CNN 데이터 분석 교육

12th lecture

"Backpropagation"

2022 - 11 - 23

수학과 최명수

지난시간?

1. Neural network structure

   - Single layer perceptron
   - Only linear structure

   - Multi layer perceptron
   - Non-linear structure

오늘은 무엇을?

1. 신경망의 학습 방법
   -Backpropagation

분류 모델의 평가 방법

오분류표, 혼돈행렬 (Confusion matrix)

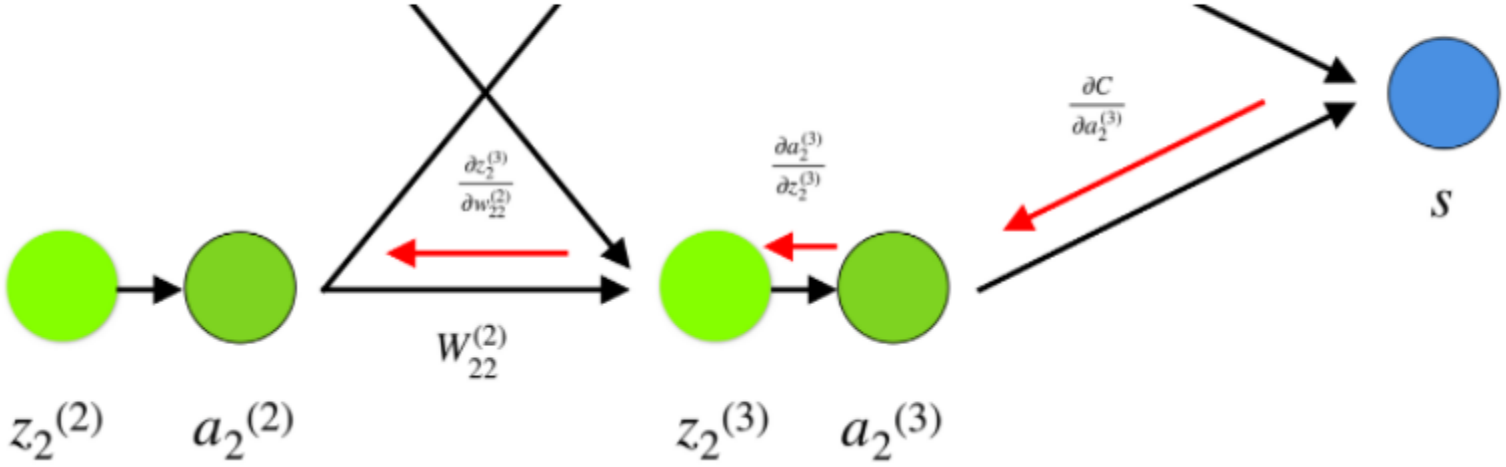
Predicted Values \ Actual Values	Positive (1)	Negative (0)
Positive (1)	TP	FP
Negative (0)	FN	TN

https://wikidocs.net/123608

Backpropagation

$$w := w - \epsilon \frac{\partial C}{\partial w}$$

$$b := b - \epsilon \frac{\partial C}{\partial b}$$



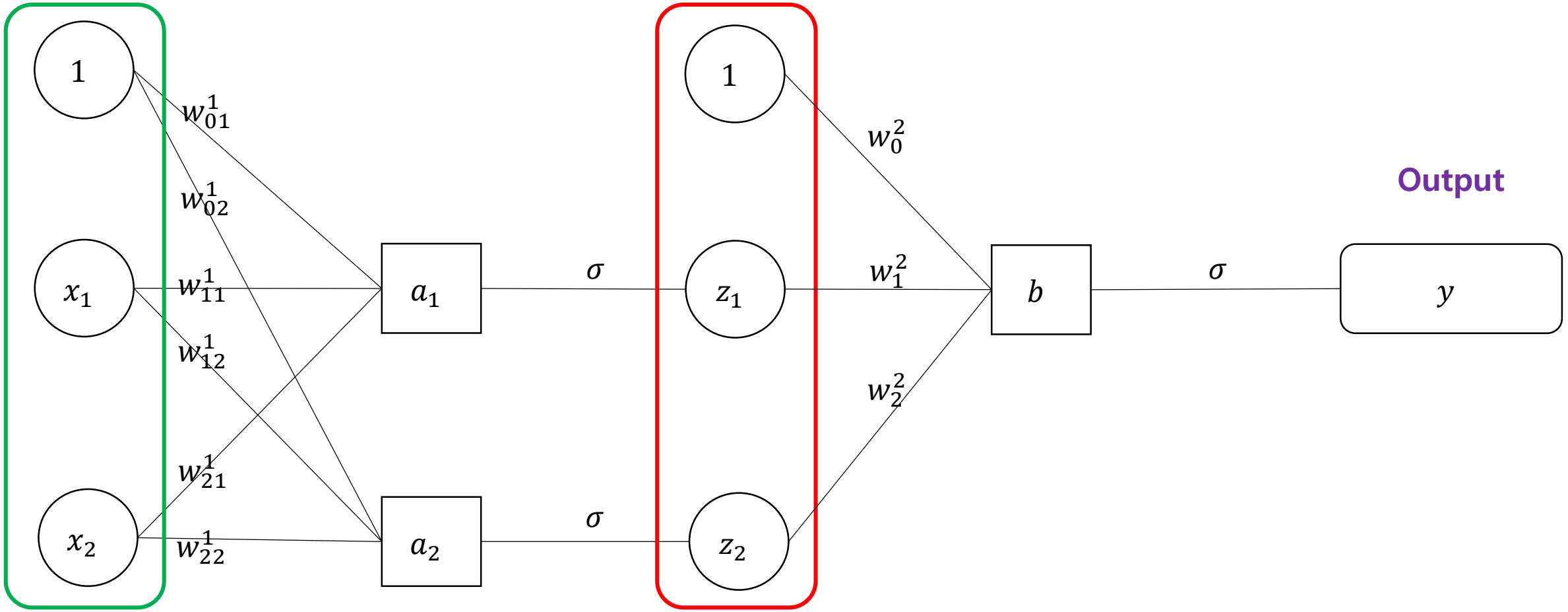
$$\frac{\partial C}{\partial w_{jk}^l} = \frac{\partial C}{\partial z_j^l} \frac{\partial z_j^l}{\partial w_{jk}^l} \qquad chain\ rule$$

https://towardsdatascience.com/understanding-backpropagation-algorithm-7bb3aa2f95fd

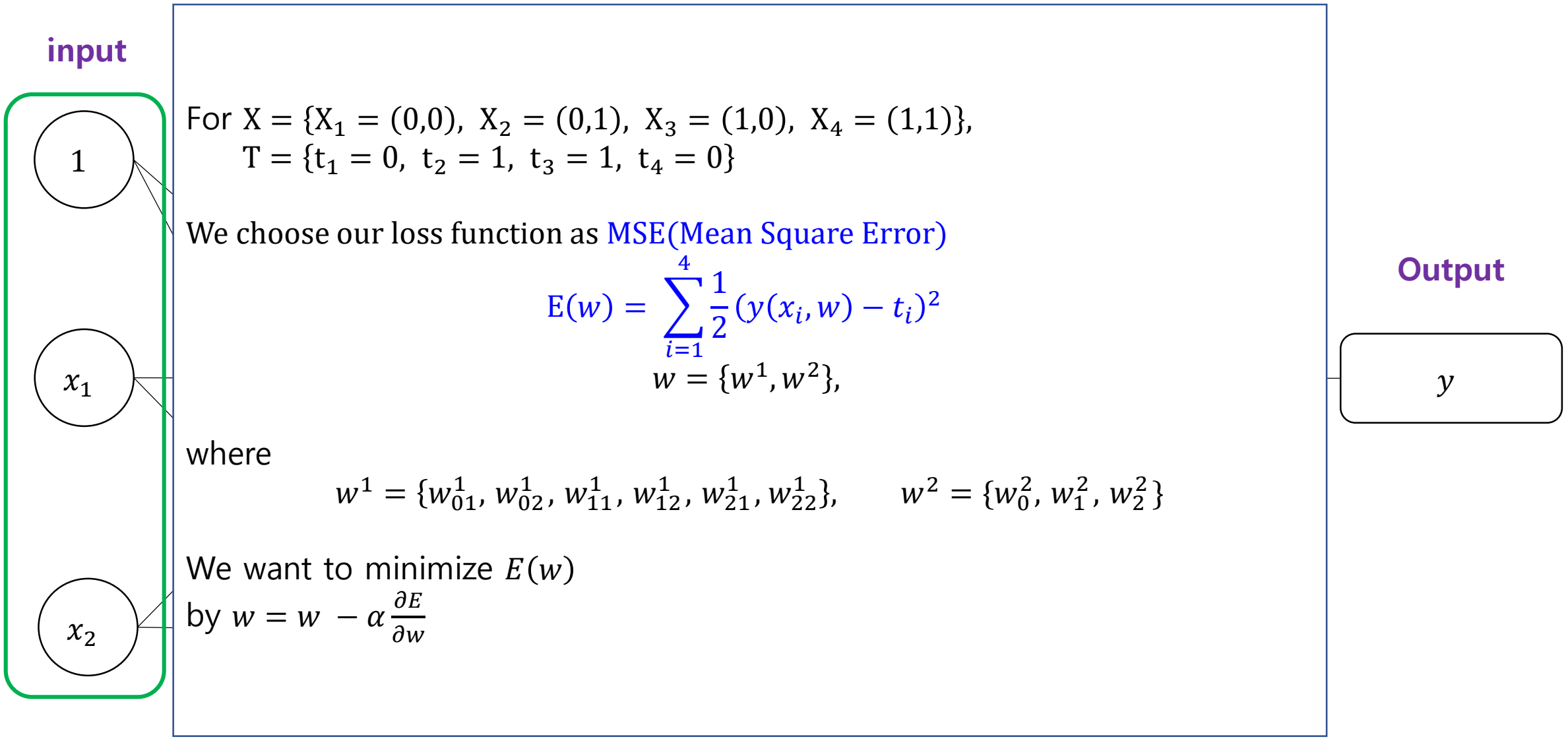
Backpropagation

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

: sigmoid function



Backpropagation



Backpropagation

$$\sigma'(x) = \left(\frac{1}{1+e^{-x}}\right)^2 \frac{d}{dx}(1+e^{-x})$$

$$= -\left(\frac{1}{1+e^{-x}}\right)^2 e^{-x}(-1)$$

$$= \left(\frac{1}{1+e^{-x}}\right)\left(\frac{e^{-x}}{1+e^{-x}}\right)$$

$$= \left(\frac{1}{1+e^{-x}}\right)\left(1-\frac{1}{1+e^{-x}}\right)$$

$$= \sigma(x)(1-\sigma(x))$$

Backpropagation

$$\sigma'(x) = \sigma(x)(1 - \sigma(x))$$

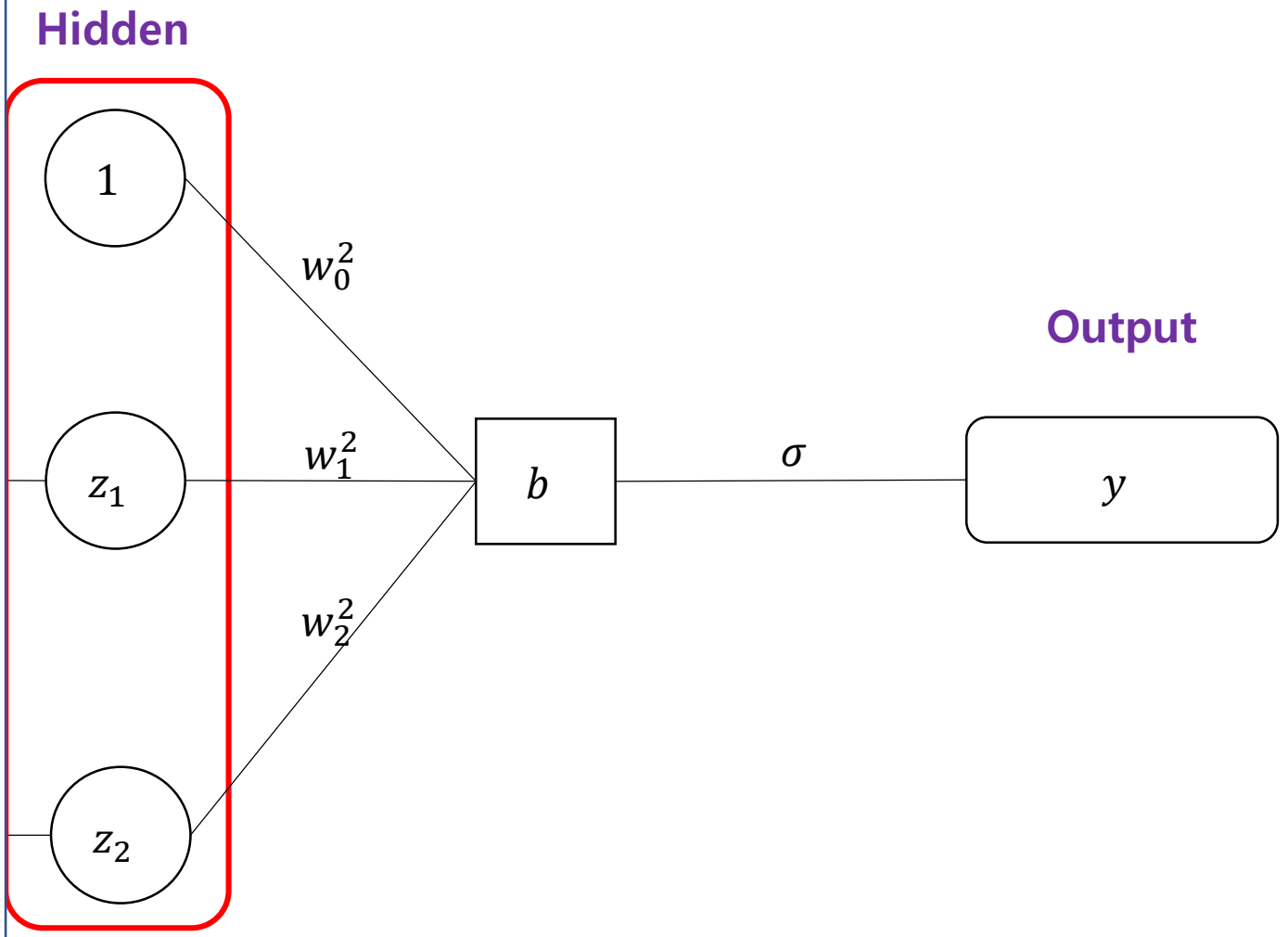
Derivative of the Sigmoid Function

Let

$$\tilde{\mathrm{E}}(w) = \frac{1}{2}(y(x_i, w) - t_i)^2$$

For $y = \sigma(b_1(z, w^2) = \sigma(w_0^2 + w_1^2 z_1 + w_2^2 z_2)$

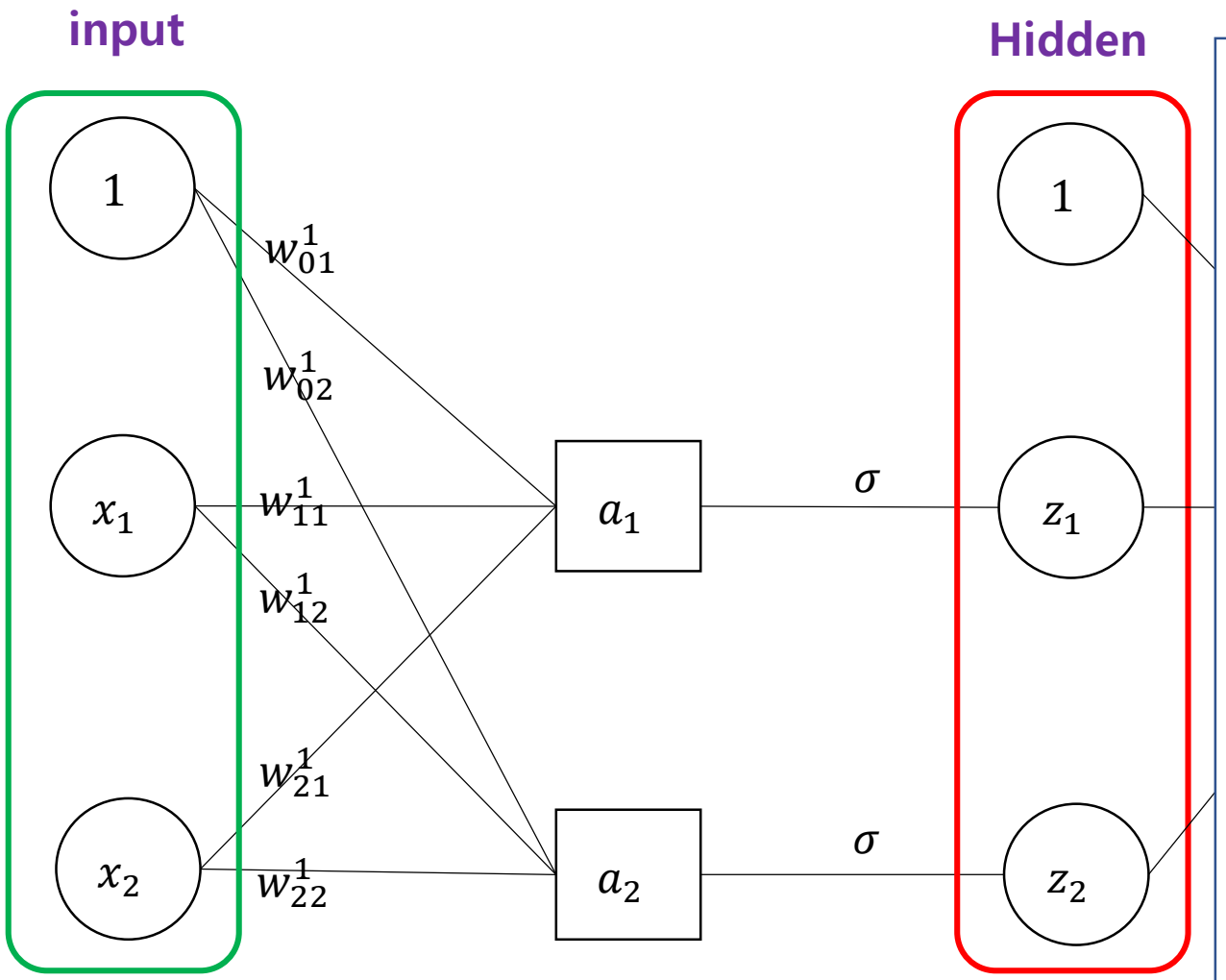
$$\frac{\partial \tilde{E}}{\partial w_i^2} = \frac{\partial \tilde{E}}{\partial y}\frac{\partial y}{\partial b}\frac{\partial b}{\partial w_i^2}$$
$$= (y - t)y(1 - y)z_i$$



Backpropagation

$$\sigma'(x) = \sigma(x)(1 - \sigma(x))$$

Derivative of the Sigmoid Function



Let

$$\tilde{E}(w) = \frac{1}{2}(y(x_i, w) - t_i)^2$$

For $y = \sigma(b_1(z, w^2) = \sigma(w_0^2 + w_1^2 z_1 + w_2^2 z_2)$

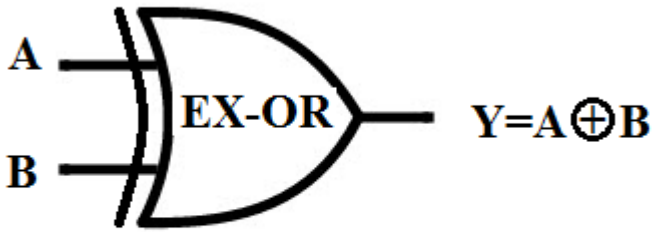
and $z_i = z_i(\sigma(a_i(x, w^1))$

$$a_i(x, w^1) = \sum w_{ji}^1 x_j$$

$$\frac{\partial \tilde{E}}{\partial w_{ji}^1} = \frac{\partial \tilde{E}}{\partial y}\frac{\partial y}{\partial b}\frac{\partial b}{\partial z_i}\frac{\partial z_i}{\partial a_i}\frac{\partial a_i}{\partial w_{ji}^1}$$

$$= (y - t)y(1 - y)w_i^2 z_i(1 - z_i)x_j$$

XOR 실습



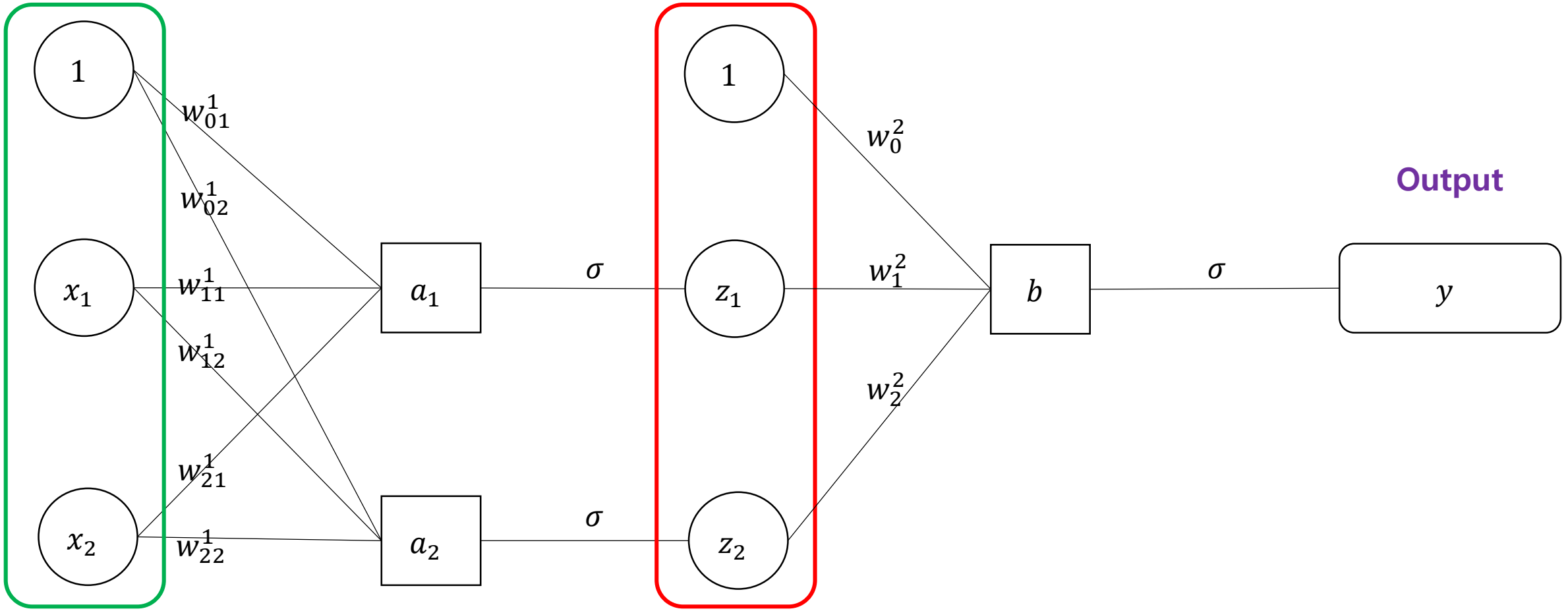
Inputs		Output
A	B	Y=A⊕B
0	0	0
0	1	1
1	0	1
1	1	0

https://electronics-club.com/logic-gates/

XOR 실습

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

: sigmoid function



정리 요약

1. 혼돈행렬은 분류모델의 평가지표.

2. Backpropagation은 신경망을 학습하는것!
   -이 알고리즘을 파이썬 라이브러리에 올려주신 분들께 감사드리자.

끝

담에봅시당