

삼성전기 AI전문가 양성과정 - 프로젝트 실습 (비영상)

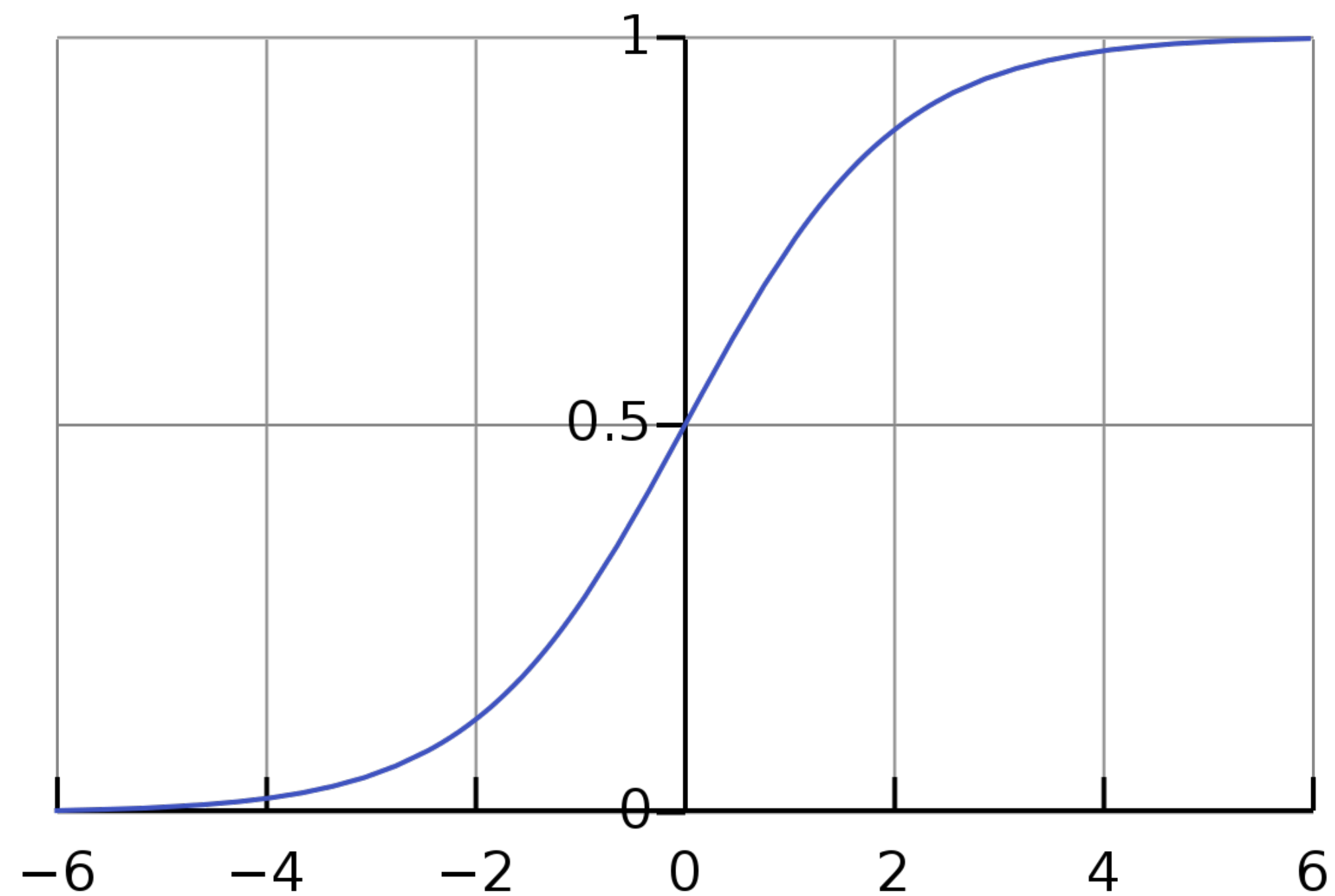
자연어처리를 위한 Numpy Neural Network

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2021.02.28

Sigmoid

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



Sigmoid

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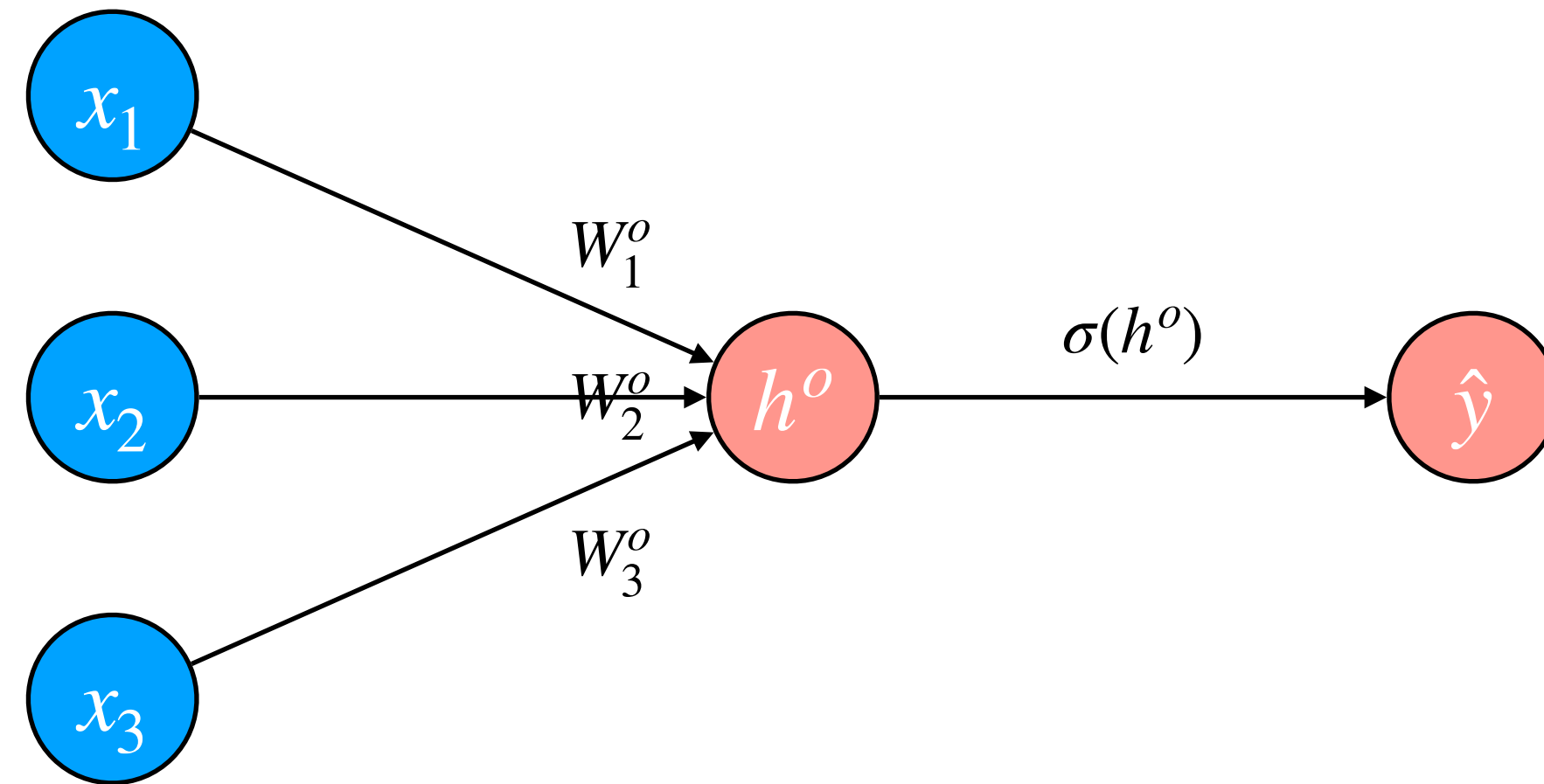
$$\frac{d\sigma(x)}{dx} = \sigma(x)(1 - \sigma(x))$$

$$\begin{aligned} \frac{d\sigma}{dx} &= (-1) \frac{1}{(1 + e^{-x})^2} \frac{d}{dx}(1 + e^{-x}) && \text{where } f(x) = 1 + e^{-x} \\ &= (-1) \frac{1}{(1 + e^{-x})^2} (0 + e^{-x}) \frac{d}{dx}(-x) && \text{where } g(x) = -x \\ &= (-1) \frac{1}{(1 + e^{-x})^2} (0 + e^{-x})(-1) \\ &= \frac{e^{-x}}{(1 + e^{-x})^2} \\ &= \frac{1 + e^{-x} - 1}{(1 + e^{-x})^2} \\ &= \frac{1 + e^{-x}}{(1 + e^{-x})^2} - \frac{1}{(1 + e^{-x})^2} \\ &= \frac{1}{(1 + e^{-x})} - \frac{1}{(1 + e^{-x})^2} \\ &= \frac{1}{(1 + e^{-x})} \left(1 - \frac{1}{(1 + e^{-x})} \right) \\ &= \sigma(x)(1 - \sigma(x)) \end{aligned}$$

Problem

x_1	x_2	x_3	y
0	0	1	0
1	1	1	1
1	0	1	1
0	1	1	0

Neural Network (layer 1)



$$x = (x_1, x_2, x_3)$$

$$W^o = \begin{pmatrix} w_1^o \\ w_2^o \\ w_3^o \end{pmatrix}, \quad b^o$$

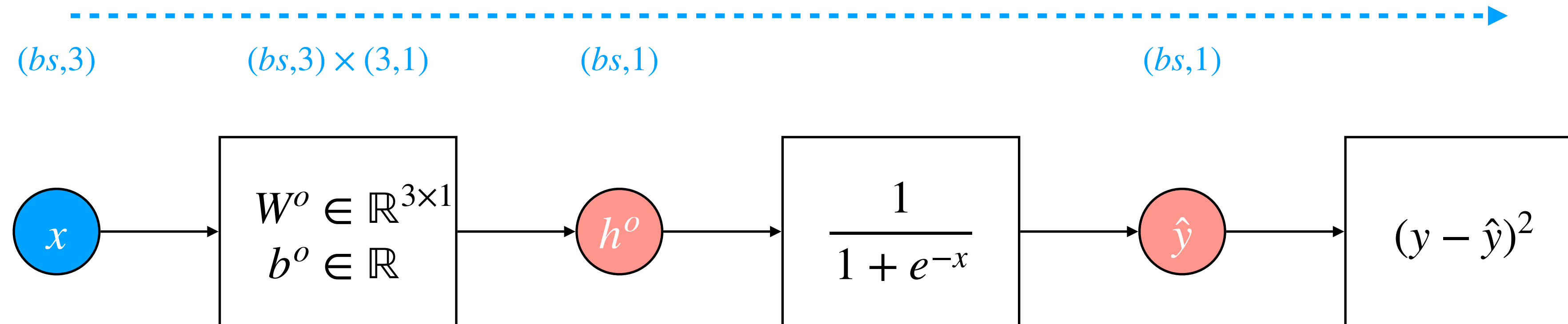
$$h^o = xW^o + b^o = x_1W_1^o + x_2W_2^o + x_3W_3^o + b^o$$

$$\hat{y} = \sigma(h^o)$$

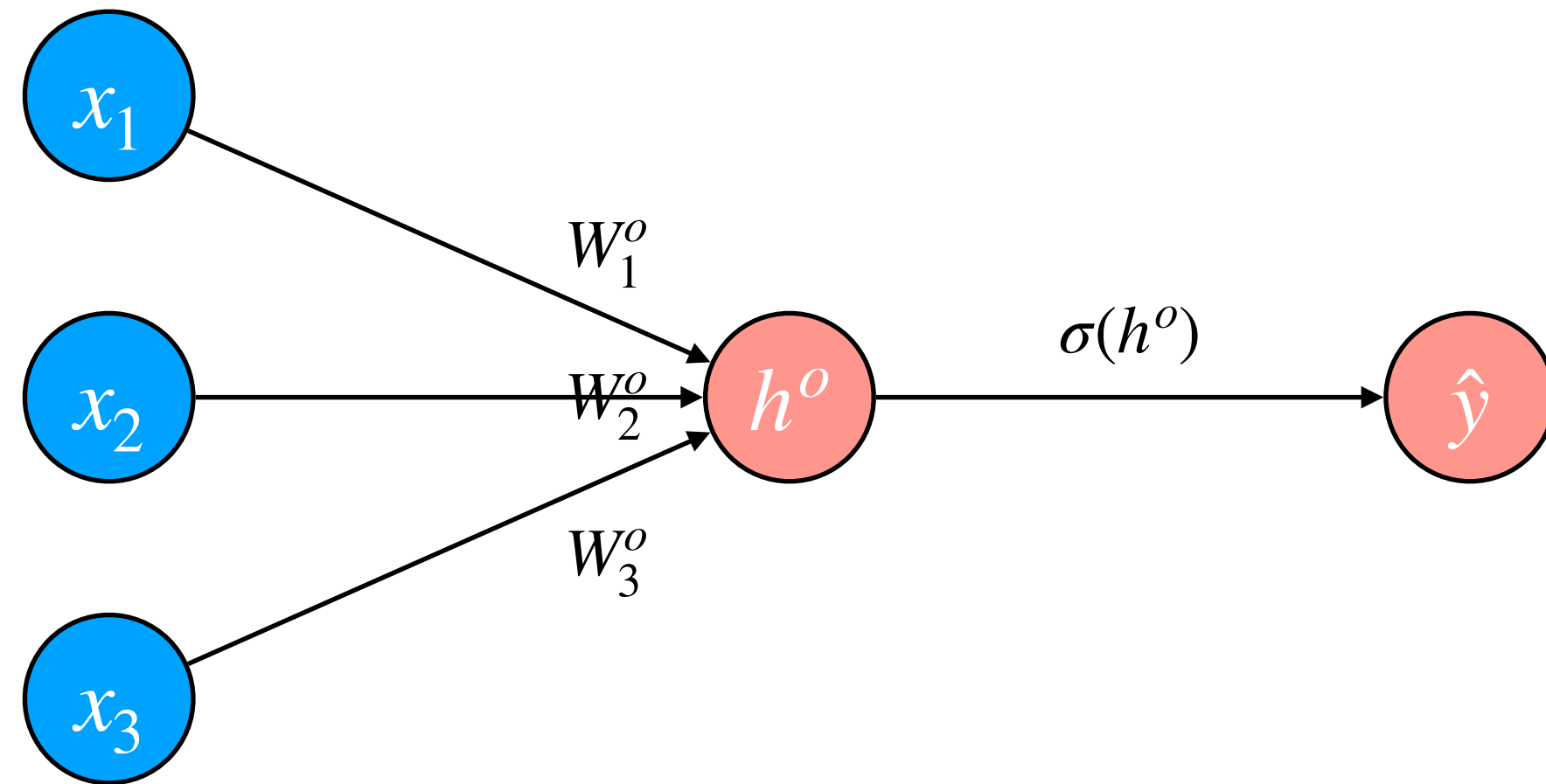
$$MSE = (y - \hat{y})^2$$

$$\hat{y} = \frac{1}{1 + e^{-(x_1W_1^o + x_2W_2^o + x_3W_3^o + b^o)}}$$

Neural Network (layer 1)



Neural Network (layer 1)



$$\frac{dMSE}{d\hat{y}} = \frac{d}{d\hat{y}}(y - \hat{y})^2 = -2(y - \hat{y})$$

$$\frac{d\hat{y}}{dh^o} = \frac{d}{dh^o}\sigma(h^o) = \sigma(h^o)(1 - \sigma(h^o)) = \hat{y}(1 - \hat{y})$$

$$\frac{dh^o}{dW^o} = \frac{d}{dW^o}(xW^o + b^o) = x$$

$$\frac{dh^o}{db^o} = \frac{d}{db^o}(xW^o + b^o) = 1$$

$$\frac{dMSE}{dW^o} = \frac{dMSE}{d\hat{y}} \frac{d\hat{y}}{dh^o} \frac{dh^o}{dW^o} = -2(y - \hat{y})\hat{y}(1 - \hat{y})x$$

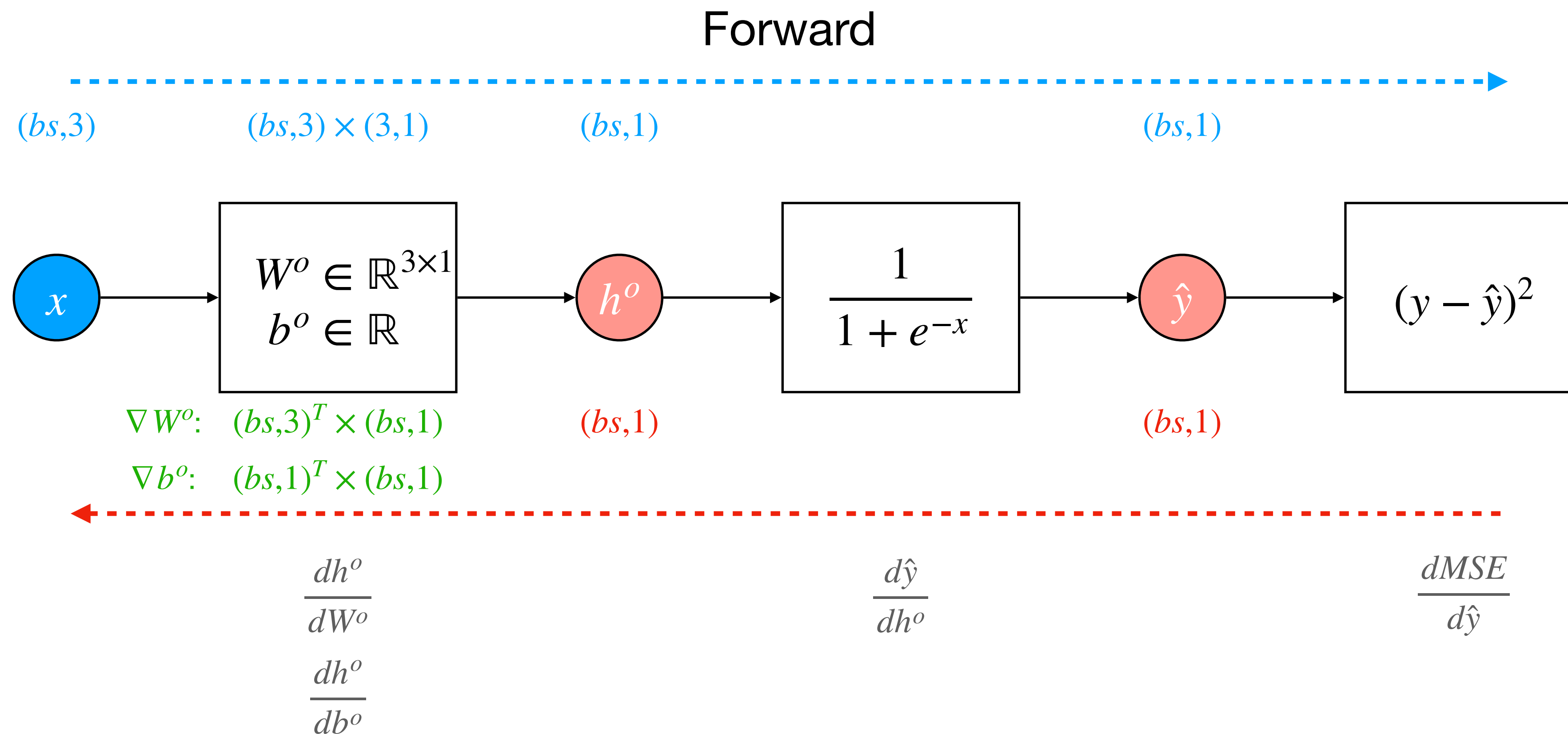
$$\frac{dMSE}{db^o} = \frac{dMSE}{d\hat{y}} \frac{d\hat{y}}{dh^o} \frac{dh^o}{db^o} = -2(y - \hat{y})\hat{y}(1 - \hat{y})$$

$$\nabla W^o = \alpha \frac{dMSE}{dW^o}$$

$$\nabla b^o = \alpha \frac{dMSE}{db^o}$$

α : learning rate

Neural Network (layer 1)



감사합니다.