ToBigs 19기 정규세션 조교차.
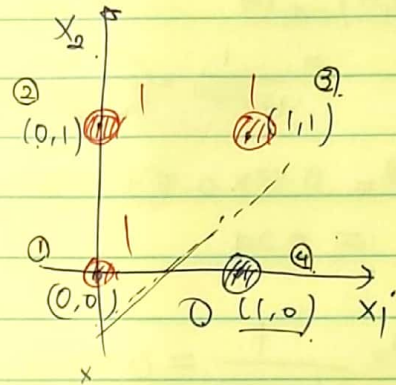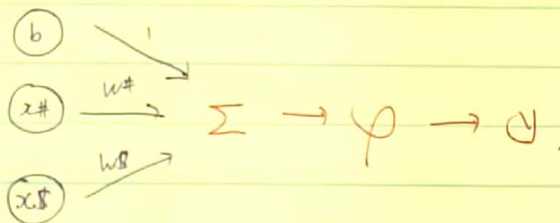NN Basics   이동우

1) $\sigma(z) = \dfrac{1}{1+\exp(-z)} = \dfrac{1}{1+e^{-z}}$.

$\dfrac{d\sigma(z)}{dz} = \dfrac{-e^{-z}\cdot(-1)}{(1+e^{-z})^2} = \dfrac{e^{-z}}{(1+e^{-z})^2} = \dfrac{1+e^{-z}-1}{(1+e^{-z})^2} = \dfrac{1}{(1+e^{-z})} - \dfrac{1}{(1+e^{-z})^2}$.

$\qquad\qquad\qquad\qquad\qquad = \sigma(z) - (\sigma(z))^2 = \sigma(z)(1-\sigma(z))$

2)

1) $\varphi(w_1 x_1 + w_2 x_2 + bias)\begin{bmatrix} 0 & (z<0) \\ 1 & (z\geq 0) \end{bmatrix}$

let $w_1 = -1$ $w_2 = +1$. $bias = 0.5$.

$z = -x_1 + x_2 + 0.5$. $\varphi(①) = \varphi(0.5) = 1$ $\ell(③) = \ell(0.5) = 1$

$\qquad\qquad\qquad \ell(②) = \ell(1.5) = 1$ $\ell(④) = \ell(-0.5) = 0$.

$\qquad\qquad\to$ 분류 잘됨

2) Parameter updates.

$\boxed{w_1 = 1, \quad w_2 = -1. \quad bias = 0.5}$. $\to z = x_1 - x_2 + 0.5$.

$\ell(①) = \ell(0.5) = 1$ $\ell(③) = \ell(0.5) = 1$

$\ell(②) = \ell(-0.5) = 0$. $\ell(④) = \ell(1.5) = 1$. $\to$ 분류 update 3④이야줄.

let $r = 0.1$.

bias $\leftarrow$ bias $+ 0.1(1-0) \times 1$ $bias = 1.5$.

$w_1 \leftarrow (w_1) + 0.1(1-0) \times 0 \to w_1 = 1$

$w_2 \leftarrow (w_2) + 0.1(1-0) \times 1 \to w_2 = -0.9$

$\Rightarrow z = x_1 - 0.9 x_2 + 1.5$

$\to$ update 더진행필요.
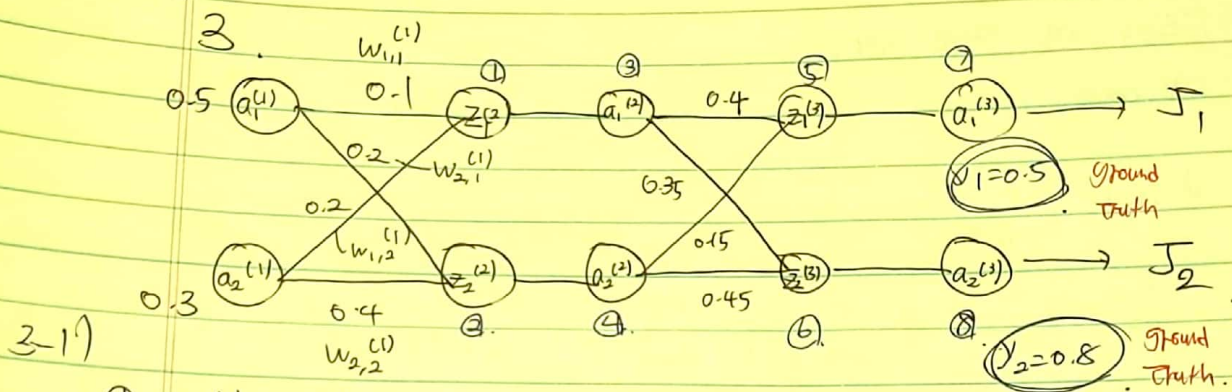
	X_1	X_2	$\hat{y}$	y O.
①	0	0	1	1
②	0	1	1	0
③	1	1	1	1
④	1	0	0	1
	0	0	1	1
	0	1	1	1
	1	1	1	1
	1	0	0	1

3.

3-1)

① $z_1^{(2)} = w_{1,1}^{(1)} \cdot a_1^{(1)} + w_{1,2}^{(1)} a_2^{(1)}$

  $= 0.1 \times 0.5 + 0.2 \times 0.3$

  $= 0.11$

②. $z_2^{(2)} = w_{2,1}^{(1)} a_1^{(1)} + w_{2,2}^{(1)} \cdot a_2^{(1)}$

  $= 0.2 \times 0.5 + 0.3 \times 0.4$

  $= 0.22$.

③. $\theta(z_1^{(2)}) = a_1^{(2)}$

  $= \dfrac{1}{1+e^{-0.11}} = \boxed{0.53}$

④. $\theta(z_2^{(2)}) = a_2^{(2)}$.

  $= \dfrac{1}{1+e^{-0.22}} = \boxed{0.55}$

⑤ $z_1^{(3)} = 0.53 \times 0.4 + 0.55 \times 0.15$.

  $= 0.29$

⑥. $0.55 \times 0.45 + 0.53 \times 0.35 = z_2^{(3)}$.

  $= 0.43$

⑦ $a_1^{(3)} = \dfrac{1}{1+e^{-0.29}} = 0.57$

⑧ $a_2^{(3)} = \dfrac{1}{1+e^{-0.43}} = 0.61$.

3-2) let Cost function as MSE.

①

$J_1 = \dfrac{1}{2}(a_1^{(3)} - y_1)^2$.

  $= \dfrac{1}{2}(0.57 - 0.5)^2$.

  $= 0.00245$

② $J_2 = \dfrac{1}{2}(a_2^{(3)} - y_2)^2$.

  $= \dfrac{1}{2}(0.61 - 0.8)^2$.

  $= 0.01805$.

3-3)

Updates) $W_j = W_j - 0.1 \cdot \dfrac{\delta_{Total}}{\delta w_j}$ (Learning rate $= 0.1$)

$\underbrace{\qquad\qquad\qquad}_{} \,'1/,$

$\Rightarrow W_{2,2}{}^{(2)} , \quad W_{2,1}{}^{(1)}$

$\delta_2{}^{(3)} = \dfrac{\delta N_2}{\delta z} \quad \underbrace{(a_2{}^{(3)} - y_2) \times a_2{}^{(3)} \times (1 - a_2{}^{(3)})}_{} \, \#.$

$\qquad\qquad = (0.61 - 0.8) \times 0.61 \times (1 - 0.61) .$

$\qquad\qquad = -\, 0.045 .$

$W_{2,1}{}^{(2)} = W_{2,1}{}^{(2)} - \delta_2{}^{(3)} a_1{}^{(2)}$

$\qquad\qquad = 0.35 - (-0.045) \times 0.53 . \qquad = 0.37385 .$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \approx 0.374 .$

$W_{2,2}{}^{(2)} = W_{2,2}{}^{(2)} - \delta_2{}^{(3)} a_2{}^{(2)} .$

$\qquad\qquad = 0.45 - (-0.045) \times 0.55 .$

$\qquad\qquad = 0.452475 . \approx 0.452 .$