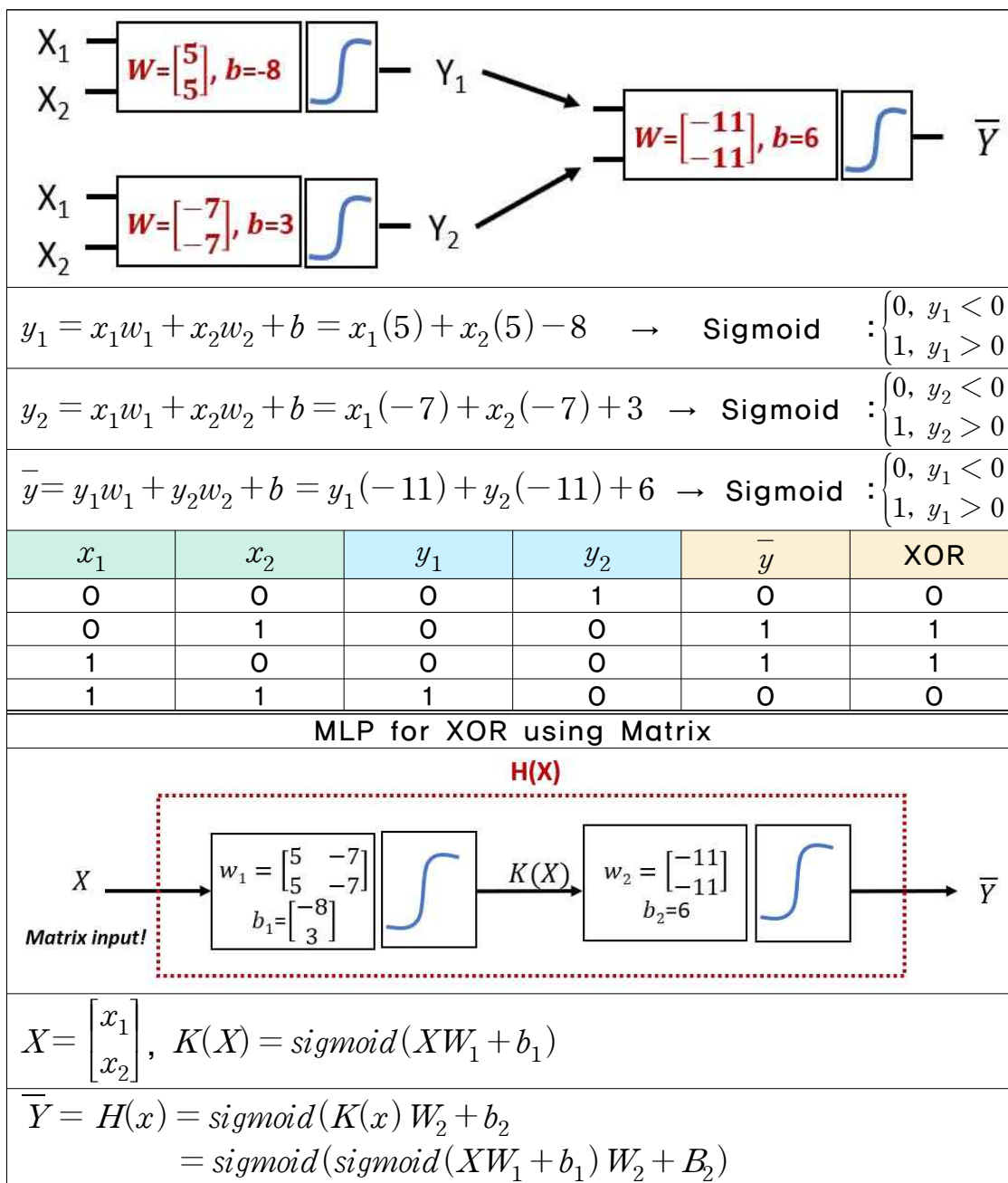# 뉴럴네트워크(Neural Network)

1. Perceptron

One logistic regression unit cannot separate XOR

2. MLP(Multi-Layer Perceptron)

Multiple logistic regression unit can separate XOR

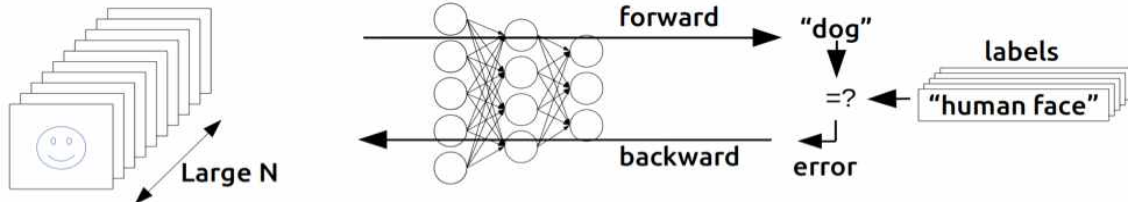Feed Forward(Forward Propagation)을 통한 XOR 풀이 가능

$y_1 = x_1 w_1 + x_2 w_2 + b = x_1(5) + x_2(5) - 8$	→	Sigmoid	:	$\begin{cases} 0, & y_1 < 0 \\ 1, & y_1 > 0 \end{cases}$	
$y_2 = x_1 w_1 + x_2 w_2 + b = x_1(-7) + x_2(-7) + 3$	→	Sigmoid	:	$\begin{cases} 0, & y_2 < 0 \\ 1, & y_2 > 0 \end{cases}$	
$\overline{y} = y_1 w_1 + y_2 w_2 + b = y_1(-11) + y_2(-11) + 6$	→	Sigmoid	:	$\begin{cases} 0, & y_1 < 0 \\ 1, & y_1 > 0 \end{cases}$	

x_1	x_2	y_1	y_2	$\overline{y}$	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

MLP for XOR using Matrix

$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, $K(X) = sigmoid(XW_1 + b_1)$

$\overline{Y} = H(x) = sigmoid(K(x) W_2 + b_2$
$= sigmoid(sigmoid(XW_1 + b_1) W_2 + B_2)$

BUT too complicated to apply GD for finding optimal parameters

3. Backpropagation

    1) W, b 초기화

    2) Forward 계산 & Error 측정

    3) Error 값을 Backward 하면서 W, b 갱신(error를 최소화하는 방향)