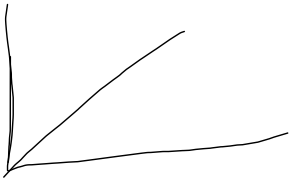
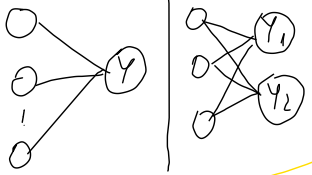
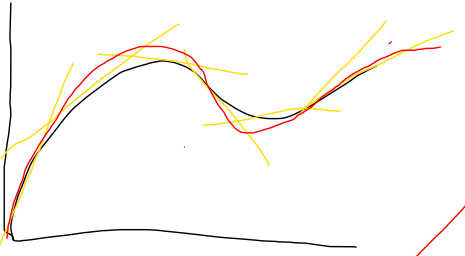
Linear



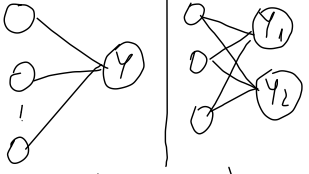
Multiple $\hat{y} = w_0 + w_1 x_1 + \_ + w_p x_p$

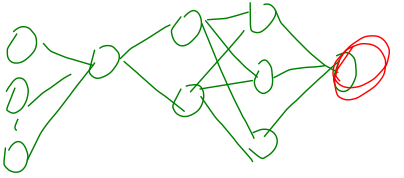




out

Logistic



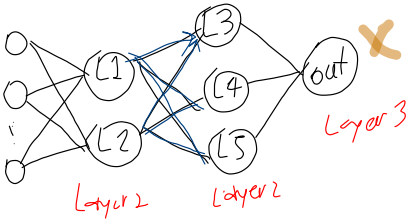


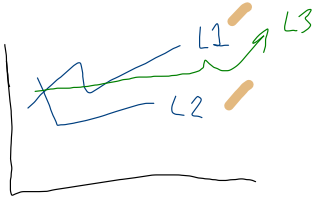
Neural Network

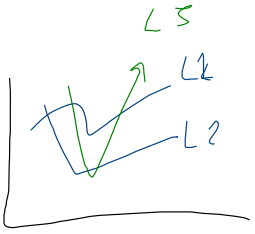
simoid (binary)

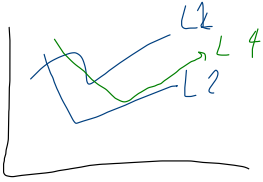
Softmax (multiclass)

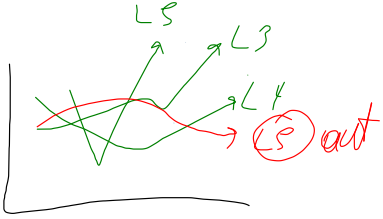
Neural Network











ค่าที่ได้จาก output ที่ผิดจาก Node

Mean Squared Error (MSE)

$$\sum_{i=1}^{N} \frac{(y_i - \hat{y}_i)}{N}$$

Activation function (Af)

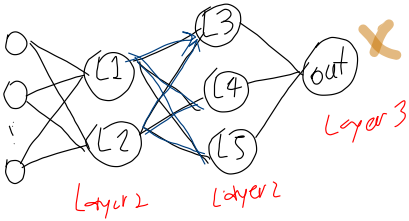
- Sigmoid
- Tanh
- ReLU
- PReLU

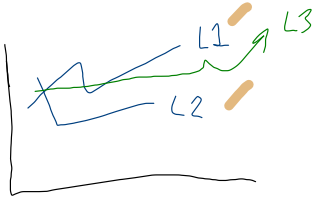
— ฯลฯ —

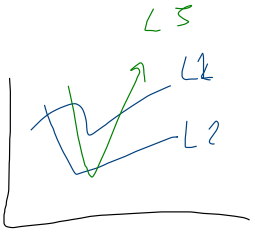
Input → Af → Input (ใหม่)

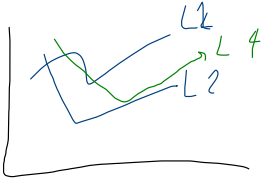
ค่าที่ได้จากเพื่อเปรียบเทียบ
(พยากรณ์)
กับ MSE

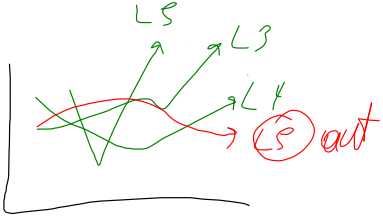
Neural Network











ค่าที่ได้จาก output ที่ผิดจาก Node

Mean Squared Error (MSE)

$$\sum_{i=1}^{N} \frac{(y_i - \hat{y}_i)}{N}$$

Activation function (Af)

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- Tanh
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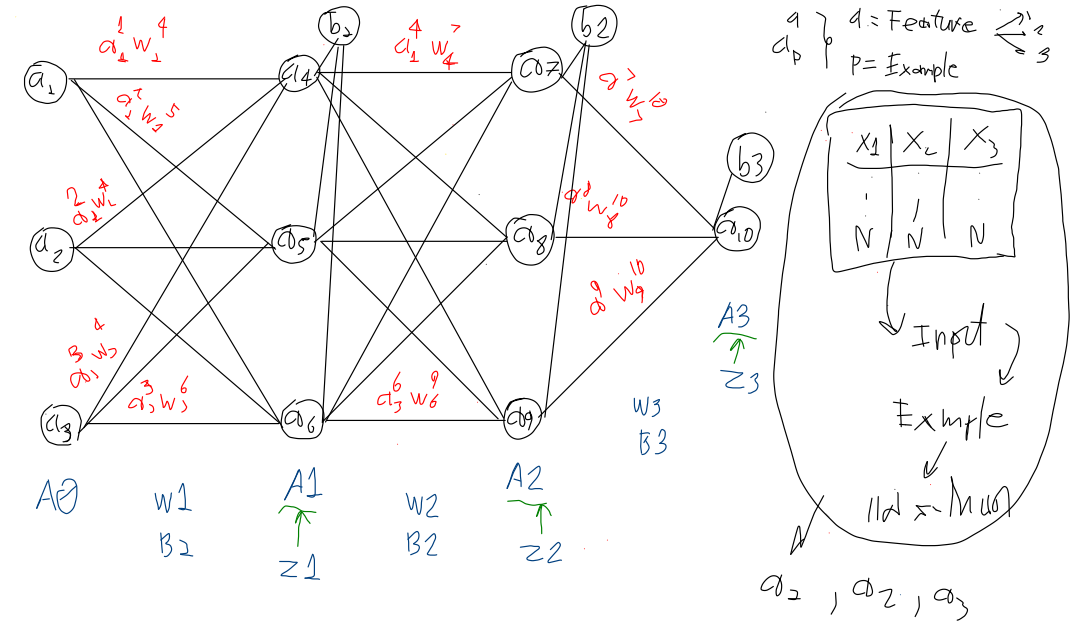
— ฯลฯ —

Input → Af → Input (ใหม่)

ค่าที่ได้จากเพื่อเปรียบเทียบ
(พยากรณ์)
กับ MSE



A0 → A0W1 + B1 → Z1 → A1 → A1W2 + B2 → Z2 → A2 → A2W3 + B3 → Z3 → A3

$A0 \rightarrow A0W1 + B1 \rightarrow Z1 \rightarrow A1 \rightarrow A1W2 + B2 \rightarrow Z2 \rightarrow A2 \rightarrow A2W3 + B3 \rightarrow Z3 \rightarrow A3$

$$Z1 = \begin{bmatrix} z_1^4 & z_1^5 & z_1^6 \\ z_2^4 & z_2^5 & z_2^6 \\ \vdots & \vdots & \vdots \\ z_N^4 & z_N^5 & z_N^6 \end{bmatrix} = \begin{bmatrix} a_1^1 & a_1^2 & a_1^3 \\ a_2^1 & a_2^2 & a_2^3 \\ \vdots & \vdots & \vdots \\ a_N^1 & a_N^2 & a_N^3 \end{bmatrix} \times \begin{bmatrix} w_1^4 & w_1^5 & w_1^6 \\ w_2^4 & w_2^5 & w_2^6 \\ w_3^4 & w_3^5 & w_3^6 \end{bmatrix} + \begin{bmatrix} b4 & b5 & b6 \end{bmatrix} = A0W1 + B1$$

a_2

$$A1 = \begin{bmatrix} a_1^4 & a_1^5 & a_1^6 \\ a_2^4 & a_2^5 & a_2^6 \\ \vdots & \vdots & \vdots \\ a_N^4 & a_N^5 & a_N^6 \end{bmatrix} = af \begin{bmatrix} z_1^4 & z_1^5 & z_1^6 \\ z_2^4 & z_2^5 & z_2^5 \\ \vdots & \vdots & \vdots \\ z_N^4 & z_N^5 & z_N^5 \end{bmatrix} = af(A1)$$

af (Activation function)

$A0 \rightarrow A0W1 + B1 \rightarrow Z1 \rightarrow A1 \rightarrow A1W2 + B2 \rightarrow Z2 \rightarrow A2 \rightarrow A2W3 + B3 \rightarrow Z3 \rightarrow A3$

$$Z2 = \begin{bmatrix} z_1^7 & z_1^8 & z_1^9 \\ z_2^7 & z_2^8 & z_2^9 \\ \vdots & & \\ z_N^7 & z_N^8 & z_N^9 \end{bmatrix} = \begin{bmatrix} a_1^4 & a_1^5 & a_1^6 \\ a_2^4 & a_2^5 & a_2^6 \\ \vdots & & \\ a_N^4 & a_N^5 & a_N^6 \end{bmatrix} \times \begin{bmatrix} w_1^7 & w_1^8 & w_1^9 \\ w_2^7 & w_2^8 & w_2^9 \\ w_3^7 & w_3^8 & w_3^9 \end{bmatrix} + \begin{bmatrix} b^7 & b^8 & b^9 \end{bmatrix} = A1W2 + B2$$

a_2

$$A2 = \begin{bmatrix} a_1^7 & a_1^8 & a_1^9 \\ a_2^7 & a_2^8 & a_2^9 \\ \vdots & & \\ a_N^7 & a_N^8 & a_N^9 \end{bmatrix} = af \begin{bmatrix} z_1^7 & z_1^8 & z_1^9 \\ z_2^7 & z_2^8 & z_2^9 \\ \vdots & & \\ z_N^7 & z_N^8 & z_N^9 \end{bmatrix} = af(A2)$$

af (Activation function)

$A0 \rightarrow A0W1 + B1 \rightarrow Z1 \rightarrow A1 \rightarrow A1W2 + B2 \rightarrow Z2 \rightarrow A2 \rightarrow A2W3 + B3 \rightarrow Z3 \rightarrow A3$

$$Z2 = \begin{bmatrix} z_1^7 & z_1^8 & z_1^9 \\ z_2^7 & z_2^8 & z_2^9 \\ \vdots & & \\ z_N^7 & z_N^8 & z_N^9 \end{bmatrix} = \begin{bmatrix} a_1^4 & a_1^5 & a_1^6 \\ a_2^4 & a_2^5 & a_2^6 \\ \vdots & & \\ a_N^4 & a_N^5 & a_N^6 \end{bmatrix} \times \begin{bmatrix} w_1^7 & w_1^8 & w_1^9 \\ w_2^7 & w_2^8 & w_2^9 \\ w_3^7 & w_3^8 & w_3^9 \end{bmatrix} + \begin{bmatrix} b^7 & b^8 & b^9 \end{bmatrix} = A1W2 + B2$$

a_2

$$A2 = \begin{bmatrix} a_1^7 & a_1^8 & a_1^9 \\ a_2^7 & a_2^8 & a_2^9 \\ \vdots & & \\ a_N^7 & a_N^8 & a_N^9 \end{bmatrix} = af \begin{bmatrix} z_1^7 & z_1^8 & z_1^9 \\ z_2^7 & z_2^8 & z_2^9 \\ \vdots & & \\ z_N^7 & z_N^8 & z_N^9 \end{bmatrix} = af(A2)$$

af (Activation function)

$A0 \rightarrow A0W1 + B1 \rightarrow Z1 \rightarrow A1 \rightarrow A1W2 + B2 \rightarrow Z2 \rightarrow A2 \rightarrow A2W3 + B3 \rightarrow Z3 \rightarrow A3$

$$Z3 = \begin{bmatrix} z_1^{10} \\ z_2^{10} \\ \vdots \\ z_N^{10} \end{bmatrix} = \begin{bmatrix} a_1^7 & a_1^8 & a_1^9 \\ a_2^7 & a_2^8 & a_2^9 \\ \vdots & & \\ a_N^7 & a_N^8 & a_N^9 \end{bmatrix} \begin{bmatrix} w_7^{10} \\ w_8^{10} \\ w_9^{10} \end{bmatrix} + [b_{10}]$$

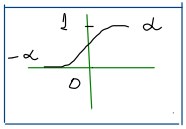
af (Activation function)

$$A3 = \begin{bmatrix} a_1^{10} \\ a_2^{10} \\ \vdots \\ a_N^{10} \end{bmatrix} = af \begin{bmatrix} z_1^{10} \\ z_2^{10} \\ \vdots \\ z_N^{10} \end{bmatrix} = af(A3)$$

af (Activation Function)

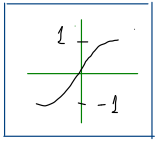
1) Simoid

$$af(z) = \sigma(z) = \frac{1}{1+e^{-z}}$$



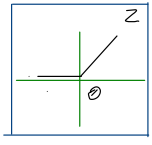
2) TanH (Hyperbolic Tangent)

$$af(z) = \tanh(z) = \frac{(e^{z} - e^{-z})}{(e^{z} + e^{-z})}$$



3) ReLU (Rectified Linear Unit)

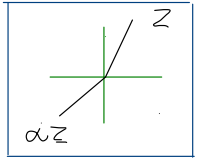
$$af(z) = \begin{cases} 0 ; & z \leq 0 \\ z ; & z > 0 \end{cases}$$



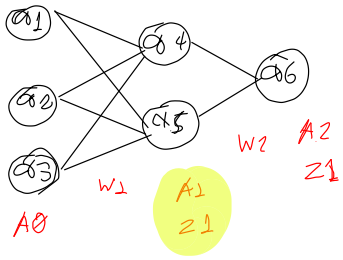
4) PReLU (Parametric Rectified Linear Unit)

$$af(z) = \begin{cases} \alpha z ; & z \leq 0 \\ z ; & z > 0 \end{cases}$$

$\alpha \neq 1$



리뉴얼 Activation function



$A_1 = Z_1 = A_0 W_1 + b_1$

$[a_4 \quad a_5] = \left[\sum_{i=1}^{3} a_i w_i^4 + b_4 \quad \sum_{i=1}^{3} a_i w_i^5 + b^5 \right]$

$A_2 = Z_2 = A_1 W_2 + b_2$

$[a_6] = \left[\sum_{i=4}^{5} a_i w_i^6 + b_6 \right]$

$= a_4 w_4^6 + a_5 w_5^6 + b_6$

$\Rightarrow \left(\sum_{1}^{3} a_i w_i^4 + b_4 \right) w_4^6 + \left(\sum_{1}^{3} a_i w_i^5 + b_5 \right) w_5^6 + b_6$

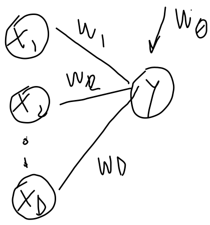
$(a_1 w_1^4 + a_2 w_2^4 + a_3 w_3^4 + b_4) w_4^6 + (a_1 w_1^5 + a_2 w_2^5 + a_3 w_3^5 + b_5) w_5^6 + b_6$

$a_1 (w_1^4 w_4^6 + w_1^5 w_5^6) + a_2 (w_2^4 w_4^6 + w_2^5 w_5^6) + a_3 (w_3^4 w_4^6 + w_3^5 w_5^6) + b_6$

$w_1 a_1 + w_2 a_2 + w_3 a_3 + w_0 \rightarrow$ Multiple Regression

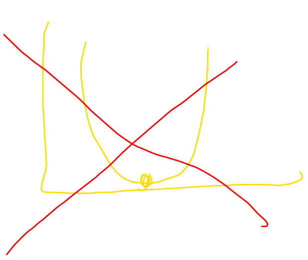
Neural Network (หาแบบ Global ไม่ได้)

Review Multiple Regression



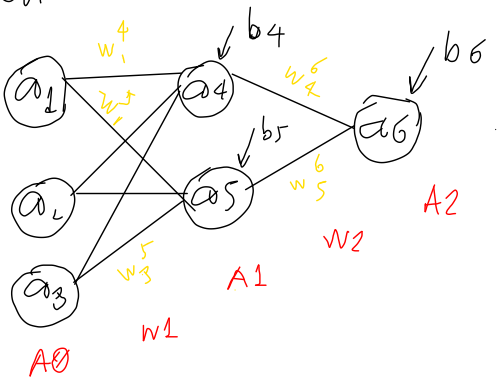
$$\begin{bmatrix} w_0 \\ w_1 \\ w_2 \\ \vdots \\ w_D \end{bmatrix} = w = (Xb^T Xb)^{-1} Xb^T Y$$

รู้ Xb , รู้ Y



Neural Network (แบบ Global ขั้นต่ำ)

Review Multiple Regression



$$W1 = (A0b^T A0b)^{-1} A0b^T A1$$

ที่ A0b , ขนาด A1

$$W2 = (A1b^T A1b)^{-1} A1b^T A2$$

ขนาด A1b , ที่ A2