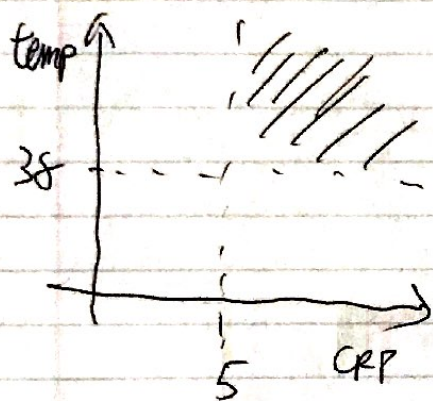
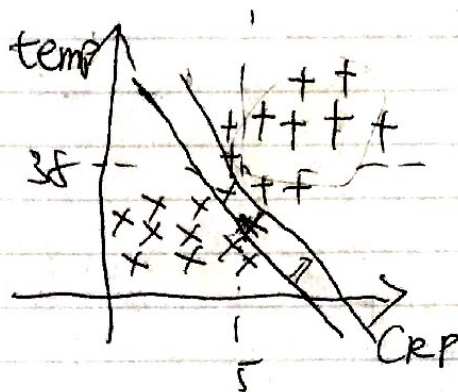
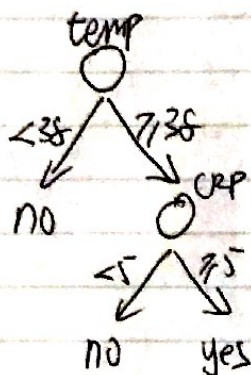


Logistic regression

temp
CRP

DA DA 2



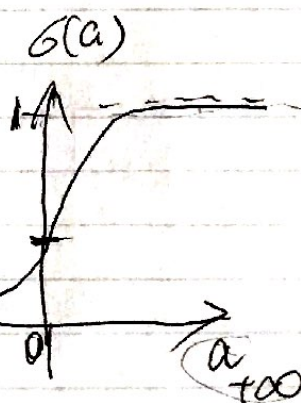
$$\text{DA DA 2} = W_{\text{temp}} \times \text{temp} + W_{\text{CRP}} \times \text{CRP}$$

$$y = W_1 x_1 + W_2 x_2 + b$$

$$= a$$

$$P = \sigma(a)$$

$$\sigma(a) = \frac{1}{1 + \exp(-a)}$$



① objective function

$$CE = \text{cross-entropy} = -y \log P - (1-y) \log(1-P)$$

$$\Delta W_1 = \frac{\partial CE}{\partial W_1} = (P - y) x_1, \quad \Delta W_2 = (P - y) x_2$$

$$\Delta b = P - y$$

$$W_1^* \leftarrow W_1 - \Delta W_1$$

Derivation for $\frac{\partial CE}{\partial W_1}$

$$\frac{\partial CE}{\partial W_1} = \frac{1}{\partial W_1} [-y \log p - (1-y) \log(1-p)]$$

$$= -y \frac{\partial \log p}{\partial W_1} - (1-y) \frac{\partial \log(1-p)}{\partial W_1}$$

$$= -y \frac{\partial \log p}{\partial p} \frac{\partial p}{\partial a} \frac{\partial a}{\partial W_1} - (1-y) \frac{\partial \log(1-p)}{\partial(1-p)} \frac{\partial(1-p)}{\partial a} \frac{\partial a}{\partial W_1}$$

$$= -y \left(\frac{1}{p}\right) \underbrace{p(1-p)}_{\text{see below}} x_1 - (1-y) \left(\frac{1}{1-p}\right) (-p(1-p)) x_1$$

$$= -y x_1 + y p x_1 + p x_1 - y p x_1$$

$$= (p - y) x_1$$

$$\frac{\partial p}{\partial a} = \frac{\partial}{\partial a} \frac{1}{1 + \exp(-a)} = \frac{\partial [1 + \exp(-a)]^{-1}}{\partial [1 + \exp(-a)]} \frac{\partial [1 + \exp(-a)]}{\partial a}$$

$$= - [1 + \exp(-a)]^{-2} (-\exp(-a))$$

$$= \frac{\exp(-a)}{1 + \exp(-a)} \underbrace{\frac{1}{1 + \exp(-a)}}_p$$

$$= \frac{(1 + \exp(-a))^{-1} - 1}{1 + \exp(-a)} \cdot p$$

$$= (1 - p) p$$