

def backPropagate (self, targets, N, M):

CALCULATE OUTPUT DELTAS

OUTPUT-DELTA [0.0]

ACTIVATIONS OUTPUT [-0.003] → ERROR [1] - [-0.003] → OUTPUT-DELTA = 1.0003 * sigmoid(-0.003) = 1.00029

UPDATE OUTPUT WEIGHTS

ACTIVATIONS HIDDEN

OUTPUT-DELTA

CHANGE

[0.197; 0.192; -0.069] * [1.00029] → [0.19705713; 0.19205568; 0.06902001]

WEIGHTS OUTPUT

CHANGE

LAST CHANGE OUTPUT

$$\begin{bmatrix} -0.2 \\ 0.17 \\ -0.05 \end{bmatrix} + \left(\begin{bmatrix} N \cdot 0.19705713 \\ N \cdot 0.19205568 \\ N \cdot 0.06902001 \end{bmatrix} + \begin{bmatrix} M \cdot 0.0 \\ M \cdot 0.0 \\ M \cdot 0.0 \end{bmatrix} \right) = \begin{bmatrix} -0.101 \\ 0.266 \\ -0.015 \end{bmatrix}$$

 → LAST CHANGE OUTPUT = CHANGE [0.0, 0.0, 0.0]
 [0.19705713; 0.19205568; 0.06902001]

CALCULATE HIDDEN DELTAS

HIDDEN-DELTA [0.0, 0.0, 0.0]

OUTPUT-DELTA [1.00029]

WEIGHT OUTPUT [-0.101, 0.266; -0.015]

ERROR += [1.00029] * [-0.101; 0.266; -0.015] = 0.15

ACTIVATIONS HIDDEN

$$\begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \end{bmatrix} = \begin{bmatrix} \text{sigmoid}(0.197) \\ \text{sigmoid}(0.192) \\ \text{sigmoid}(-0.069) \end{bmatrix} * [0.15] = \begin{bmatrix} 0.144 \\ 0.144 \\ 0.149 \end{bmatrix}$$

UPDATE INPUT WEIGHTS

ACTIVATIONS INPUT

HIDDEN DELTA

CHANGE

WEIGHTS INPUT

$$\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} * \begin{bmatrix} 0.144 \\ 0.144 \\ 0.149 \end{bmatrix} = \begin{bmatrix} 0.0 \\ 0.0 \\ 0.144 \end{bmatrix} \rightarrow \begin{bmatrix} -0.2 \\ 0.11 \\ 0.02 \end{bmatrix} + \begin{bmatrix} 0.0 \\ 0.0 \\ 0.144 \end{bmatrix} = \begin{bmatrix} -0.2 \\ 0.11 \\ 0.13 \end{bmatrix}$$

CHANGE

LAST INPUT CHANGE

$$\begin{bmatrix} N \cdot 0.0 \\ N \cdot 0.0 \\ N \cdot 0.144 \end{bmatrix} + \begin{bmatrix} M \cdot 0.0 \\ M \cdot 0.0 \\ M \cdot 0.0 \end{bmatrix} \rightarrow \text{LAST INPUT CHANGE} = \text{CHANGE}$$