M1.

['pretty', 'good', 'bad', 'plot', 'not', 'scenery'].

w_1, w_2 w_3 w_4 w_5 w_6

$W = [0, 0, 0, 0, 0, 0]$, $\alpha = 0.5$.

x_1 : 0 pretty bad → $\phi(x_1) = [1, 0, 1, 0, 0, 0]$

x_2 1 good plot → $\phi(x_2) = [0, 1, 0, 1, 0, 0]$

x_3 0 not good → $\phi(x_3) = [0, 1, 0, 0, 1, 0]$

x_4 1 pretty scenery → $\phi(x_4) = [1, 0, 0, 0, 0, 1]$

$k_1 = \text{dot}(W, \phi(x_1)) = [0,0,0,0,0,0] \cdot [1,0,1,0,0,0] = 0.$

$h_1 = \text{sigmoid}(k_1) = 0.5.$

$W = W - \overset{0.5}{\alpha}\,(\overset{0.5-0}{h_1 - y_1})\,\phi(x_1)$

$= [0,0,0,0,0,0] - 0.25[1,0,1,0,0,0] = [-0.25, 0, -0.25, 0, 0, 0]$ ※.

$k_2 = W \cdot \phi(x_2) = 0$

$h_2 = \text{sigmoid}(0) = \frac{1}{2}$

$W = W - \overset{0.5}{\alpha}\,(\overset{0.5-1}{h_2 - y_2})\,\phi(x_2)$

$= [-0.25, 0, -0.25, 0, 0, 0] + 0.25[0, 1, 0, 1, 0, 0]$

$= [-0.25, 0.25, -0.25, 0.25, 0, 0]$ ※

$k_3 = W \cdot \phi(X_3) = [-0.25, +0.25, -0.25, 0.25, 0, 0] \cdot [0, 1, 0, 0, 1, 0] = 0.25$

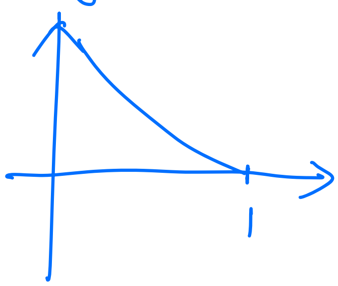
$h_3 = \text{sigmoid}(0.25) = \dfrac{1}{(1+e^{-x})} = 0.56217$

$W = W - \alpha(h_3 - y_3)\phi(X_3)$ 0.281

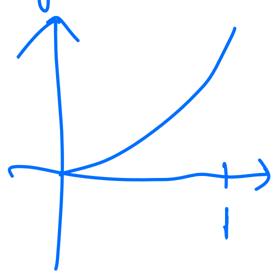
$= [-0.25, 0.25, -0.25, 0.25, 0, 0] - \underline{0.5(0.56217-0)}[0, 1, 0, 0, 1, 0]$

$= [-0.25, -0.031, -0.25, 0.25, -0.281, 0]$ **

<yi=1>



<yi==0>



$k_4 = W \cdot \phi(X_4) = [-0.25, -0.031, -0.25, 0.25, -0.281, 0] \cdot [1, 0, 0, 0, 0, 1]$

$= -0.25$

$h_4 = \sigma(k_4) = \dfrac{1}{1+\exp(-0.25)} = \underline{0.43782.}$

0.5 0.43782 − 1

$W = W - \alpha(\underline{h_4} - y_4)\phi(X_4)$ + 0.28109

$= [-0.25, -0.031, -0.25, 0.25, -0.281, 0] - \underline{0.5(-0.56218)}[1, 0, 0, 0, 0, 1]$

$= [0.03109, -0.031, -0.25, 0.25, -0.281, 0.28109]$ **

$M_2.$

$$\mathcal{L}(y,h) = -[\, y\log h + (1-y)\log(1-h)\,]$$

Goal $\Rightarrow$ $$\frac{dL}{dw} = \frac{dL}{dh} \times \frac{dh}{dk} \times \frac{dk}{dw}.$$

$$\frac{dL}{dh} = -\left[\frac{y}{h} + (1-y)\frac{-1}{1-h} \right]$$

$$h = \text{sigmoid}(k) = \frac{1}{(1+e^{-k})}.$$

$$\frac{dh}{dk} = \frac{d}{dk}\left(\frac{1}{1+e^{-k}}\right)$$

$$= \frac{d}{dk}(1+e^{-k})^{-1} = -1\,(1+e^{-k})^{-2} \cdot e^{-k} \cdot (-1)$$

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

$$= \underline{h \cdot (1-h)}$$

$$\frac{dk}{dw} = \underline{\phi(X)} \qquad k = w \cdot \phi(X_k)$$

$$\frac{dL}{dw} = -\left(\frac{y}{h} - \frac{1-y}{1-h}\right)(h)(1-h) \cdot \phi(X)$$

$$= \left(-y(1-h) + h(1-y)\right)\phi(X)$$

$$= (-y + yh + h - yh)\phi(x)$$

$$= \underline{(h-y)\phi(x)}$$