투빅스 18기 정규세션 3주차

Neural Network Basic Assignment

정 민서

1. Sigmoid Function을 z에 대해 미분해요

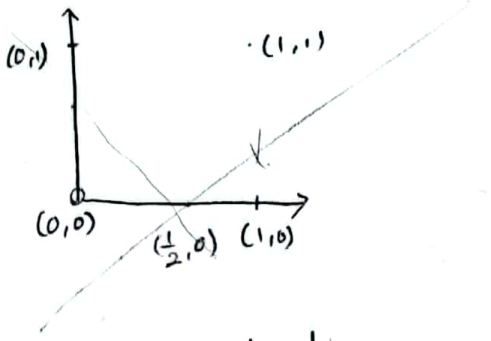
$$\sigma(z) = \frac{1}{1+e^{-z}}$$

$$\frac{\partial}{\partial z}\sigma(z) = \frac{(1)'(1+e^{-z}) - (1)(-e^{-z})}{(1+e^{-z})^2}$$

$$= \frac{e^{-z}}{(1+e^{-z})^2}$$

2.

2-1 임의의 b, w로 분류하기



$W = [1, 1]$, $b = \frac{1}{2}$

$(0,0) \Rightarrow \varphi(z) = 1$ $(1,1) \Rightarrow \varphi(z) = 1$ → 예측값 non-linear

$(0,1) \Rightarrow \varphi(z) = 1$ $(1,0) \Rightarrow \varphi(z) = 1$

2-2

학습률 0.1

$W_1 = W_1 + 0.1 \times (0-1) \times 1$

$= W_1 - 0.1$

$= 0.9$

$W_2 = W_2 + 0.1 \times (0-1) \times 1$

$= W_2 - 0.1$

$= 0.9$

$b = b + 0.1 \times (0-1) = b - 0.1 = 0.4$

∴ $W_1 = 0.9$, $W_2 = 0.9$, $b = 0.4$

3.

3-1

$Z_1^{(2)} = 0.5 \times 0.1 + 0.3 \times 0.2 = 0.11$

$Z_2^{(2)} = 0.5 \times 0.2 + 0.3 \times 0.4 = 0.22$

$a_1^{(2)} = \frac{1}{1+e^{-0.11}} = 0.53$

$a_2^{(2)} = \frac{1}{1+e^{-0.22}} = 0.55$

$Z_1^{(3)} = 0.53 \times 0.4 + 0.55 \times 0.15$

$= 0.29$

$Z_2^{(3)} = 0.53 \times 0.35 + 0.55 \times 0.45$

$= 0.43$

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

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

3-2

$J_1 = \frac{1}{2}(0.5 - 0.57)^2 = \frac{1}{2}0.07^2 = 0.00245$

$J_2 = \frac{1}{2}(0.8 - 0.61) = \frac{1}{2}0.19^2 = 0.01805$

3-3.

i) $W_{2,1}^{(2)}$ =

$$W_{2,1}^{(2)} = W_{2,1}^{(2)} - \frac{\partial J_2}{\partial a_2^{(3)}} \times \frac{\partial a_2^{(3)}}{\partial z_2^{(3)}} \times \frac{\partial z_2^{(3)}}{\partial W_{2,1}^{(2)}} \times lr$$

$$= 0.35 - 0.1 \times (a_2^{(3)} - y_2) \times \underbrace{a_2^{(3)} \times (1 - a_2^{(3)})}_{\text{sigmoid}} \times a_1^{(2)}$$

$$= 0.35 - 0.1 (0.61 - 0.8) \times \underbrace{(0.61 \times 0.39)}_{0.238} \times 0.53$$

$$= 0.35239666$$

ii) $W_{2,2}^{(2)}$

$$W_{2,2}^{(2)} = W_{2,2}^{(2)} - lr \times \frac{\partial J_2}{\partial a_2^{(3)}} \times \frac{\partial a_2^{(3)}}{\partial z_2^{(3)}} \times \frac{\partial z_2^{(3)}}{\partial a_2^{(2)}}$$

$$= 0.45 - 0.1 \times (a_2^{(3)} - y_2) \times a_2^{(3)} \times (1 - a_2^{(3)}) \times a_2^{(2)}$$

$$= 0.45248711$$