

성균관대학교

S I O R

로봇학회

2022년 05월 12일

AI

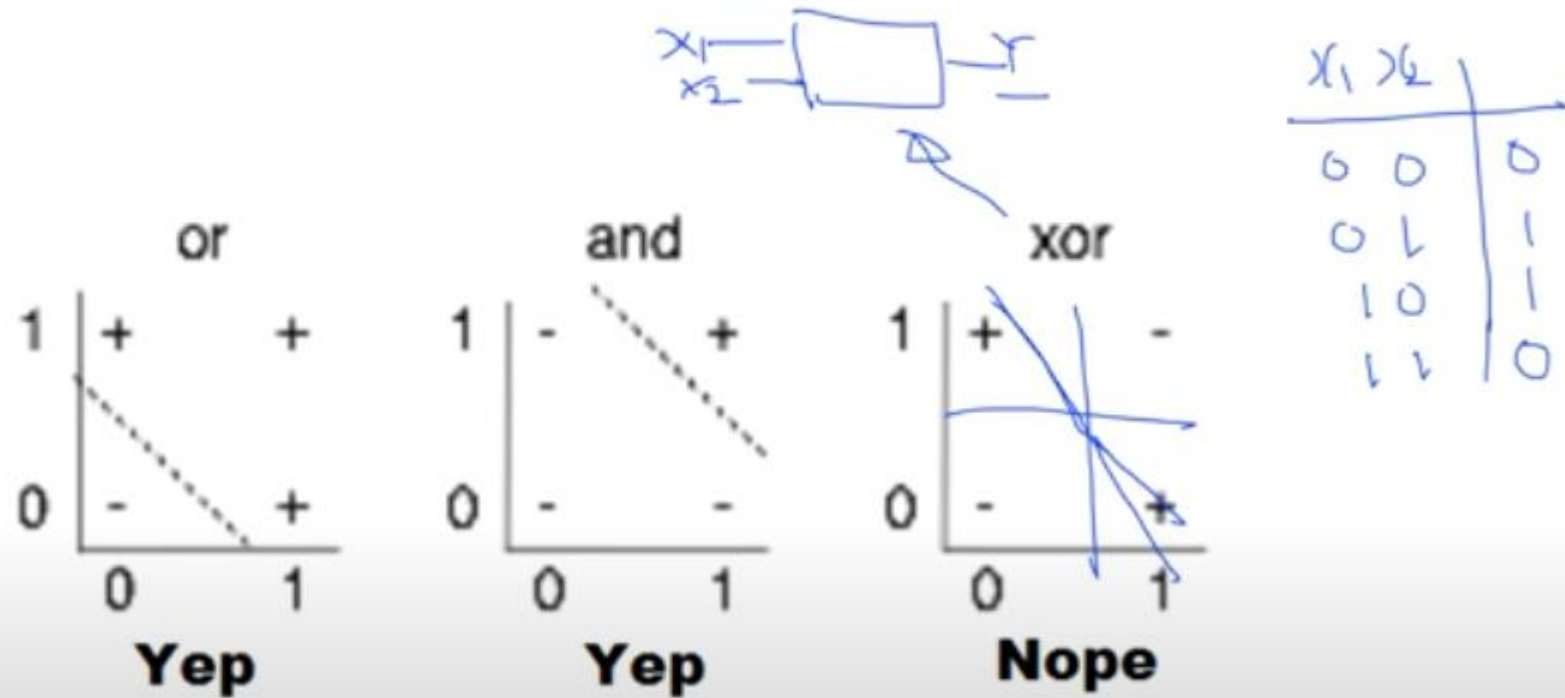
4 주 차

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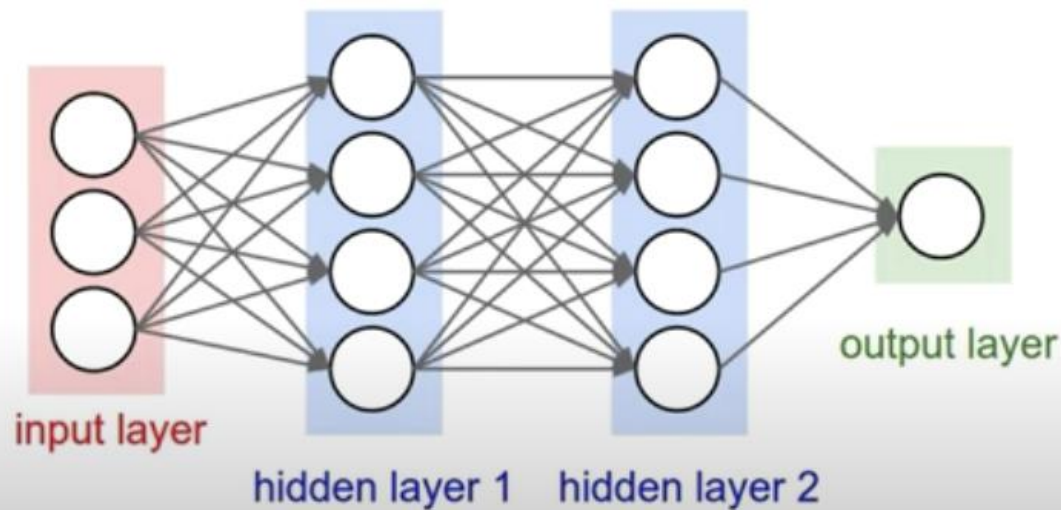
딥러닝 기본 개념1 : XOR 문제

(Simple) XOR problem: linearly separable?



딥러닝 기본 개념1 : XOR 문제

“No one on earth had found a viable way to train*”



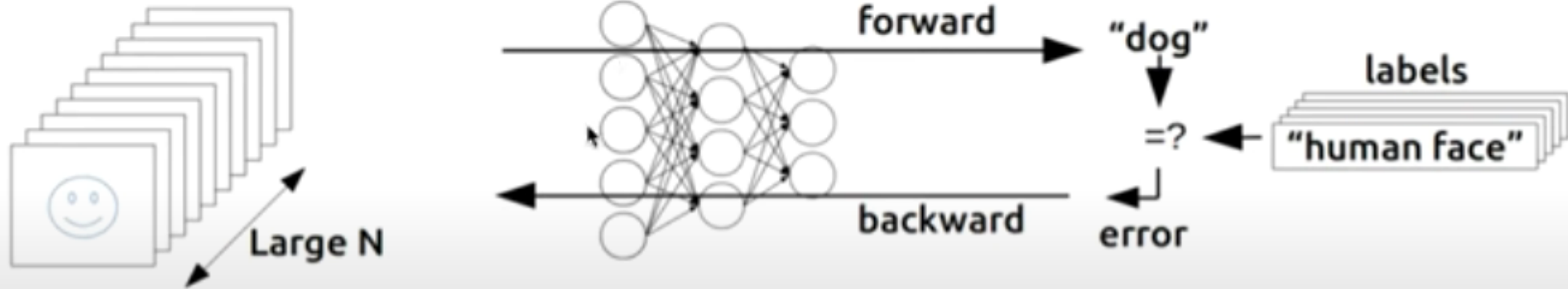
*Marvin Minsky, 1969

딥러닝 기본 개념2 : Back-propagation

Backpropagation

(1974, 1982 by Paul Werbos, 1986 by Hinton)

Training

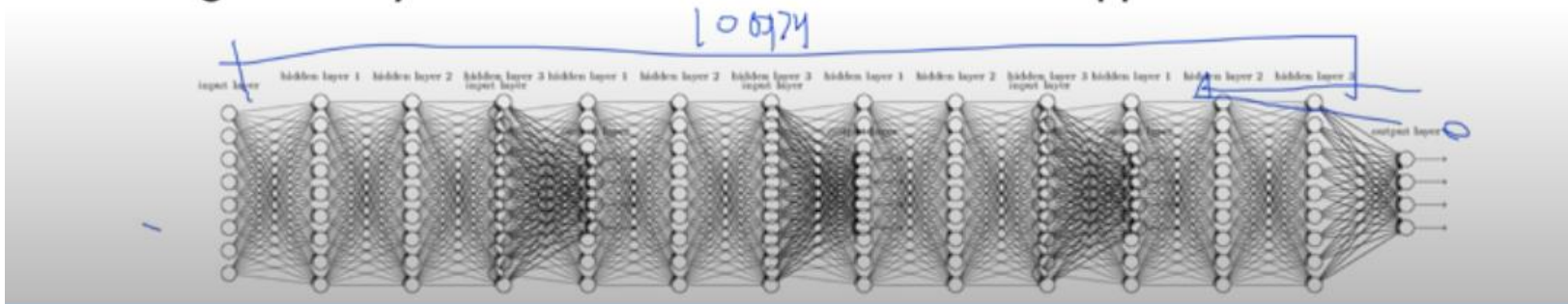


딥러닝 기본 개념2 : Back-propagation(단점)

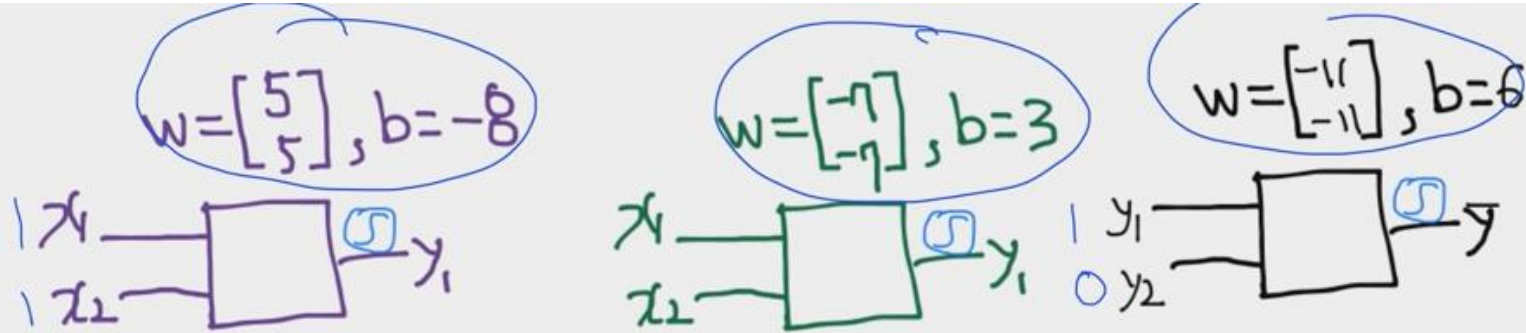
A BIG problem



- Backpropagation just did not work well for normal neural nets with many layers
- Other rising machine learning algorithms: SVM, RandomForest, etc.
- 1995 “Comparison of Learning Algorithms For Handwritten Digit Recognition” by LeCun et al. found that this new approach worked better



XOR 문제 딥러닝으로 풀기 (1)



$$\begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} 5 \\ 5 \end{bmatrix} - 8 = 5 + 5 - 8 = 2, \text{Sigmoid}(2) = 1$$

$$\begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} -7 \\ -7 \end{bmatrix} + 3 = -7 + -7 + 3 = -11, \text{Sigmoid}(-11) = 0$$

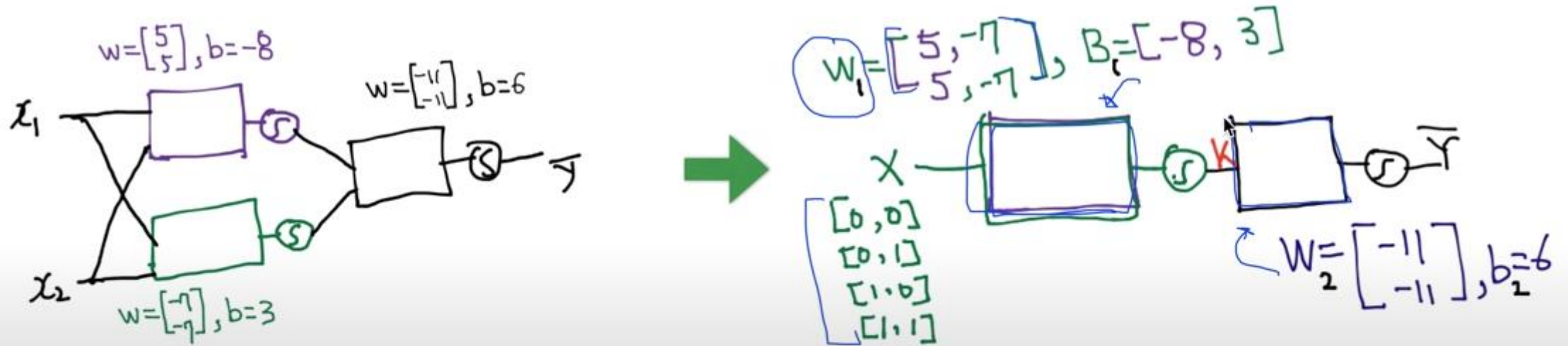
$$\begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} -11 \\ -11 \end{bmatrix} + 6 = -11 + 0 + 6 = -5, \text{Sigmoid}(-5) = 0$$

x_1	x_2	y_1	y_2	\bar{y}	XOR
0	0	0	1	0	0
0	1	0	0	1	1
1	0	0	0	1	1
1	1	1	0	0	0

AI

XOR 문제 딥러닝으로 풀기 (2)

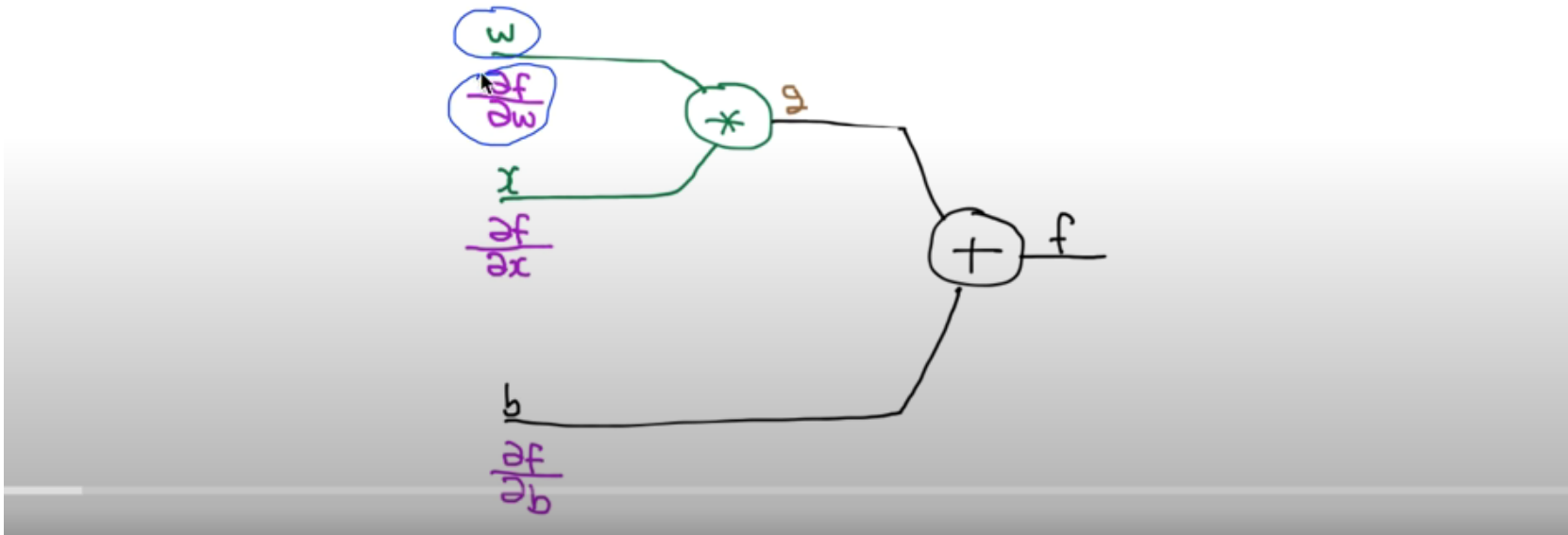
NN



딥네트워크 학습시키기(Back propagation) (1)

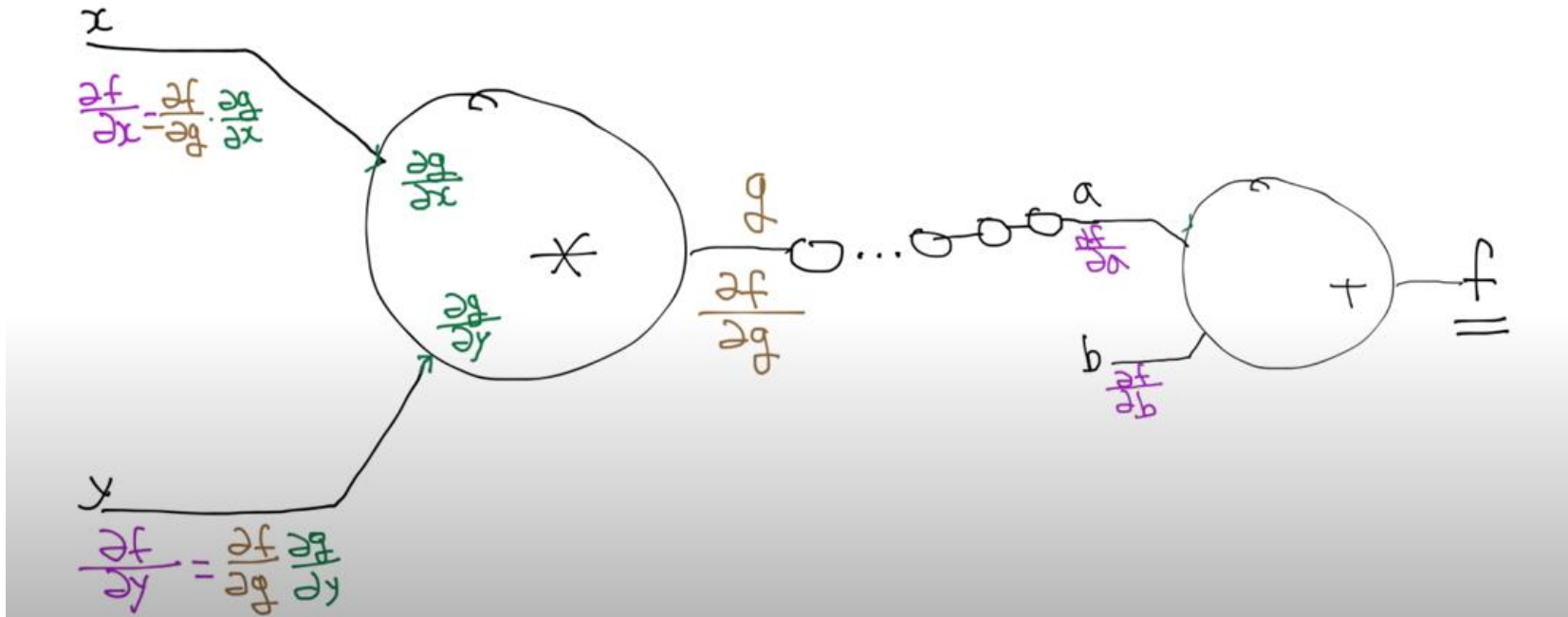
Back propagation (chain rule)

$$f = wx + b, \quad g = wx, \quad f = g + b$$



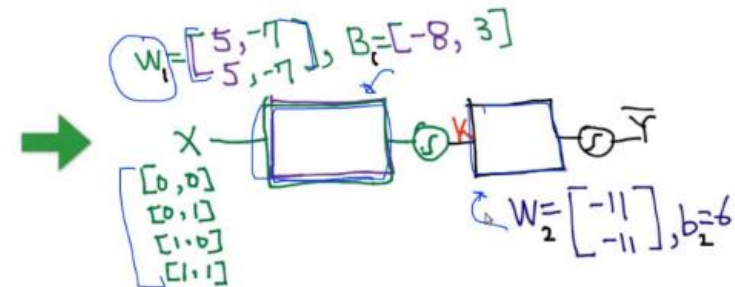
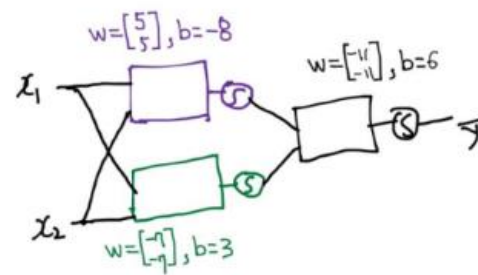
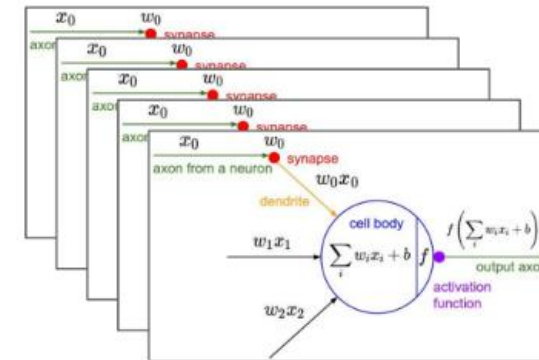
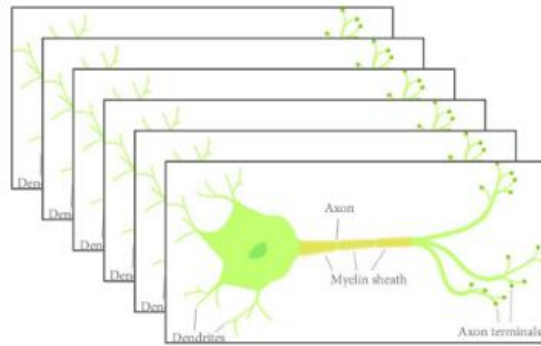
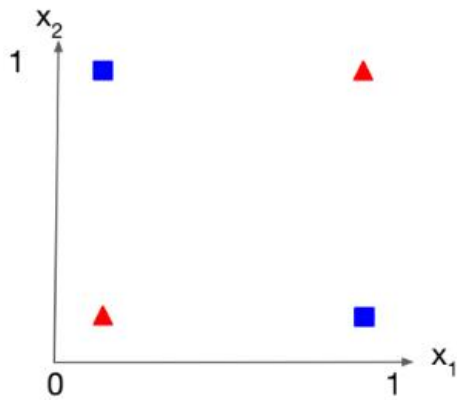
딥네트워크 학습시키기 (2)

Back propagation (chain rule)



Neural Net for XOR

Summary



Tensorboard (Neural Net for XOR)



```
$ pip install tensorboard  
$ tensorboard --logdir=./logs/xor_logs
```

- You can navigate to <http://127.0.0.1:6006>

[Eager Execution]

```
writer = tf.contrib.summary.FileWriter("./logs/xor_logs")  
with tf.contrib.summary.record_summaries_every_n_global_steps(1):  
    tf.contrib.summary.scalar('loss', cost)
```

[Keras]

```
tb_hist = tf.keras.callbacks.TensorBoard(log_dir="./logs/xor_logs", histogram_freq=0,  
write_graph=True, write_images=True)  
model.fit(x_data, y_data, epochs=5000, callbacks=[tb_hist])
```

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Thank You

로봇동아리