P2

$$h_1 = \frac{1}{1 + e^{-z_1}}$$

$$h_2 = \frac{1}{1 + e^{-z_2}}$$

$$z_1 = 0{,}35 + \underbrace{0{,}05 \cdot 0{,}15}_{0.0075} + \underbrace{0{,}1 \cdot 0{,}20}_{0{,}02} = 0{,}3775$$

$$z_2 = 0{,}35 + \underbrace{0{,}25 \cdot 0{,}05}_{0{,}0125} + \underbrace{0{,}3 \cdot 0{,}1}_{0{,}03} = 0{,}3925$$

$$h_1 = \frac{1}{1 + e^{-0{,}3775}} = 0{,}59322$$

$$h_2 = \frac{1}{1 + e^{-0{,}3925}} = 0{,}59688$$

$$o_1 = \frac{1}{1 + e^{z_{12}}} \quad / \qquad z_{12} = 0{,}6 + \underbrace{0{,}4 \cdot 0{,}59322}_{0{,}23728} + \underbrace{0{,}45 \cdot 0{,}59688}_{0{,}268596} = 1{,}10$$

$$o_2 = \frac{1}{1 + e^{z_{22}}} \quad / \qquad z_{22} = 0{,}6 + \underbrace{0{,}50 \cdot 0{,}59322}_{0{,}2966} + \underbrace{0{,}55 \cdot 0{,}59688}_{0{,}328284} = 1{,}$$

$$o_1 = 0{,}751359$$

$$o_2 = 0{,}772521$$

$$P_3 = \frac{(0{,}751359 - op1)^2 + (0{,}772521 - 0{,}99)^2}{0{,}5496131 \overset{2}{+} 0{,}0471232} = 0{,}298368$$

$$\frac{\quad}{2}$$

P4

$$f = \frac{1}{2}\underbrace{(target_{o1} - out_{o1})^2}_{Dif_1} + \frac{1}{2}\underbrace{(target_{o2} - a_{o2})^2}_{Dif_2}$$

W5

$$\frac{\partial f}{\partial w_5} = \frac{\partial f}{\partial out_{o1}} \cdot \frac{\partial out_{o1}}{\partial net_{o1}} \cdot \frac{\partial net_{o1}}{\partial w_5} =$$

$$\frac{\partial f}{\partial out_{o1}} = \frac{2}{2} \cdot Dif_1 \cdot -1 = -(0{,}01 - 0{,}751359) = 0{,}741359$$

$$out_{o1} = \frac{1}{1 - e^{-z_{o1}}} \Rightarrow \frac{\partial out_{o1}}{\partial z_1} = \underbrace{(1 - out_{o1})}_{(1-0{,}751359)} \cdot out_{o1} \cdot \underbrace{(1 - 0{,}751359)(0{,}751359)}_{0{,}18681}$$

$$\frac{\partial out_{o1}}{\partial net_{o1}} = (o_1) \cdot (1 - o_1)$$

$$\frac{\partial net_{o1}}{\partial w_5} = \frac{\partial z_{21}}{\partial w_5} = h_1 = 0{,}5932$$

$$\frac{\partial f}{\partial w_5} = 0{,}741359 \cdot 0{,}18681 \cdot 0{,}5932 = 0{,}082154$$

For w_6, The result is: $\frac{\partial f}{\partial out_{o1}} \cdot \frac{\partial out_{o1}}{\partial z_{21}} \cdot \underbrace{\frac{\partial z_{21}}{\partial w_6}}_{h_2} = 0{,}08263392$

$$0{,}741359 \cdot 0{,}18681 \cdot 0{,}55688$$

For w_7 ~ w_8:

$$\frac{\partial f}{\partial w_7} = \frac{\partial f}{\partial out_{o2}} \cdot \frac{\partial out_{o2}}{\partial z} \cdot \frac{\partial z}{\partial w_i}$$

$$\underbrace{-0{,}03659}_{-0{,}21075 \cdot 0{,}17551} \cdot 0{,}5532 = -0{,}02194$$

$$-Dif_2 \cdot (1 - o_2) \cdot (o_2) \cdot h_1 = -0{,}21075 \cdot 0{,}17551 \cdot 0{,}5532 = -0{,}02194$$

$$\frac{\partial f}{\partial w_8} = -Dif_2 \cdot (1 - o_2)(o_2) h_2 = \underbrace{-0{,}21075 \cdot 0{,}17551}_{-0{,}03659} \cdot 0{,}55688 = -0{,}02208$$

$$\frac{\partial f}{\partial w_8} = -0{,}21$$

w_1

$$\left(\frac{\partial F}{\partial E_1}\cdot\frac{\partial E_1}{\partial O_1}\cdot\frac{\partial O_1}{\partial z_{21}}\cdot\frac{\partial z_{21}}{\partial h_1}+\frac{\partial F}{\partial E_2}\cdot\frac{\partial E_2}{\partial O_2}\cdot\frac{\partial O_2}{\partial z_{22}}\cdot\frac{\partial z_{22}}{\partial h_1}\right)\cdot\frac{\partial h_1}{\partial z_{11}}\cdot\frac{\partial z_{11}}{\partial w_1}$$

$$1 \quad -DiF_1\cdot O_1(1-O_1)\cdot w_5 \quad 1 \quad -DiF_2\cdot O_2(1-O_2)\cdot w_7 \cdot \quad h_1(1-h_1) \quad I_1$$

$$\frac{\partial F}{\partial w_1}=\left(1\cdot -DiF_1\cdot O_1(1-O_1)\cdot w_5 + DiF_2\cdot O_2(1-O_2)\cdot w_7\right) h_1(1-h_1)\, I_1$$

$$(0{,}741353\cdot 0{,}18681\cdot w_5 - 0{,}21079\cdot 0{,}17551\cdot w_7)\, h_1(1-h_1)\cdot 0{,}05\cdot$$

$$(0{,}0533 \quad - 0{,}01664)\; 0{,}01206$$

$$0{,}03665$$

$$= 0{,}000442022$$

w_2

The only change for w_2 is in the last part of the chain rule, where instead of I_1, we have I_2

$$\frac{\partial F}{\partial w_2}=(0{,}0353)\cdot h_1(1-h_1)\cdot 0{,}1 = 0{,}00085184$$

$w_3 \wedge w_4$

For $w_3 \wedge w_4$, we have to change a few things in the derivate.

$$\frac{\partial F}{\partial w_3}=\left(\frac{\partial F}{\partial E_1}\cdot\frac{\partial O_1}{\partial z_{21}}\cdot\frac{\partial z_{21}}{\partial h_2}+\frac{\partial F}{\partial E_2}\cdot\frac{\partial O_2}{\partial z_{22}}\cdot\frac{\partial z_{22}}{\partial h_2}\right)\cdot\frac{\partial h_2}{\partial z_{12}}\cdot\frac{\partial z_{12}}{\partial w_3}$$

$$(-DiF_1\, O_1(1-O_1)\cdot w_6 + -DiF_2(1-O_2)O_2\cdot w_8)\cdot h_2(1-h_2)\cdot I_1$$

$$(0{,}741353\cdot 0{,}18681\cdot \underset{0{,}45}{w_6} + (-0{,}21079)\cdot 0{,}17551\cdot \underset{0{,}55}{w_7})\, 0{,}59698(1-0{,}59698)\cdot 0{,}05$$

$$\frac{\partial F}{\partial w_3}=(0{,}06232 \quad - 0{,}023476)\cdot 0{,}012030 = 0{,}00046731$$

$$\frac{\partial F}{\partial w_4} = (0{,}06232 - 0{,}02347766) \cdot 0{,}59688(1-0{,}59688) \cdot \frac{I_2}{0{,}1}$$

$$= \left(\quad / \quad \right) \cdot 0{,}02406143$$

$$0{,}03885534 \cdot 0{,}02406143$$

$$= 0{,}00093481 //$$

P5-

$$w_k^+ = w_k + \tau \frac{\partial F}{\partial w}$$

$$\begin{bmatrix} w_1^+ \\ w_2^+ \\ w_3^+ \\ w_4^+ \\ w_5^+ \\ w_6^+ \\ w_7^+ \\ w_8^+ \end{bmatrix} = \begin{bmatrix} 0{,}15 \\ 0{,}2 \\ 0{,}25 \\ 0{,}3 \\ 0{,}4 \\ 0{,}45 \\ 0{,}50 \\ 0{,}55 \end{bmatrix} - \tau \begin{bmatrix} 0{,}0004202 \\ 0{,}00085184 \\ 0{,}00046731 \\ 0{,}00053487 \\ 0{,}082154 \\ 0{,}08266387 \\ -0{,}02194 \\ -0{,}022078 \end{bmatrix}$$

P1 As they are two I_i, $\Rightarrow$ there are two features