

# 성균관대학교 S / O / R

로봇학회



2022년 05월 12일

AI

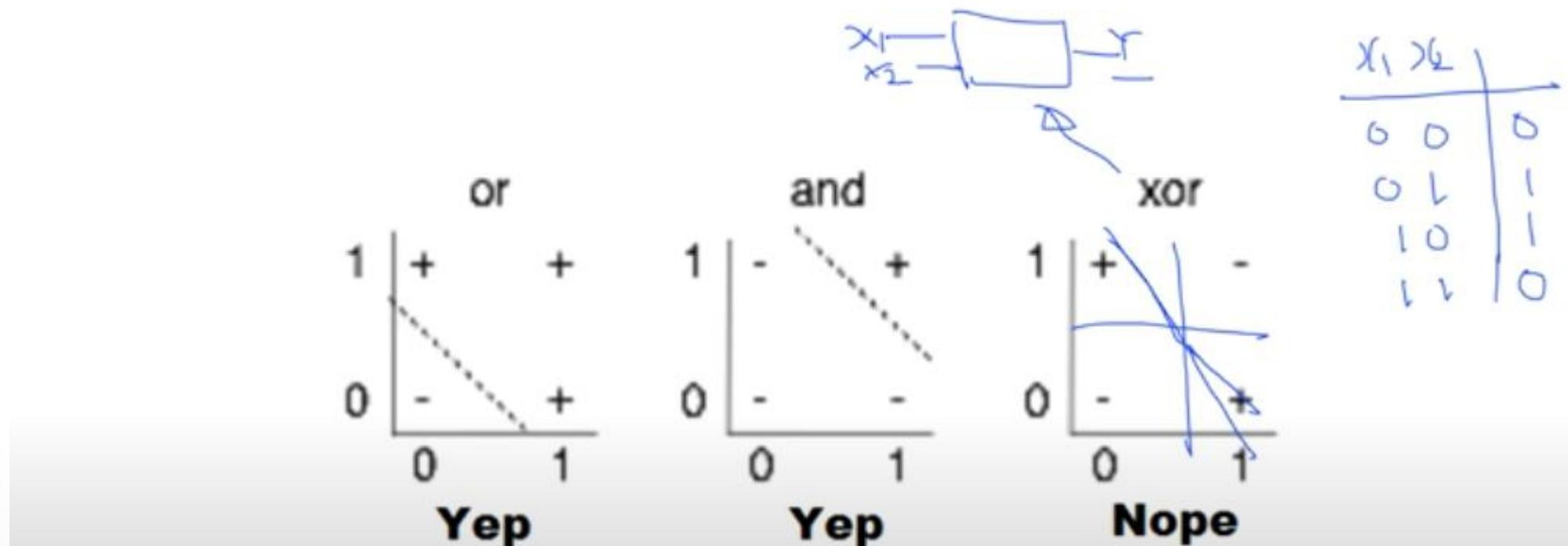
4 주 차

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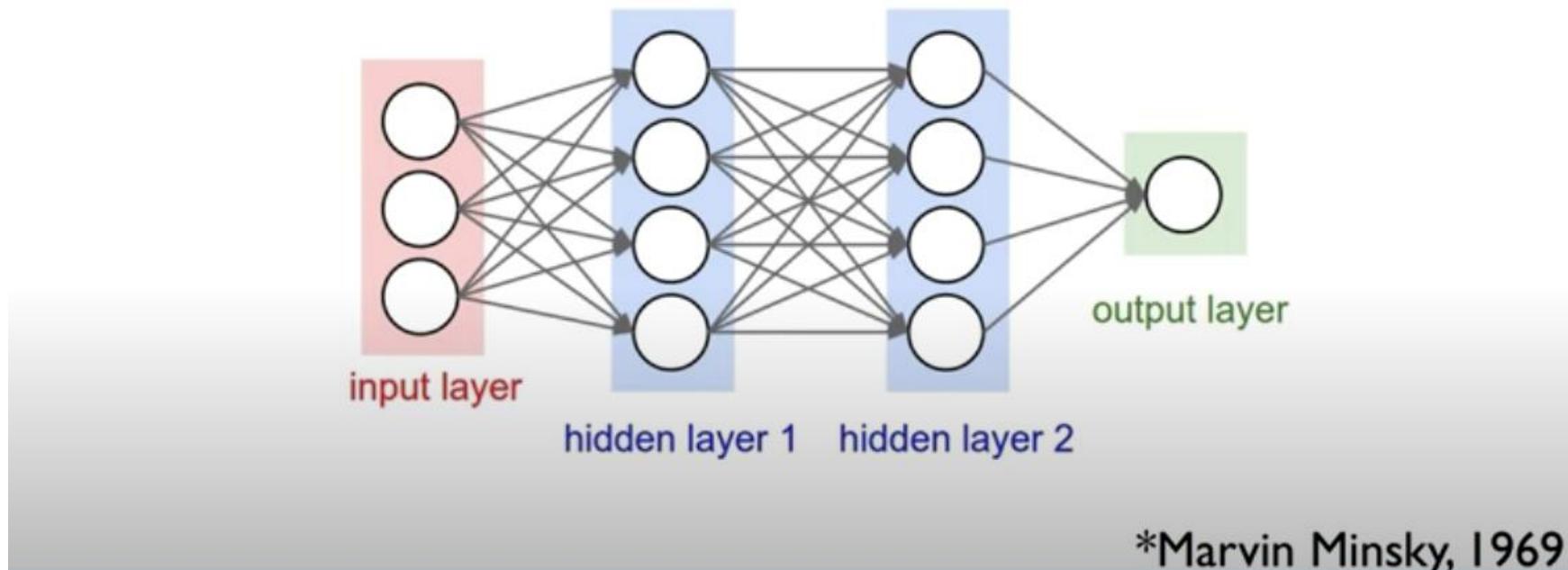
# 딥러닝 기본 개념1 : XOR 문제

(Simple) XOR problem: linearly separable?



# 딥러닝 기본 개념1 : XOR 문제

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



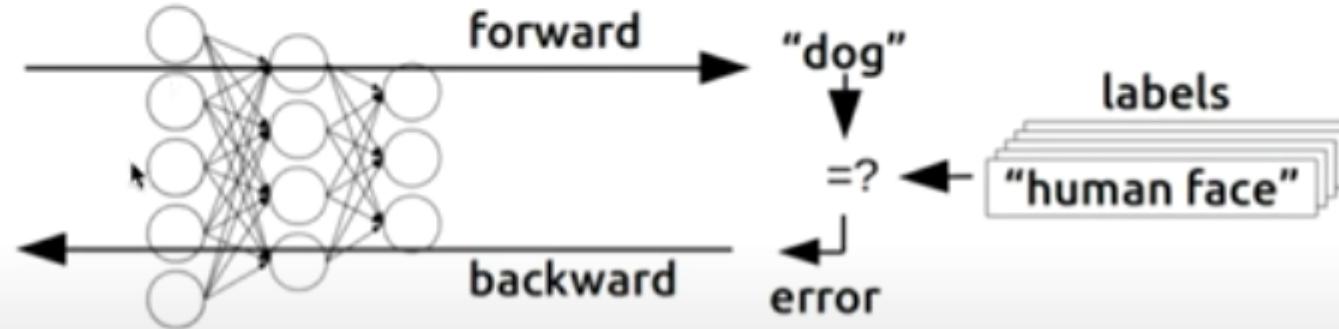
\*Marvin Minsky, 1969

# 딥러닝 기본 개념2 : Back-propagation

## Backpropagation

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

Training

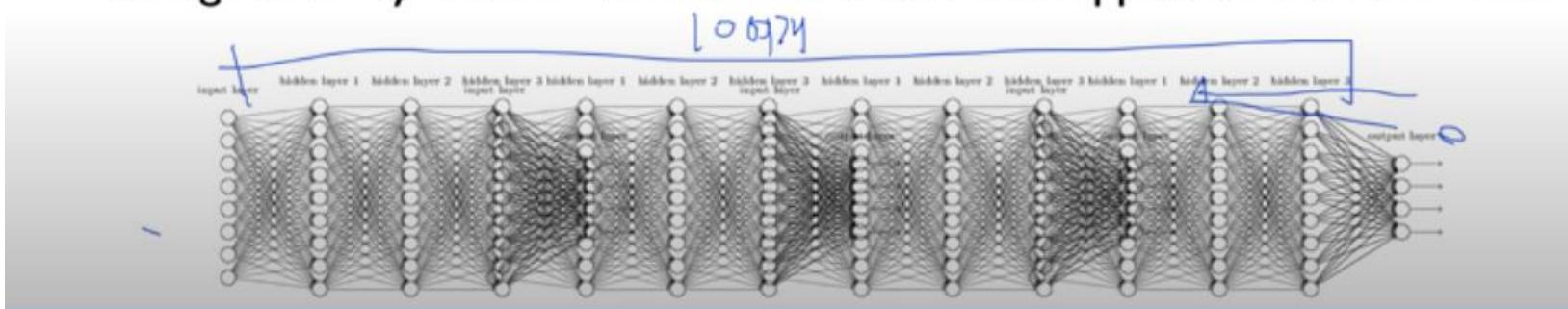


# 딥러닝 기본 개념2 : Back-propagation(단점)

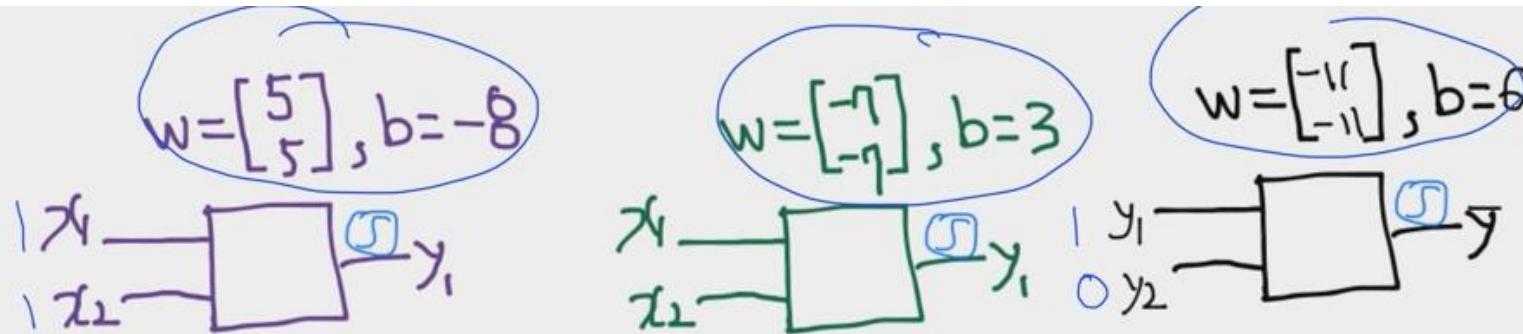
A BIG problem



- 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)



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

$$\begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} -1 \\ -1 \end{bmatrix} + 3 = -1 - 1 + 3 = \underline{-1}, \text{ sigmoid } (-1) = \underline{0}$$

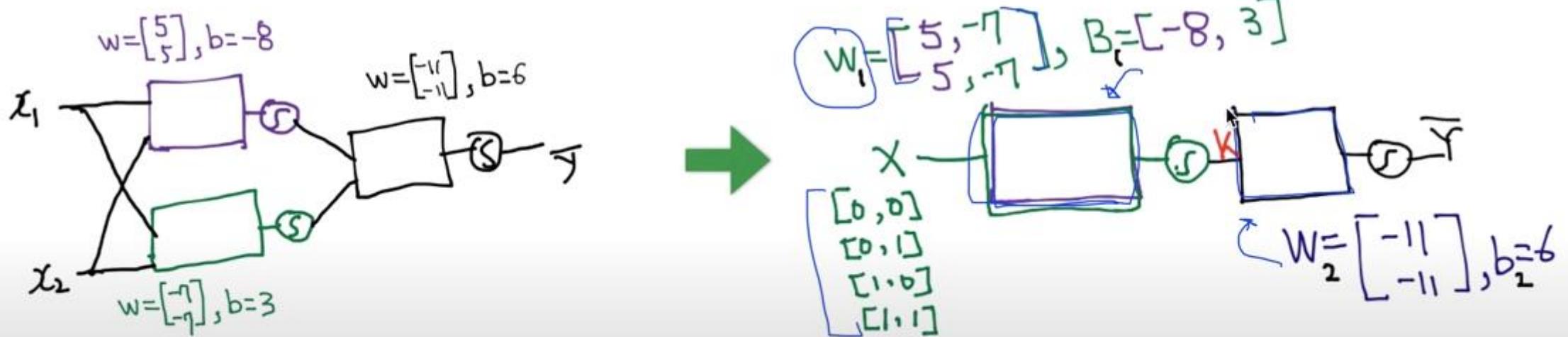
$$\begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \end{bmatrix} + 6 = \underline{-1} + 0 + \underline{6} = \boxed{5}$$

$\text{sigmoid } (5) = 0$

$x_1$	$x_2$	$y_1$	$y_2$	$\bar{y}$	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 ✓

# XOR 문제 딥러닝으로 풀기 (2)

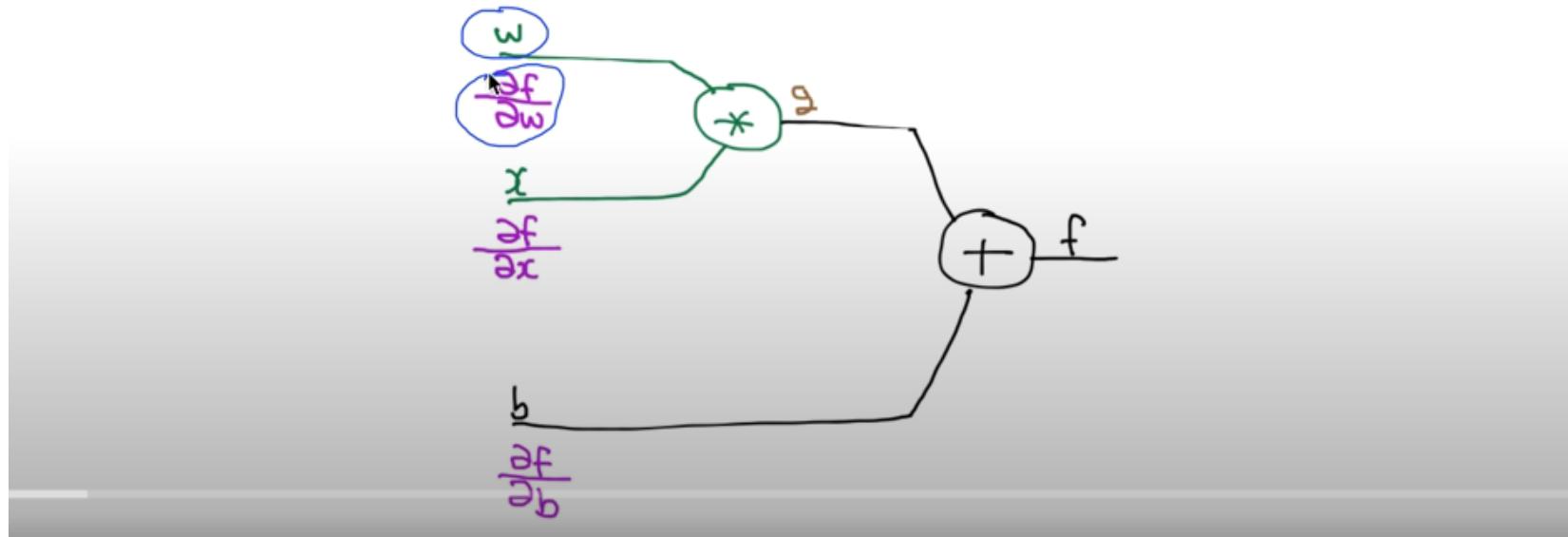
NN



# 딥네트워크 학습시키기(Back propagation) (1)

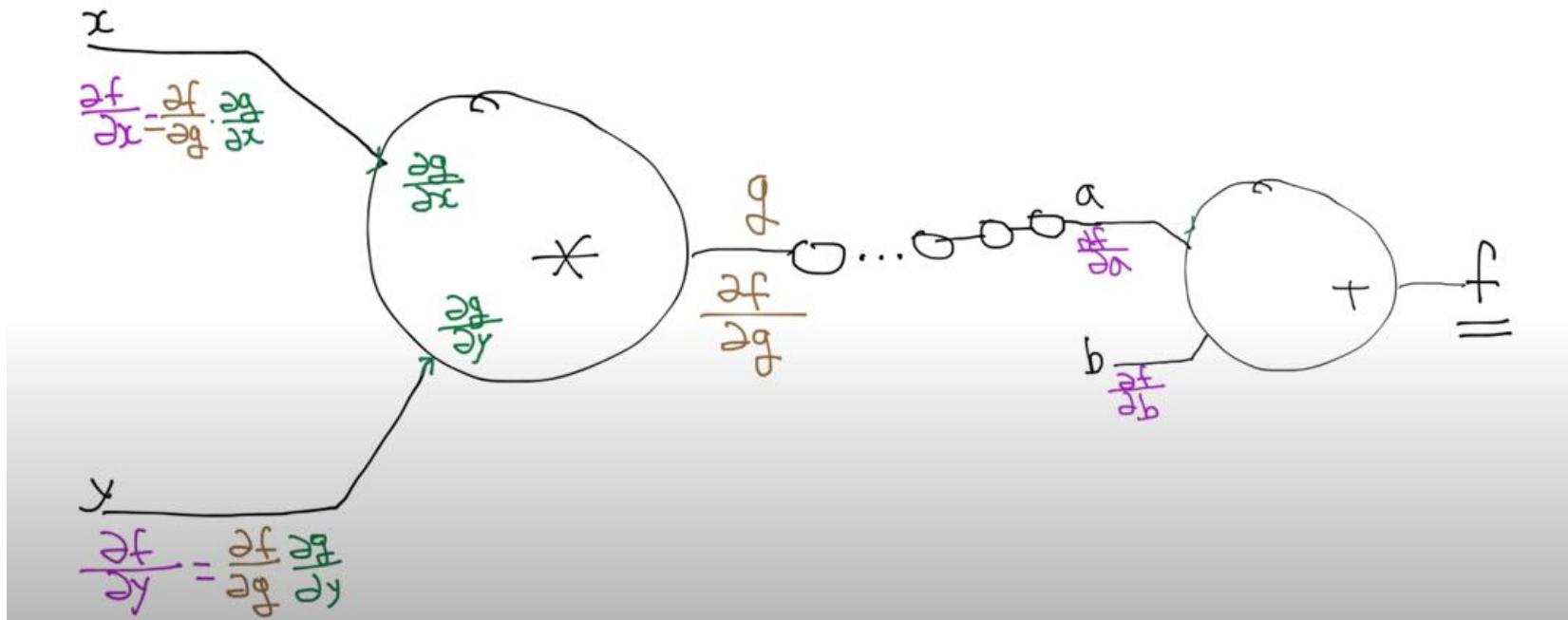
Back propagation (chain rule)

$$f = w \cdot x + b, g = w \cdot x, f = g + b$$



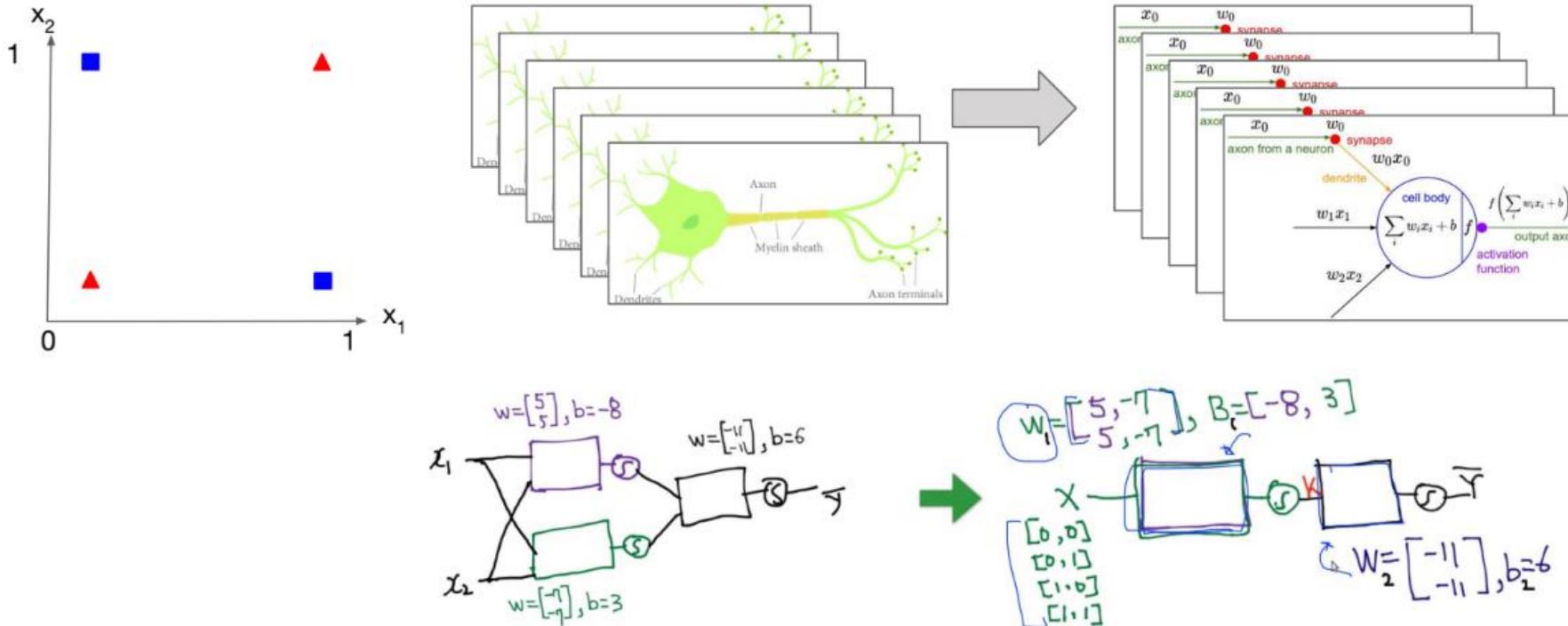
# 딥네트워크 학습시키기 (2)

Back propagation (chain rule)

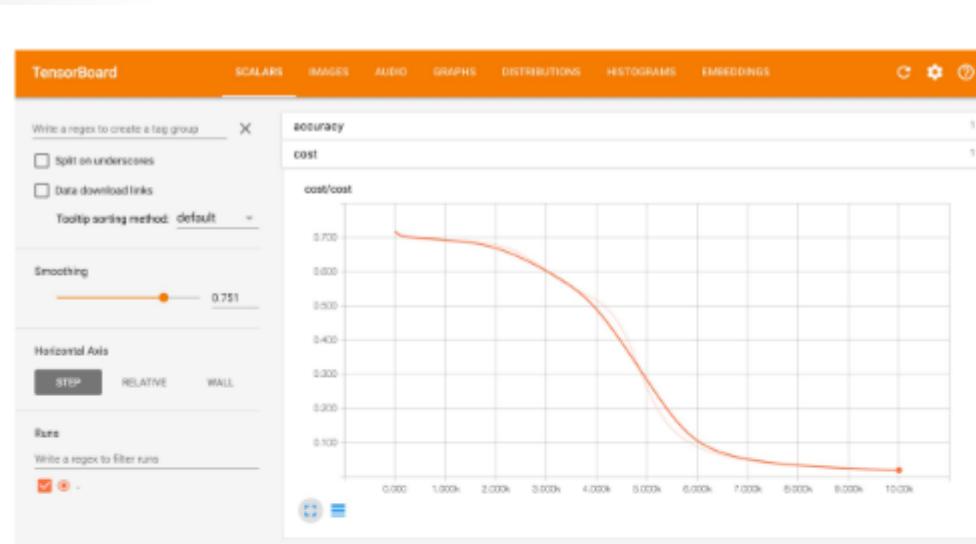


# Neural Net for XOR

## 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])
```

성 균 관 대 학 교

*Thank You*

로 봇 동 아 리