2. input $x \in \mathbb{R}$
output $y \in \{0, 1\}$

$$P(y=1|x) = \frac{e^{(\alpha+\beta x)}}{1+e^{\alpha+\beta x}}$$

2.1. $$P(y=0|x) = \frac{e^{(\alpha+\beta x)}}{1+1} = \frac{e^{(\alpha+\beta x)}}{2}$$

$$\begin{aligned} p(y=0|x) &= 1 - P(y=1|x) \\ &= 1 - \frac{e^{\alpha+\beta x}}{1+e^{\alpha+\beta x}} \\ &= \frac{1+e^{\alpha+\beta x}}{1+e^{\alpha+\beta x}} - \frac{e^{\alpha+\beta x}}{1+e^{\alpha+\beta x}} \\ &= \frac{1}{1+e^{\alpha+\beta x}} \quad \checkmark \end{aligned}$$

2. $$[P(y=1|x)]^{y} \times [P(y=0|x)]^{1-y}$$

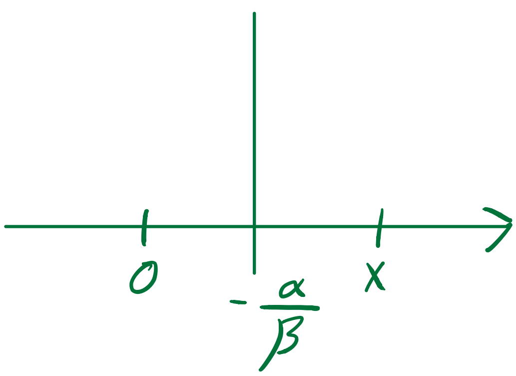
$$(\alpha, b)^{*} = \arg\max_{(\alpha,\beta)} \prod_{i=1}^{n} [P(y_i=1|x_i]_i^{y} \times [P(y_i=0|x_i)]^{1-i}$$

$$y_i = 0 \rightarrow p(y_i=1|x_i)^{0} \times p(y_i=0|x_i)^{1-0}$$

$$y_i = 1 \rightarrow p(y_i=0|x_i)^{1} \rightarrow [p(y_i=0|x_i)]^{2} =$$

$$= \frac{1}{1+e^{-(2y-1)(\alpha+\beta x)}} \quad \checkmark$$

2.3



$$y = \begin{cases} 1, & \alpha+\beta x \geq 0 \\ 0, & \text{else} \end{cases}$$

3. input $x \in \mathbb{R}$
output $y \in \{0,1\}$

$$P(y=1|X) = \frac{1}{1+e^{-(w^T X+b)}}$$

1. $$p(y|X) = \frac{1}{1+e^{-(2y-1)\times(w^T x+b)}}$$

$$p(y=1) = \frac{1}{1+e^{-(2(1)-1)\times(w^T x+b)}} = \frac{1}{1+e^{-1\cdot(w^T X+b)}}$$

$$p(y=0) = \frac{1}{1+e^{-(2(0)-1)\times(W^T X+b)}} = \frac{1}{1+e^{1\times(w^T X+b)}}$$

3.2 $$y = \begin{cases} 1, & w^T x\beta \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

4.1 $$\frac{dL(w)}{\delta w} = \frac{d}{dw}\left(\ln\left[\frac{1}{1-e^{-2y_i-1)(w^T x_i+b)}}\right]\right)$$

$$= \frac{d(w)}{\delta w} \ln\left(\frac{d}{\delta w}\left[1+e^{-(2y_i-1)\times(w^T x_i+b)}\right]\right)$$

$$= \sum_i \frac{1}{1+e^{-(2y_i-1)\times(w^T x+b)}} \cdot -(2y-1)e^{-(2y-1)\times(w^T x+b)}$$

$$= \frac{(2y-1)x_i\, e^{-(2y_i-1)\times(w^T x_i+b)}}{1+e^{-(2y_i+1)\times(w^T x_i+b)}}$$

$$= \sum_i -(2y-1)x_i \cdot (1-P_{y_i}|x_i;w,b)$$

4.1.2 $$w^* = W_{old} - \alpha\left(\frac{\delta L(w)}{\delta w}\right)$$