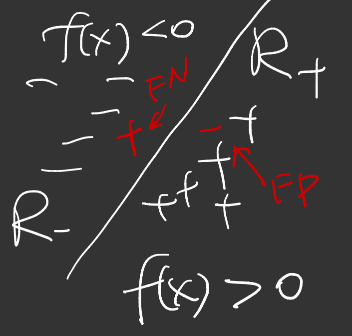

$$P(x \text{ is FP, FN} \mid f)$$

$$= \int_{R+} p(x,-)\,dx + \int_{R-} p(x,+)\,dx$$

$$= \int \mathbb{1}(f(x)>0)\, p(x,-)\,dx + \int \mathbb{1}(f(x)<0)\, p(x,+)\,dx$$

$$= \int \left[1 - \mathbb{1}(f(x<0))\right] p(x,-)\,dx + \int \mathbb{1}(f(x)<0)\, p(x,+)\,dx$$

$$= \int p(x,-) + \underbrace{\mathbb{1}(f(x)<0)}_{①}\underbrace{\left[p(x,+) - p(x,-)\right]}_{②} dx$$

$$= \underbrace{\int p(x,-)\,dx}_{\text{Const.}} + \underbrace{\int \left(\mathbb{1}(f(x)<0)\right)\left[p(x,+) - p(x,-)\right] dx}_{\text{Select an } f\text{, such that}}$$

when ② < 0, ① = 1

② > 0, ① = 0

possible choice of f $\Longrightarrow$

$$f(x) = p(x,+) - p(x,-)$$

$$f(x) = \log p(x,+) - \log p(x,-) = \log \frac{p(x,+)}{p(x,-)}$$

$\vdots$

Completing the square

$$wAw^T - 2w^T b$$

$$= \underbrace{wAw^T - 2w^T b + b^T A^{-1} b}_{} - b^T A^{-1} b$$

$$= (w^T - A^{-1}b)^T A (w - A^{-1}b) - b^T A^{-1} b,$$ when A is invertible!

$\Downarrow$

does not depend on w.