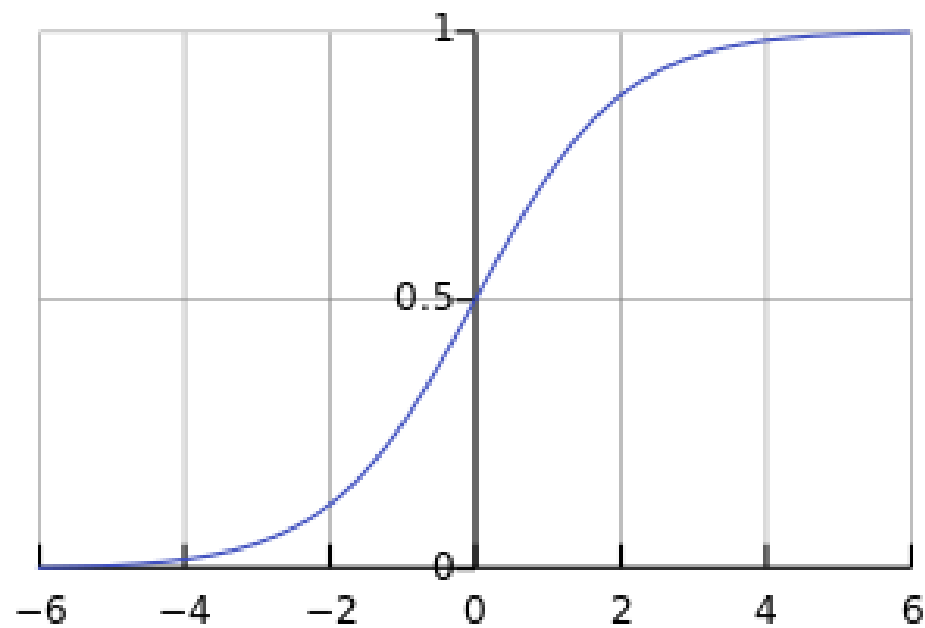
수식으로 표현

- 입력의 합계 $>$ 역치 $\rightarrow 1$
- 입력의 합계 $<$ 역치 $\rightarrow 0$

계단 함수(step function)



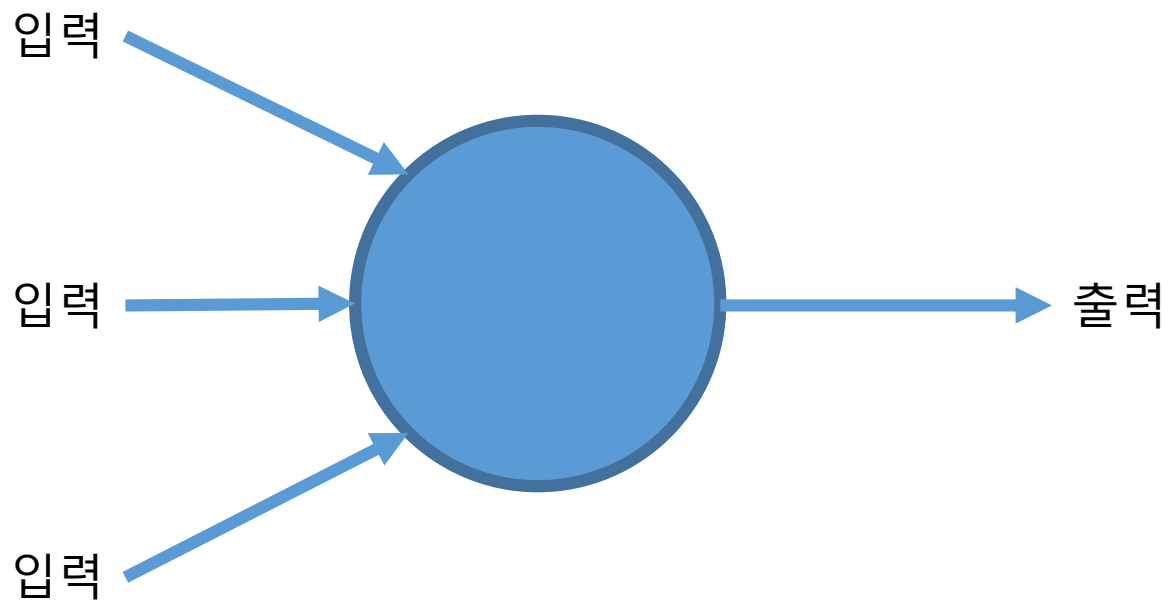
로지스틱 함수

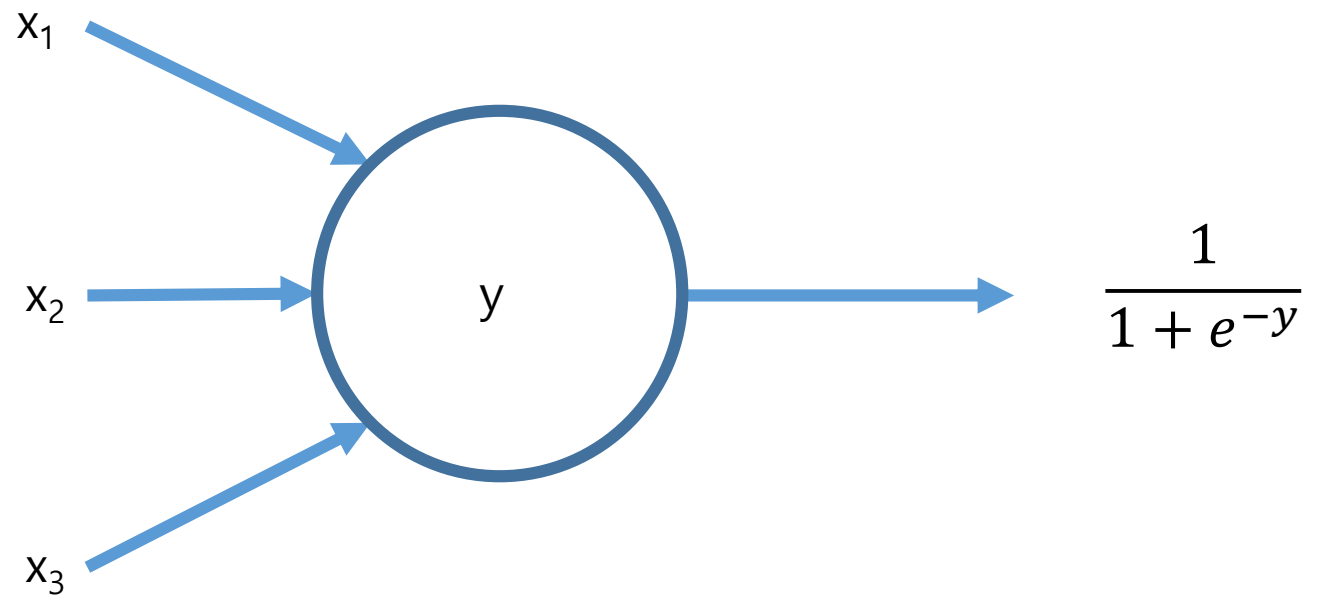


Logistic function

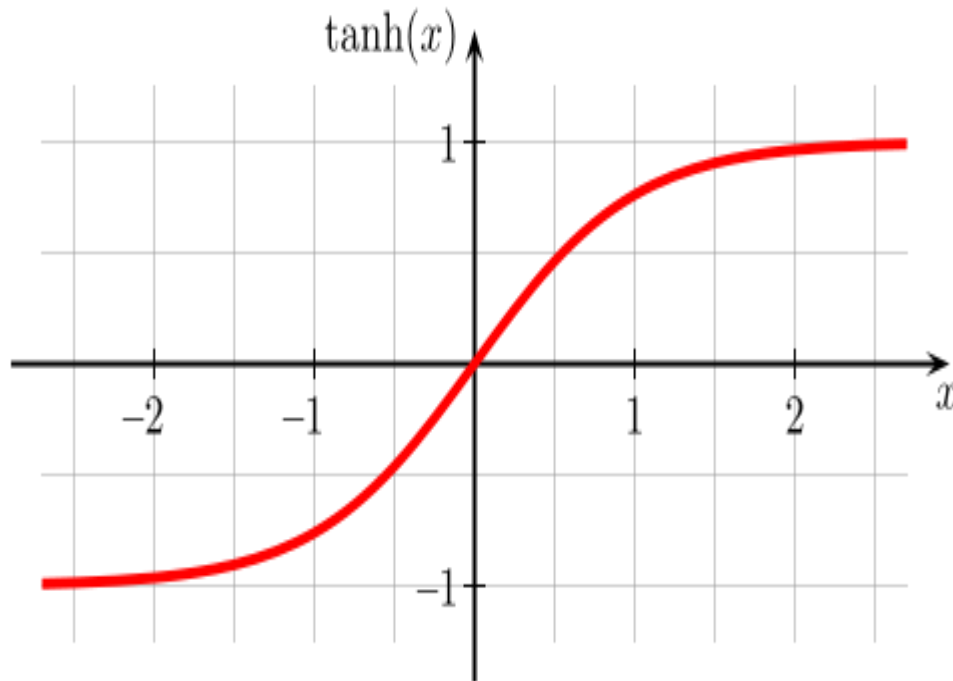
$$\frac{e^y}{1 + e^y} = \frac{1}{1 + e^{-y}}$$

$$y = w_0 + w_1x_1 + w_2x_2$$





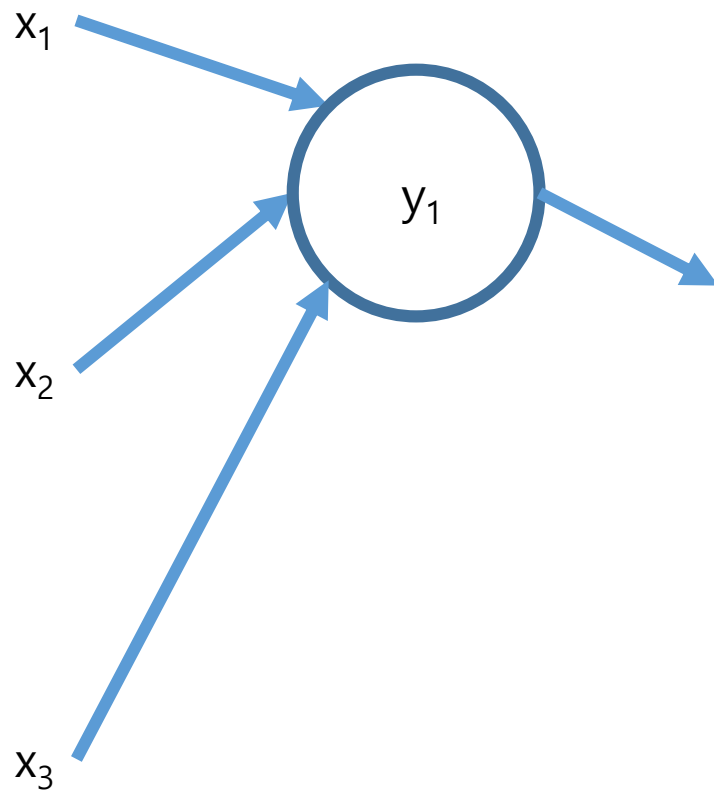
쌍곡탄젠트(hyperbolic tangent)



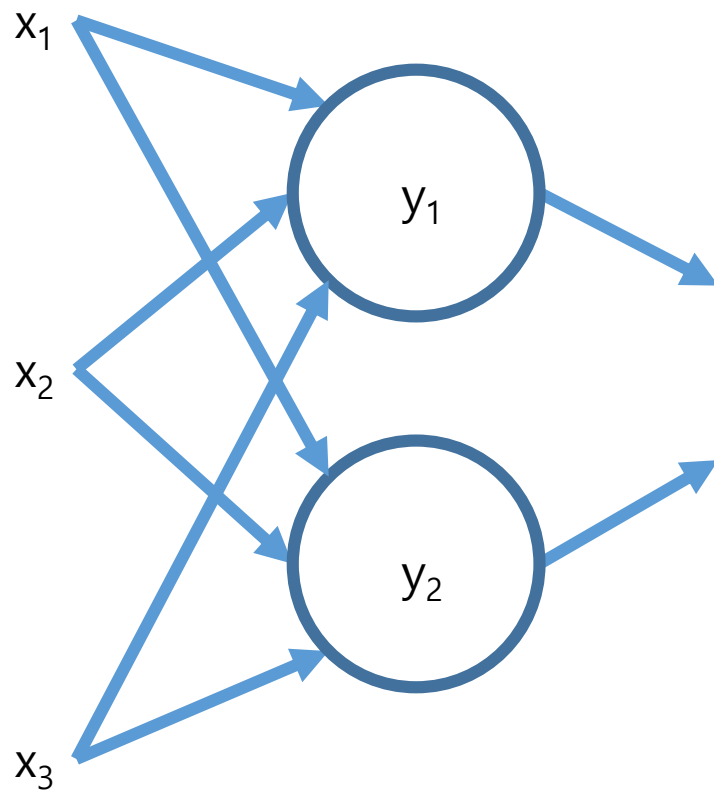
경사 하강법(gradient descent)

- 현재 모형의 오차를 구한다
- 오차를 가장 많이 줄일 수 있는 방향을 찾는다
- 그 방향으로 일정 폭만큼 계수를 수정한다
- 더 이상 오차가 줄어들지 않을 때까지 반복한다

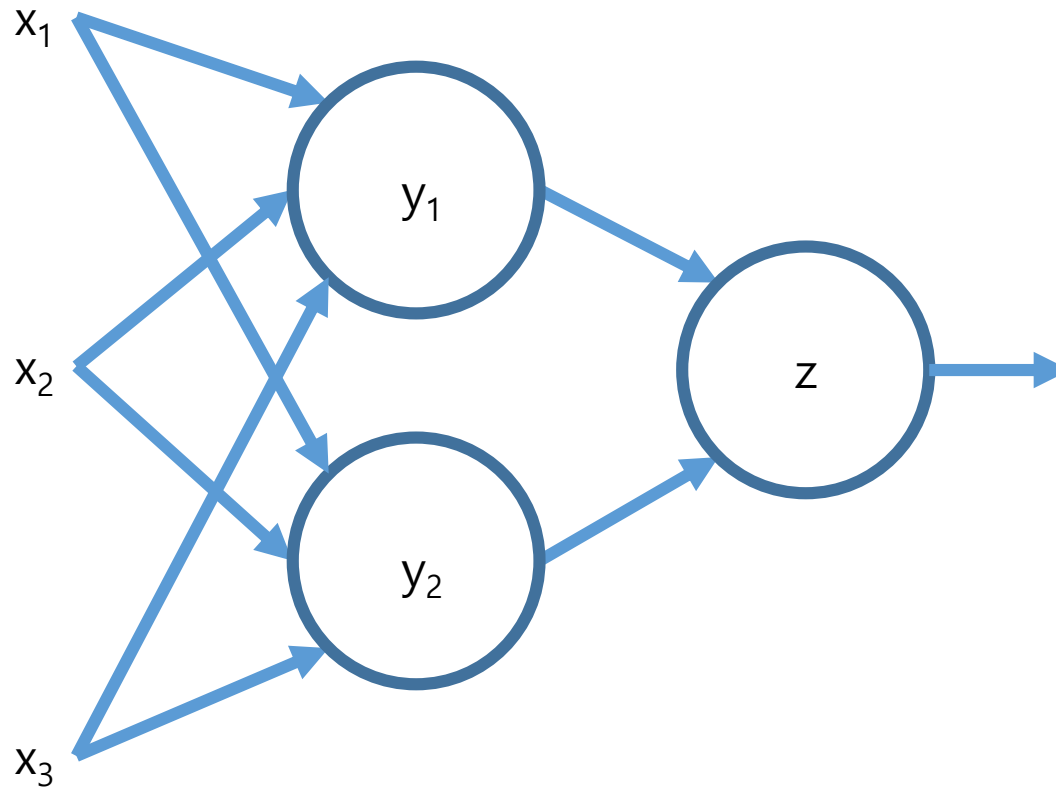
단층 신경망



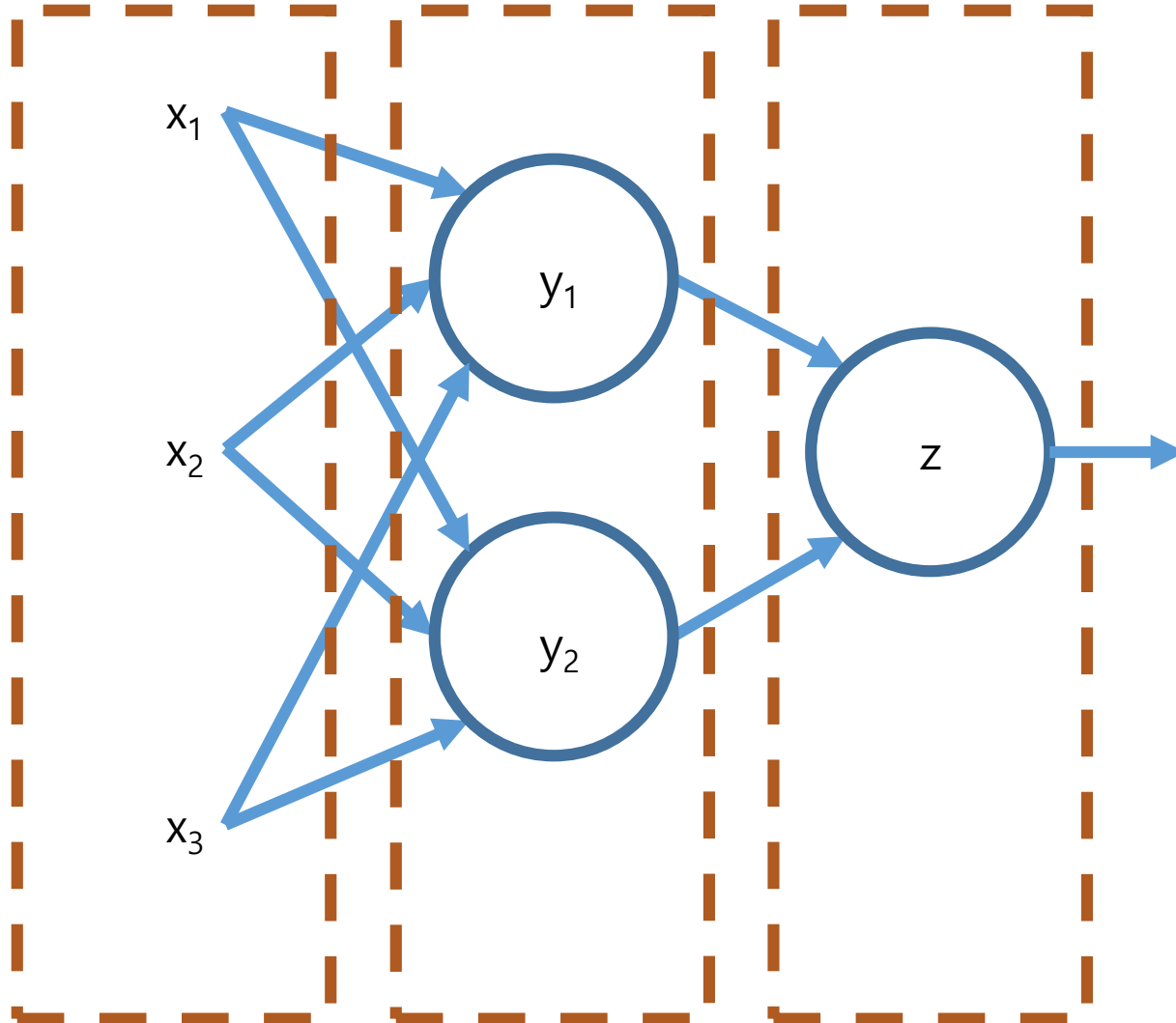
다층 신경망



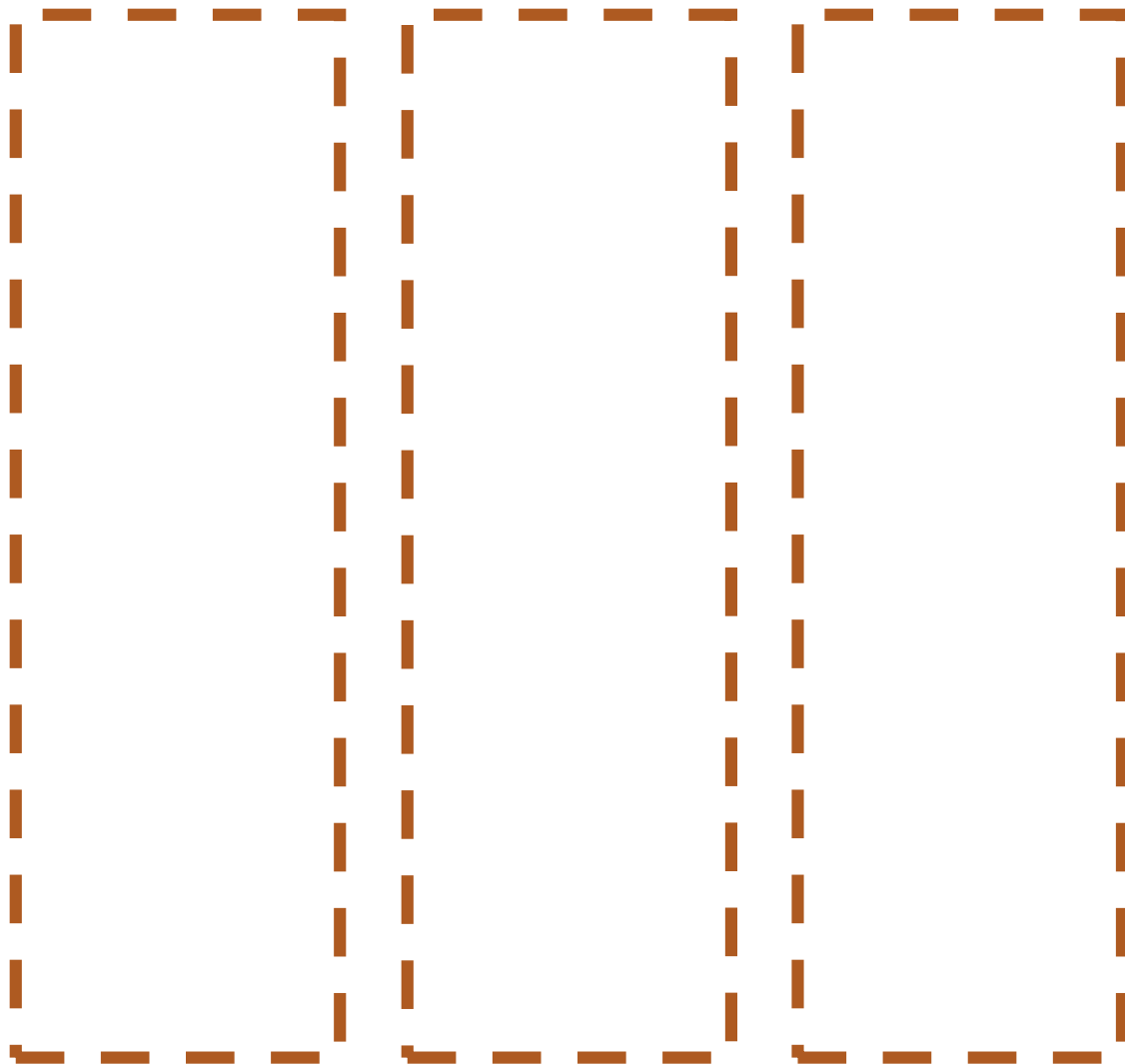
다층 신경망



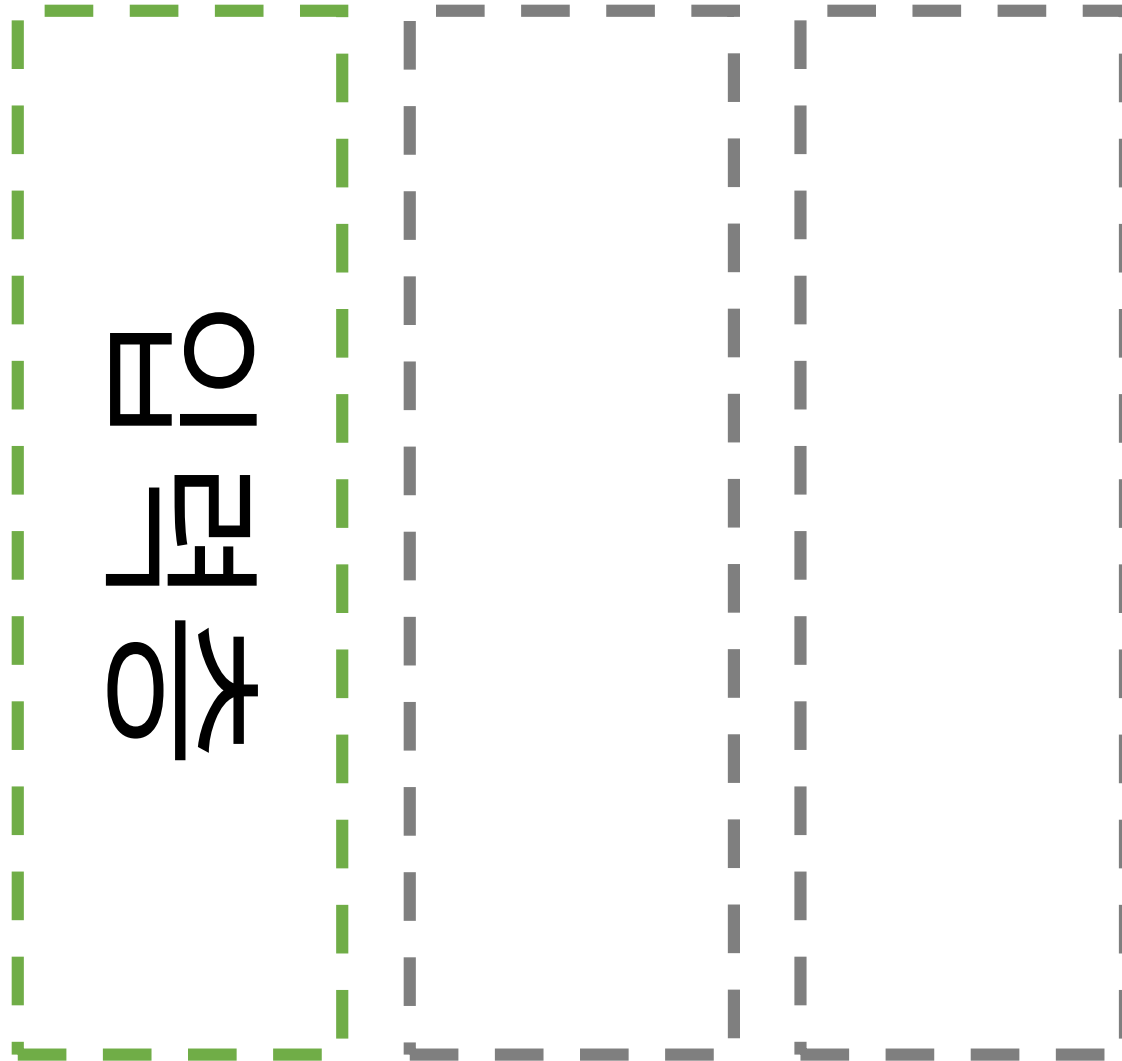
다층 신경망



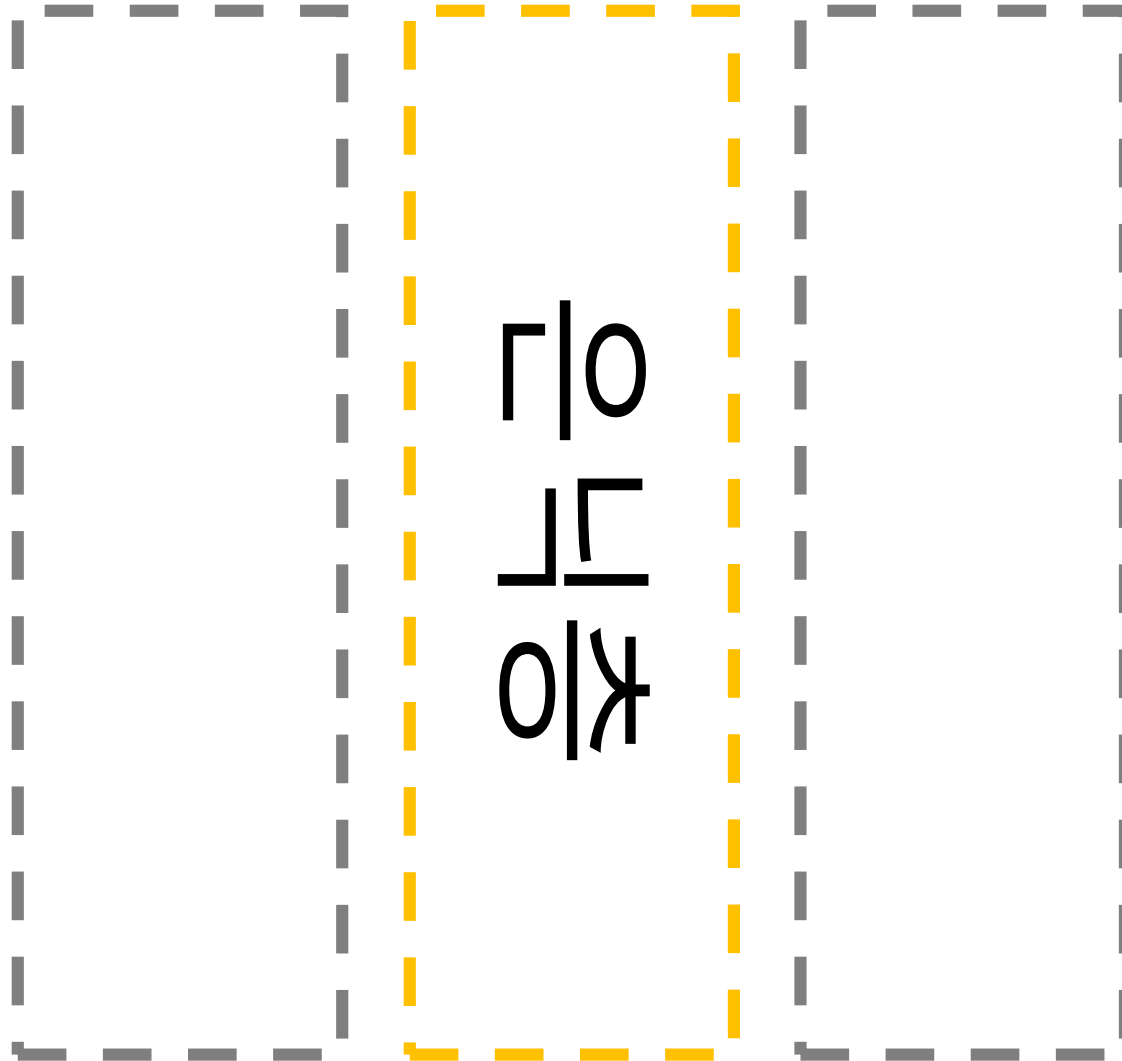
다층 신경망



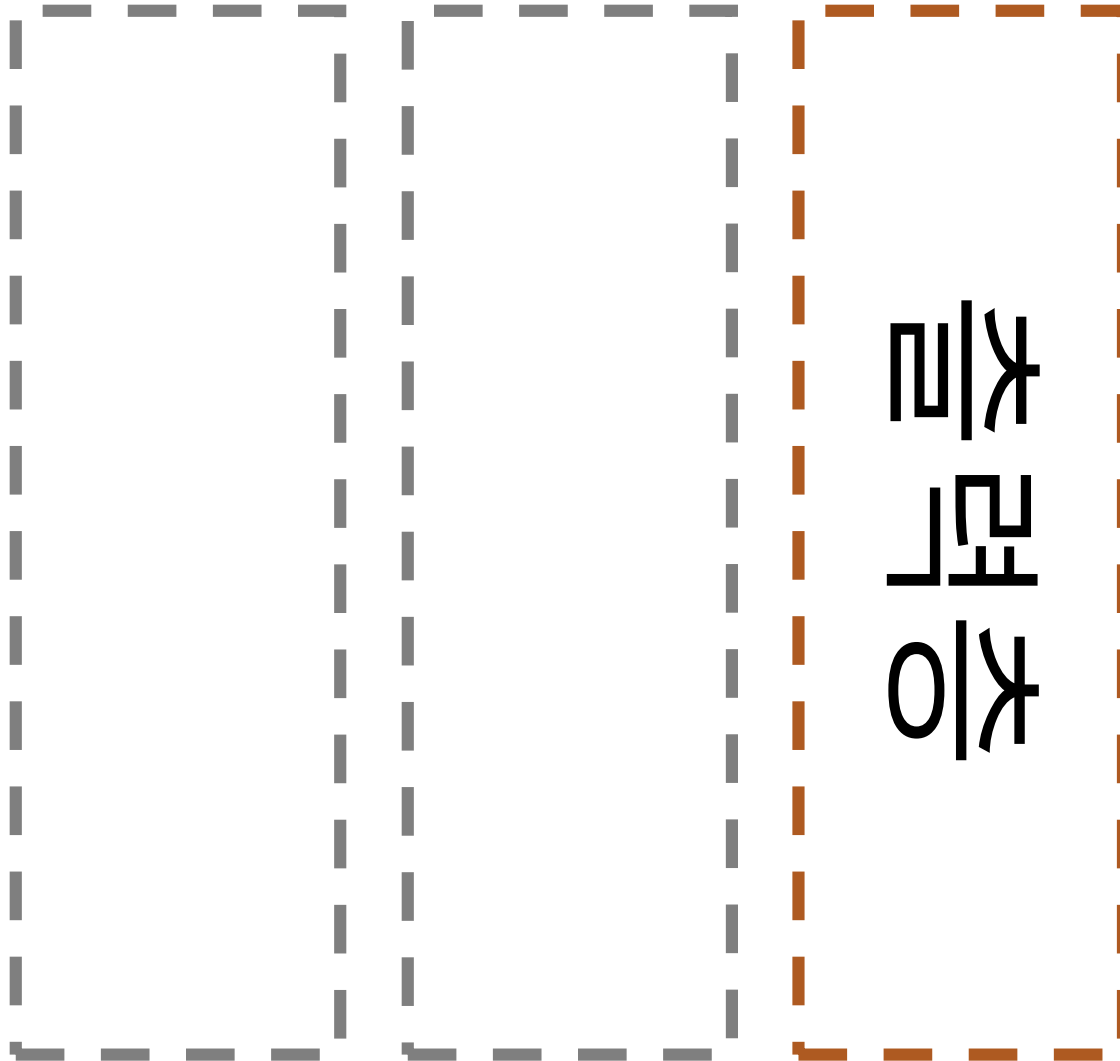
다층 신경망



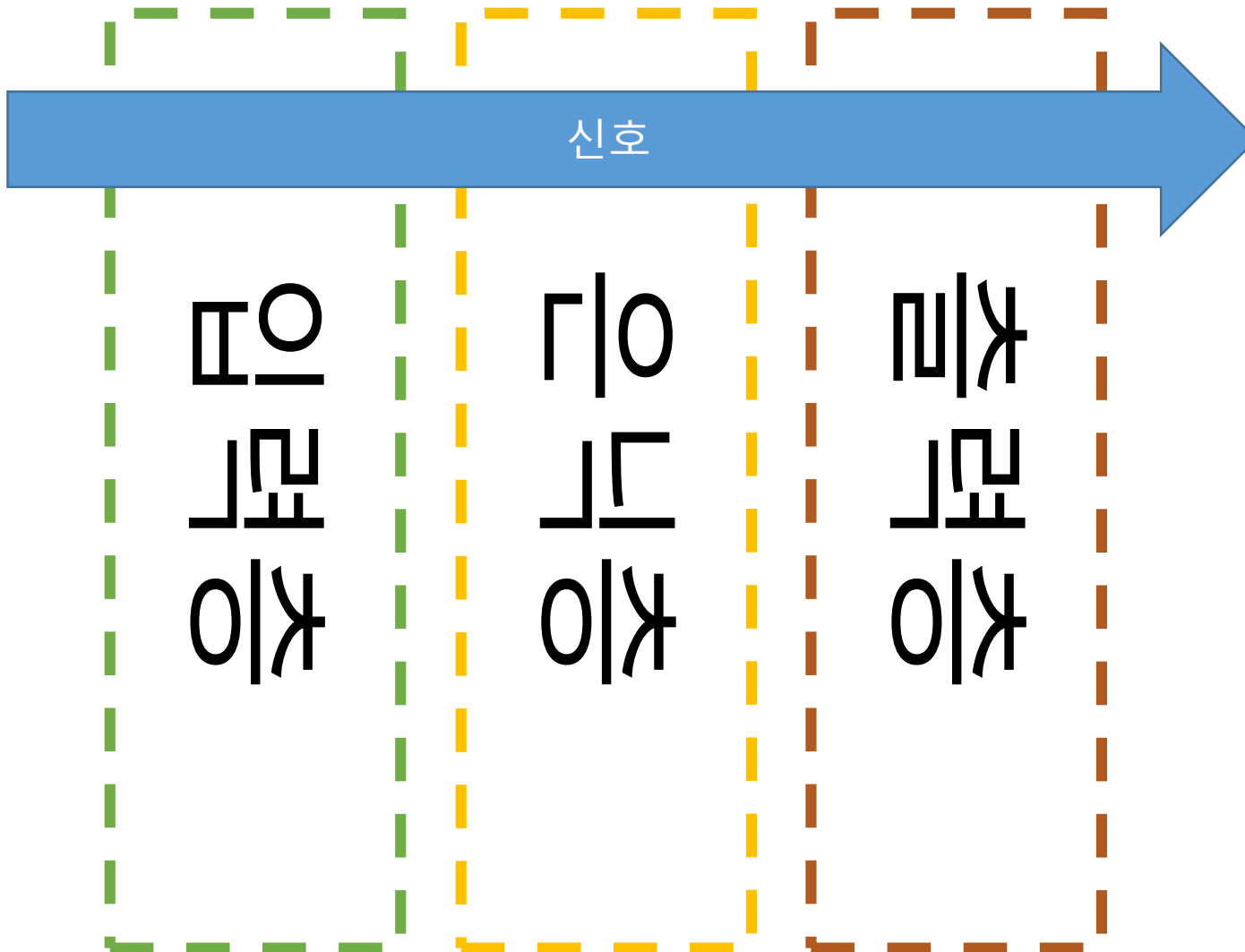
다층 신경망



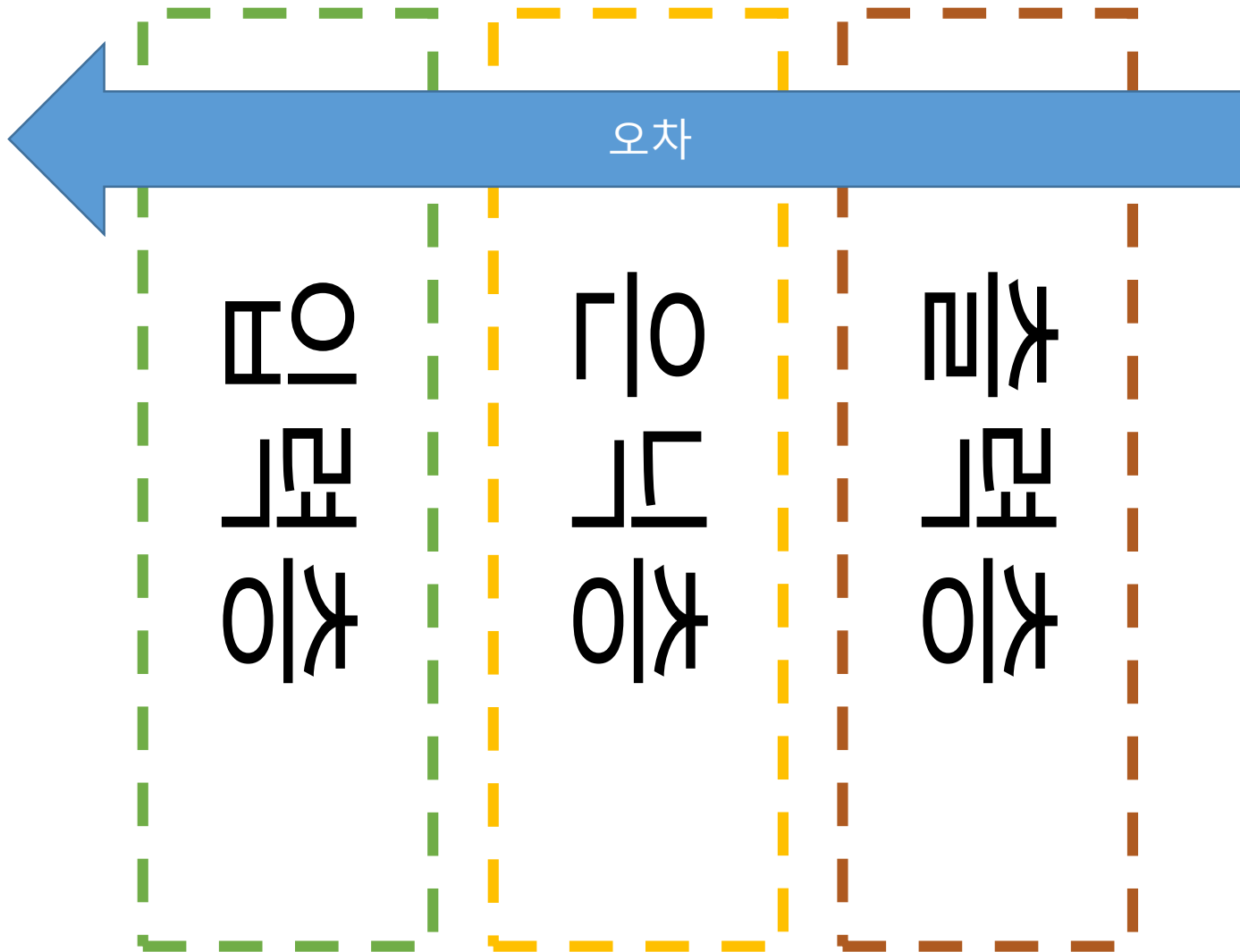
다층 신경망



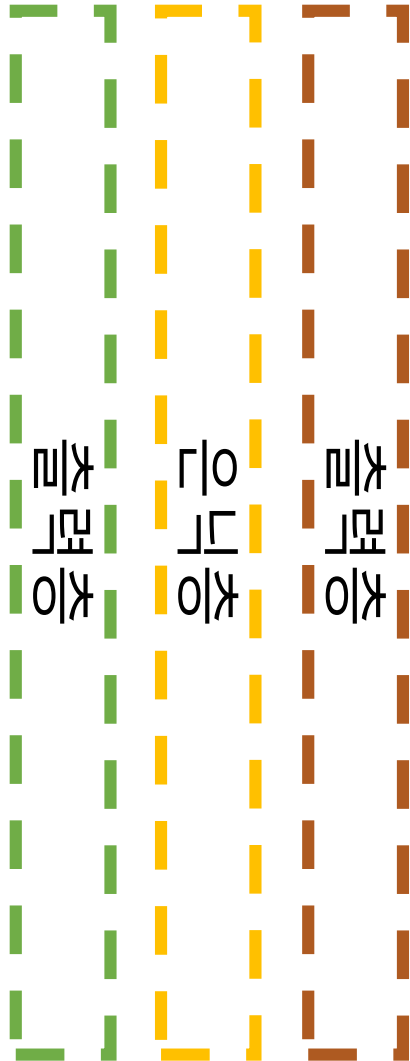
앞먹임 네트워크(feedforward network)



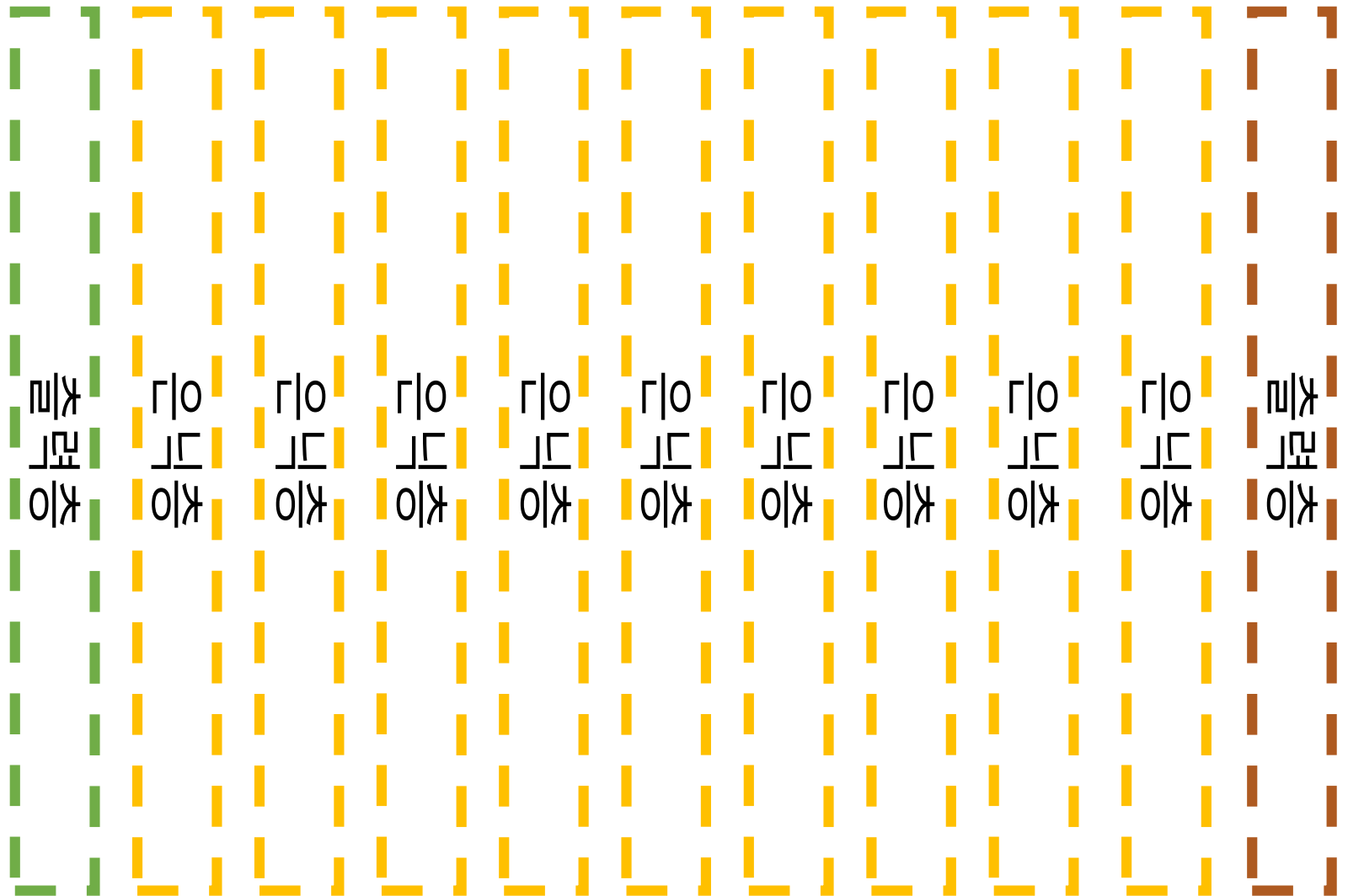
역전파 (backpropagation)



얕은 학습(shallow learning)



깊은 학습(deep learning)





Iterations
000,000

Learning rate
0.03

Activation
Tanh

Regularization
None

Regularization rate
0

Problem type
Classification

DATA

Which dataset do you want to use?



Ratio of training to test data: 50%

Noise: 0

Batch size: 10

REGENERATE

FEATURES

Which properties do you want to feed in?

X^0

X^1

X^{12}

X^{22}

X^0X^1

$\sin(X^0)$

$\sin(X^1)$

2 HIDDEN LAYERS

+ -

4 neurons

+ -

2 neurons

This is the output from one neuron. Hover to see it larger.

The outputs are mixed with varying weights, shown by the thickness of the lines.

OUTPUT

Test loss 0.500
Training loss 0.508



Colors shows data, neuron and weight values.

☐ Show test data ☐ Discretize output

딥러닝의 어려움

- 느린 학습 속도
- 사라지는 경사 문제(vanishing gradient)
- 과적합

해결책

- 컴퓨터 성능 향상 + GPGPU
- 빅데이터
- 정규화(L1, L2, Dropout ...)

GPU

- GPU: 그래픽 카드에 들어가는 칩
- 그래픽 관련 계산에 특화
- 많은 코어 수(GTX 1080의 경우 2,560코어)
- 그래픽 외의 대량의 특수 계산을 하는데 써보자(GPGPU)
- 엔비디아 그래픽 카드가 사실상 표준(CUDA)
- 딥러닝의 돌파구 마련

GPU

- GPU 프로그래밍은 매우 어려움
- GPU를 쉽게(?) 쓸 수 있는 딥러닝 라이브러리
 - Torch, Caffe, Theano, TensorFlow, MXNet, CNTK ...
- TensorFlow: 구글에서 개발 최근 각광
- Scikit-learn처럼 잘 몰라도 돌릴 수 있는 건 아님

아주 간단한 형태(AND, OR)

AND

X1	X2	Y
0	0	0
0	1	0
1	0	0
1	1	1

OR

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	1