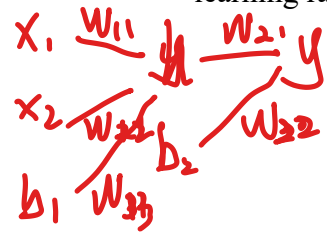
INT301 Bio-Computation

Week 5 Tutorial

For a feedforward neural network with two inputs and one output, use the back-propagation algorithm with momentum as shown below to update the weights after each of the training examples {(1, 0), 1} and {(0, 1), 0} in order (i.e. incremental learning version).

$$\Delta w(t) = -\frac{\partial E_e}{\partial w(t)} + \alpha \Delta w(t-1)$$

Assume the network has a single hidden layer with one neuron and all neurons use the sigmoid activation function. All weights (including bias) are initially equal to 1, learning rate η =0.2 and momentum term α = 0.9.



(注意 bias 不算神经元!).

处理样本1: forward $z_1 = 1\times1 + 0\times1 + 1 = 2$ $h = \sigma(z) = 0.8808$

$\sigma'(z) = 0.1040$

$z_2 = w_{21} h + w_{22} b_2 = 1\times0.8808 + 1 = 1.8808$

$y = \sigma(z_2) = 0.8675$

$\sigma'(z_2) = 0.1148$

$\delta_2 = (y_1 - t_1)\cdot\sigma'(z_2) \approx -0.0152$

$\delta_1 = \delta_2 \cdot w_{21} \cdot \sigma'(z_1) \approx -0.0016$

$\Rightarrow w_{11} = 1.0003$, $w_{12} = 1$ $w_{13} = 1.0003$

$w_{21} = 1.0027$. $w_{22} = 1.0030$

$\Rightarrow$ 样本2 $z_1 = 2.0003$ $h = \sigma(z_1) = 0.8808$ $\sigma'(z_1) = 0.1040$

$z_2 = 1.8862 \Rightarrow \hat{y}_2 = 0.8685$ $\sigma'(z_2) = 0.1146$

$\Rightarrow w_{11} = 1.0006$ $w_{12} = 0.9979$ $w_{13} = 0.9984$ $w_{21} = 0.9874$

$w_{22} = 0.9856$