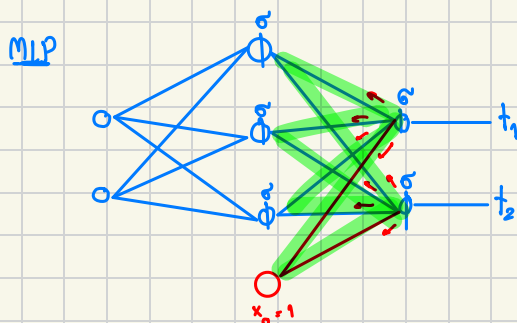
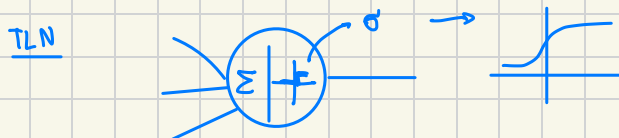


Back propagation Neural Network



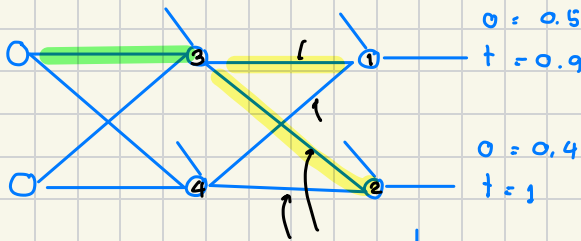
$$\tilde{w} = w + \Delta \tilde{w}$$

$$\Delta \tilde{w} = \eta (t - o)(1 - o) \tilde{x}$$

units: input - hidden to output target

$$\begin{aligned} \frac{\partial \sum E}{\partial w_{ih}} &= \sum \frac{\partial \frac{1}{2} (t - o)^2}{\partial w_{ih}} = \sum \frac{\partial \frac{1}{2} (t - o)}{\partial w_{ih}} \\ &= \sum \left[\frac{\partial}{\partial w_{ih}} - \frac{\partial o}{\partial w_{ih}} \right] \\ &= \sum \left[- \frac{\partial \sigma(\tilde{w}_{ho} \cdot o_h)}{\partial w_{ih}} \right] \\ &= - \sum \left[\frac{\partial (\tilde{w}_{ho} \cdot o_h)}{\partial (\tilde{w}_{ho} \cdot o_h)} \cdot \frac{\partial (\tilde{w}_{ho} \cdot o_h)}{\partial w_{ih}} \right] \\ &= - \sum \left[\frac{\partial \sigma(\tilde{w}_{ho} \cdot o_h)}{\partial (\tilde{w}_{ho} \cdot o_h)} \cdot \frac{\partial (\tilde{w}_{ho} \cdot o_h)}{\partial \sigma(w_{ih} \tilde{x})} \cdot \frac{\partial \sigma(w_{ih} \tilde{x})}{\partial w_{ih}} \right] \end{aligned}$$

$$\delta_h = o_h (1 - o_h) \sum_{k \text{ output}} w_{hk} \delta_k$$



$$\delta_k = o_k (1 - o_k) (t - o_k)$$

$$\delta_1 = o_1 (1 - o_1) (t - o_1)$$

$$= 0.5 (1 - 0.5) (0.9 - 0.5) \text{ node 1}$$

$$\delta_2 = o_2 (1 - o_2) (t - o_2)$$

$$= 0.4 (1 - 0.4) (1 - 0.4) \text{ node 2}$$

$$\Delta n_3 = \eta \delta_3 (x_{i3})$$

$$\Delta w_{3 \rightarrow 1} = \eta \delta (o_3)$$

find weight node 3 to 4

$$\delta_3 = o_3 (1 - o_3) \sum_k w_{hk} \delta_k$$

$$\delta_3 = o_3 (1 - o_3) [w_{31} \delta_1 + w_{32} \delta_2]$$

$$\delta_4 = o_4 (1 - o_4) \sum_k w_{4k} \delta_k$$

$$\delta_4 = o_4 (1 - o_4) [w_{41} \delta_1 + w_{42} \delta_2]$$

oh 20 output from hidden node 3

Spreadsheet XOR

$$\eta = 0.1$$

=1/(1+((N2+O2*L2+P2*M2))																				
A	B	+ เพิ่มปัจจัยใหม่ Ctrl + Alt + N																		
X0	X1	X2	T01	T02	W0H1	W1H1	W2H1	W0H2	W1H2	W2Hw2	OH1	OH2	W0O1	WH1O1	WH2O1	W0O2	WH1O2	HW2O2	O1	O2
1	0	0	0	1	-0.0021	-0.0309	0.0386	0.0223	-0.0187	-0.02107	0.4992590	0.5055895	0.016670	-0.02296	-0.02726	-0.01587	-0.03185	0.02943	=1/(1+((N2+O2*L2+P2*M2))	
1	0	1	1	0																
1	1	0	1	0																
1	1	1	1	0	1															

$\Delta o_1, \Delta o_2$

$\Delta h_1, \Delta h_2$

$$\Delta o_1 = o_1 (1 - o_1) (t_{01} - o_1)$$

$$\Delta o_2 = o_2 (1 - o_2) (t_{02} - o_2)$$

$$\Delta h_1 = o_{h1} (1 - o_{h1}) [(w_{h1o1} \cdot \Delta o_1) + (w_{h1o2} \cdot \Delta o_2)]$$

$$\Delta h_2 = o_{h2} (1 - o_{h2}) [(w_{h2o1} \cdot \Delta o_1) + (w_{h2o2} \cdot \Delta o_2)]$$

$$\Delta w_{001} = \eta (1) (\Delta o_1)$$

$$\Delta h_{101} = \eta (\Delta o_1 \cdot o_{h1})$$

$$D(w_{0o1})$$

$$D(h_{101})$$

$$D(h_{201})$$

$$D(w_{0o2})$$

$$D(h_{102})$$

$$D(h_{202})$$

$$D(w_{h1o1})$$

$$D(x_{1h1})$$

$$D(x_{2h1})$$

$$D(w_{h2o1})$$

$$D(x_{1h2})$$

$$D(x_{2h2})$$

$$DH_{2O1} = \eta (\Delta O_1 \cdot OH_2)$$

$$DW_{O2} = \eta (c1) (\Delta O_2)$$

$$DH_{1O2} = \eta (\Delta O_2 \cdot OH_1)$$

$$DH_{2O2} = \eta (\Delta O_2 \cdot OH_2)$$

$$DW_{OH1} = \eta (c1) (\Delta H_1)$$

$$w_{OH1}^+ = w_{OH1} + DW_{OH1}$$

$$Dx_{1H1} = \eta (\Delta H_1 \cdot x_1)$$

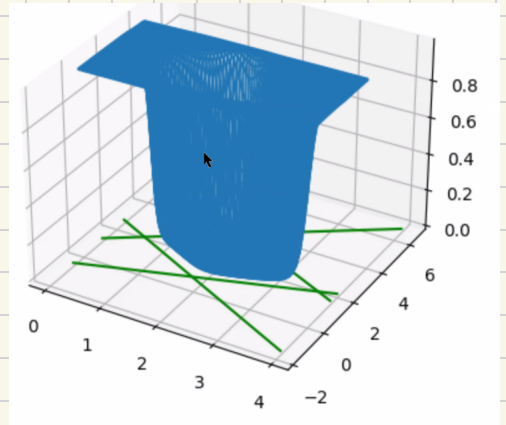
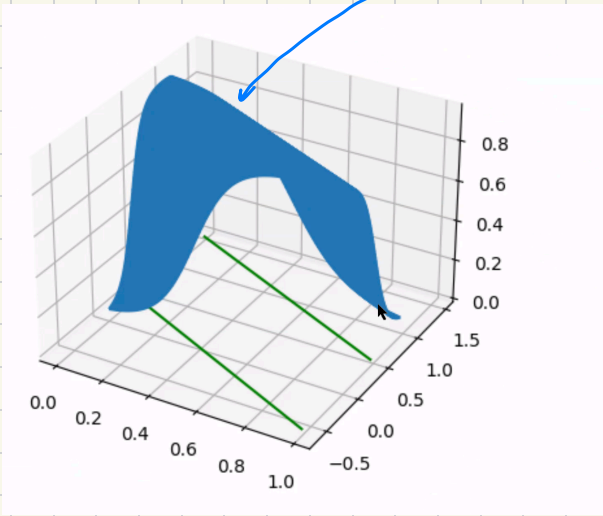
$$Dx_{2H1} = \eta (\Delta H_1 \cdot x_2)$$

$$Dw_{OH2} = \eta (c1) (\Delta H_2)$$

$$Dx_{1H2} = \eta (\Delta H_2 \cdot x_1)$$

$$Dx_{2H2} = \eta (\Delta H_2 \cdot x_2)$$

пэкар η $\frac{1}{\text{байт}}$



$$\begin{array}{lcl} \Delta x_{1H1} & = & \eta(\Delta H_1)(x_1) \\ \Delta x_{2H1} & = & \eta(\Delta H_1)(x_2) \end{array} \quad \begin{array}{lcl} \Delta x_{1H2} & = & \eta(\Delta H_2)(x_1) \\ \Delta x_{2H2} & = & \eta(\Delta H_2)(x_2) \end{array}$$

$$W_{OH1}^t = W_{OH1} + \Delta W_{OH1}$$

$$x_1 = x_1$$

$$W_{IH1}^t = W_{IH1} + \Delta x_{IH1}$$

ค่าที่ random จะถูกไปใช้ค่าเดิม + Δ