[GY 2010 1] $\underline{x} = [+1\ \ -1]$ $d = 0{,}5$ $w_1 = 1$ $w_2 = -0{,}5$ $\Delta w = (0{,}01\ \ -0{,}01)$

1) Momentum: $\Delta w(k) = \alpha \cdot \Delta w(k-1) - \mu \cdot \frac{\delta C}{\delta w}$ $\mu = 0{,}05$ $\alpha = 0{,}1 = \mu \cdot 2$

$C = \varepsilon^2$ $\frac{\delta C}{\delta w_2} = 2 \cdot \varepsilon \cdot -1 \cdot f'(w^T \underline{x}) \cdot x_2$

$\varepsilon = (d - y)$

$y = f(s)$

$s = w^T \cdot \underline{x} = w_1 \cdot x_1 + w_2 \cdot x_2$

$w^T \cdot \underline{x} = s = 1 \cdot +1 + -0{,}5 \cdot -1 = 1{,}5$

$\Rightarrow f(s) = 1 + \sin(1{,}5)$

$f' = \cos(1{,}5) = 0{,}9997$

$\varepsilon = 0{,}5 - y$ $y = f(s) = 1{,}0262$

$\varepsilon = -0{,}5262$

$2 \cdot \varepsilon \cdot f' \cdot x_2 = -1{,}05204 \cdot -1 = 1{,}05204$

$\frac{\delta C}{\delta w_2} = -1{,}05204$

$\Delta w_2 = 0{,}1 \cdot -0{,}01 + 0{,}0526 = 0{,}0516$

$w_2(0_1) = -0{,}5 + 0{,}0516 = -0{,}4484$

2) A kis abm. értékű számokat a közelében viszem, ugyan [illegible]

3) $C = \varepsilon^2 = E\{\varepsilon^2\}$ $\varepsilon = d - y = (d - w^T x)$

$\frac{\delta C}{\delta w} = 0 =$ $E\{\varepsilon^2\} = d^2 + w^T E\{x x^T\} w - 2 \cdot E\{dx^T\} w$

$\frac{\delta C}{\delta w} = 2 w^T R_{xx} - 2 p_{dx} = 0$

$R_{xx} \cdot w = p_{dx}$

$w = R^{-1} p = \left[E\{x x^T\}\right]^{-1} \cdot E\{x d\}$ $w = R^{-1} p$

$w = \frac{1}{2{,}3} \cdot 0{,}3 = 0{,}13044$

4) $\underline{x} = [1\ \ -1]$ $d = 0{,}5$ $w_{21} = ?$ $C = \varepsilon^2$ $\frac{\delta C}{\delta w_{21}} = ?$ $\varepsilon = d - y$

$y = w_{12} \cdot f(s_1) + w_{22} \cdot f(s_2)$ $s_2 = w_{21} \cdot x_2$ f = sigmoid $= \frac{1}{1+e^{-s}}$

$\frac{\delta C}{\delta w} = 2 \cdot \varepsilon \cdot -1 \cdot w_{22} \cdot f'(s_2) \cdot x_2$ $f' = y \cdot (1 - y)$ [illegible]

$y = 0{,}5 \cdot \frac{1}{1+e^{-x_1 \cdot 1}} + 0{,}5 \cdot \frac{1}{1+e^{-0{,}5 \cdot x_2}} = 0{,}3655 + 0{,}3112 = 0{,}6767$

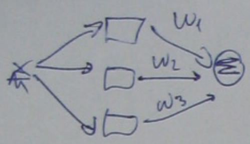
$f'(s_2) = 0{,}6224(1 - 0{,}6224) = 0{,}235$

$\varepsilon = d - y = 0{,}5 - 0{,}6464 = -0{,}1464$

$w_{21}(0) = -0{,}5 + \mu \cdot \frac{\delta C}{\delta w} = \boxed{-0{,}4979}$

$\frac{\delta C}{\delta w} = 2 \cdot -0{,}1464 \cdot -1 \cdot 0{,}5 \cdot 0{,}235 \cdot -1 = -0{,}0415265$

5/

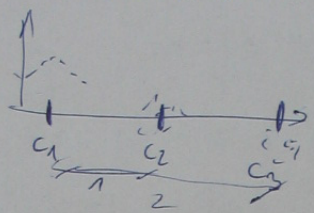


σ : ellenőrzött tanításnál

$$\sigma_i(k+1) = \sigma_i(k) - \mu \cdot \frac{\partial C}{\partial \sigma_i}$$

A/ azonos σ-knál

$$\sigma = \frac{1}{M}\sum_{i=1}^{M} \|c_i - c_i^{(i)}\| \qquad M = 3$$



$$\sigma = \frac{1}{M}\cdot\left(\|c_1-c_2\| + \|c_2-c_1\| + \|c_3-c_2\|\right)$$

$$\sigma \approx \frac{1+1+2}{3} = \frac{4}{3}$$

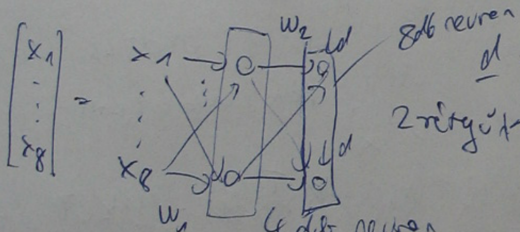
B/ σ különböző: R legközelebbi szomszéd R = 2

$$\sigma_1 = \frac{1}{R}\cdot\sum_{j=1}^{R}\|c_1 - c_1^{(j)}\| = \frac{1}{R}\cdot\sum_{j=1}^{2}\|c_1 - c_1^{(j)}\| = \frac{1}{2}\cdot\left(\|c_1-c_2\| + \|c_1-c_3\|\right)$$

$$\sigma_2 = \frac{1}{2}\left(\|c_2-c_1\| + \|c_2-c_3\|\right) \qquad \sigma_3 = \frac{1}{2}\cdot\left(\|c_3-c_2\| + \|c_3-c_1\|\right)$$

B/ $f = \frac{1}{1+r^2}$ nincs σ

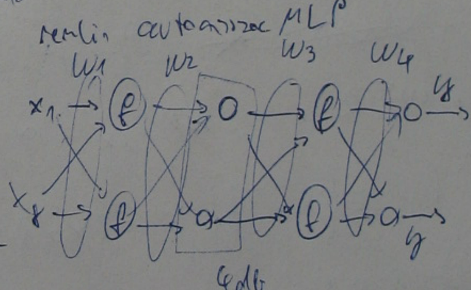
6/ 8 dim σC-i. tömörítésre akarok MLP-t ⇒ auto asszociatív MLP



$\underline{d} = \underline{x}$

2 rétegű tanuló

nemlin autoasszoc MLP



tanítás: BP

neuron bemenete: $\underline{w}_2 \cdot f(\underline{w}_1 \cdot \underline{x}) = in$

kimenete: $y = w_4 \cdot f(w_3 \cdot in)$