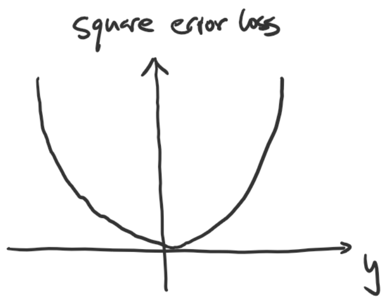
Q1

a)



since

b)

$$\frac{\partial L}{\partial w} = \frac{\partial H_\delta(y-t)}{\partial w}$$

$$= \frac{\partial}{\partial w} H'(y-t)$$

$$= \frac{\partial}{\partial w} H'(w^T x + b - t)$$

$$= \frac{\partial (y-t)}{\partial w} H'(w^T x + b - t)$$

$$\frac{\partial L}{\partial w} = x^T H'_\delta(y-t)$$

$$\partial \frac{L}{\partial b} = \frac{\partial (y-t)}{\partial b} \cdot H'(y-t)$$

$$= H'(y-t)$$

$$H'_\delta(a) = \begin{cases} a & \text{if } |a| \leq \delta \\ \alpha & \text{if } |a| > \delta \end{cases}$$

$$H'_\delta(y-t) = \begin{cases} w^T x + b - t & \text{if } |a| \leq \delta \\ \delta & \text{if } |a| > \delta \end{cases}$$

Q2

a) $L(w) = \frac{1}{2}(y - xw)^T A(y - xw) + \frac{\lambda}{2}\|w\|^2$

$w^* = \text{argmin } L(w)$

$L(w) = \frac{1}{2}(y^T - w^T A^T) A(y - xw) + \frac{\lambda}{2}\|w\|^2$

$= \frac{1}{2}(y^T A y - 2W^T x^T A y + w^T x A x w) + \frac{\lambda}{2}\|w\|^2$

$\frac{\partial L(w)}{\partial w} = x^T A y + x^T A x W + \lambda W$ note: $y = \|w\|^2$

$= 0$

then

$(x^T A x + \lambda I) w^* = x^T A y$

$w^* = (x^T A x + \lambda I)^{-1} x^T A y$

d) as $\sigma \to \infty$, average loss increase slightly.

as $\sigma \to 0$, average lose increase sharply.