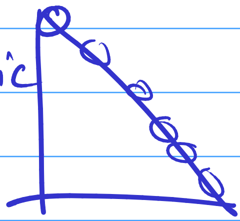
$$[\;]_{1\times n}\,[\;\;]_{n\times n}\,[\;]_{n\times 1}$$

∇E

$$[\;]_{1\times n}\,[\;]_{n\times 1}$$

$n \rightarrow$ symmetric



$$\begin{bmatrix} 0 & x & y \\ x & 0 & x \\ y & x & 0 \end{bmatrix}$$

$\left\lceil \frac{n}{2} \right\rceil \rightarrow$ elements

if E is continuous, differentiable

E' is continuous, differentiable

@ $w = \vec{w}$

$$\sum t_n \ln y_n + (1-t_n)\ln(1-y_n)$$

$$\tanh = \frac{e^{a} - e^{-a}}{e^{a}+e^{-a}} = 2\sigma(2a) - 1$$

$$\frac{\tanh(a)+1}{2} = \sigma(2a)$$

$$\sigma(2a) - (1-\sigma(2a))$$

σ

$$\tanh(a) = \sigma(2a) - \sigma(-2a)$$

$$-1 \leq \tanh(z) \leq 1$$

$$P(y=1/x) = \tfrac{1}{2}(1+\tanh(z))$$
$$P(y=-1/x) = 1-\tfrac{1}{2}(1+\tanh(z))$$

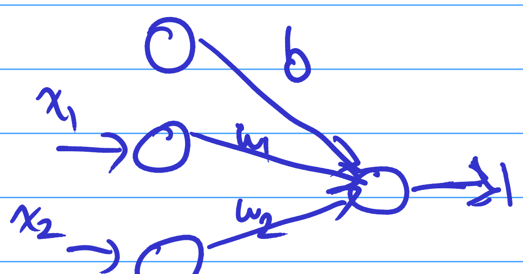
MLE

$$\max = \left(\tfrac{1}{2}(1+\tanh(z))\right)^{\frac{1+y_i}{2}} \left(1-\tfrac{1}{2}(1+\tanh(z))\right)^{\frac{1-y_i}{2}}$$

$$\max \tfrac{1}{N} \left(\left(\tfrac{1+y_i}{2}\right) \log\left(\tfrac{1}{2}(1+\tanh(z))\right) + \left(\tfrac{1-y_i}{2}\right) \log\left(1-\tfrac{1}{2}(1+\tanh(z))\right)\right)$$

$$\min \sum_{i=1}^{N} \left((1+y_i)\log(1+\tanh(z)) + (1-y_i)\log(1-\tanh(z))\right)\tfrac{1}{N}$$

(3)



$$\underset{D\times D}{(X^T X)^{-1}} \underset{D\times n}{(X^T} \underset{n\times 1}{y)}$$

$$[w_1 \cdots\cdots w_n] \begin{bmatrix} x_1 + x_1^2 \\ x_2 + x_2^2 \\ \vdots \\ x_n + x_n^2 \end{bmatrix} + [W_0]$$

$$J = \frac{(w^T x + b - y)^2}{2N} \qquad \frac{\partial J}{\partial w_i} = \frac{1}{N}(w^T x + b - y)(x_i + x_i^2)$$

(5) $\sigma(-a) = \dfrac{1}{1+e^{a}} = \dfrac{1}{1+\frac{1}{e^{-a}}} = \dfrac{e^{-a}}{1+e^{-a}} = \dfrac{1+e^{-a}-1}{1+e^{-a}}$

$= 1 - \sigma(a)$

$y = \cancel{\sigma}\ \dfrac{1}{1+e^{-a}}$

$\cancel{r} = \dfrac{1}{y} - 1 = e^{-a}$

$\ln\left(\dfrac{1-y}{y}\right) = -a \quad \ln\left(\dfrac{y}{1-y}\right) = a$

$E(x)$

$\cancel{f(x)} = -\dfrac{1}{n}\sum_{i=1}^{n}\left(y_i \log(\sigma(z)) + (1-y_i)\log(1-\sigma(z))\right)$

$=$

$\tanh(a) = 2\sigma(2a) - 1$

$\dfrac{\tanh(\frac{a}{2}) + 1}{2} = \sigma(a)$

$w \Rightarrow \dfrac{w}{2}$ ignoring bias outside & scaling up.