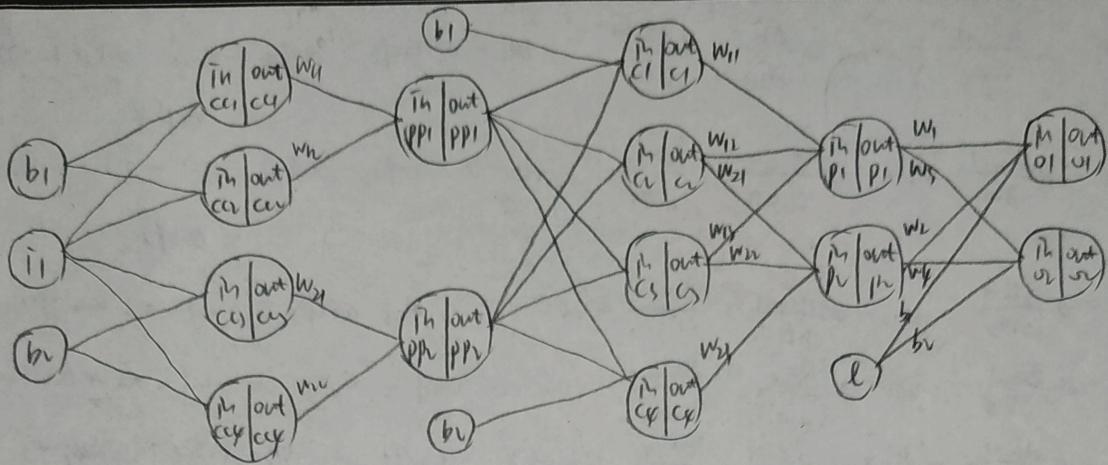


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0.1	0.2	0.3	0.15	0.13	0.2	0.1	-0.15
0.0	0.1	0.	0	0.1	0.2	0.1	0
0.13	0.2	0.1		0.13	0.2	0.1	
0.13	0.2	0.1		0.13	0.2	0.1	
0.51	0.625	6	0.619	0.664	0.660		0.461 0.716
0.51	0.619	+	0.619	0.766	0.683		
-0.47	0.385	+	0.385	-0.259	0.436		-0.461 0.284
-0.49	0.380	8		-0.460	0.411		



正向传播

$$\begin{matrix} k_{11} & k_{12} & k_{13} & b_1 \\ k_{11} & 0.1 & 0.2 & 0.3 & 0.5 \end{matrix}$$

$$\begin{matrix} k_{21} & k_{22} & k_{23} & b_2 \\ k_{21} & 0.3 & 0.1 & 0.1 & -0.5 \end{matrix}$$

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$$in_{cc1} = 0 * k_{11} + 0 * k_{12} + i_1 * k_{13} + b_1$$

$$in_{cc2} = i_1 * k_{13} + 0 * k_{12} + 0 * k_{11} + b_1$$

$$in_{cc3} = 0 * k_{13} + 0 * k_{11} + i_1 * k_{12} + b_2$$

$$in_{cc4} = i_1 * k_{11} + 0 * k_{13} + 0 * k_{12} + b_2$$

$$in_{pp1} = \max(in_{cc1}, out_{cc1})$$

$$in_{pp2} = \max(in_{cc2}, out_{cc2})$$

$$\begin{matrix} k_{11} & k_{12} & k_{13} & b_1 \\ k_1 & 0.1 & 0.2 & 0.3 & 0.5 \end{matrix}$$

$$\begin{matrix} k_{21} & k_{22} & k_{23} & b_2 \\ k_2 & 0.3 & 0.1 & 0.1 & -0.5 \end{matrix}$$

$$in_{c1} = 0 * k_{13} + out_{pp1} * k_{12} + out_{pp2} * k_{11} + b_1$$

$$in_{c2} = out_{pp1} * k_{13} + out_{pp2} * k_{11} + 0 * k_{12} + b_1$$

$$in_{c3} = 0 * k_{12} + out_{pp1} * k_{11} + out_{pp2} * k_{13} + b_2$$

$$in_{c4} = out_{pp1} * k_{12} + out_{pp2} * k_{13} + 0 * k_{11} + b_2$$

$$in_{p1} = \frac{1}{3} (out_{cc1} + out_{cc2} + out_{cc3})$$

$$in_{p2} = \frac{1}{3} (out_{c1} + out_{c2} + out_{c3})$$

$$in_{o1} = w_1 * out_{p1} + w_2 * out_{p2} + b_1$$

$$in_{o2} = w_3 * out_{p1} + w_4 * out_{p2} + b_2$$

反向传播

$$cost_{o1} = \frac{\partial E_{ML}}{\partial in_{o1}} = out_1 - o_1 = 0.716 - 1 = -0.284$$

$$cost_{o2} = \frac{\partial E_{ML}}{\partial in_{o2}} = out_2 - o_2 = 0.284 - 0 = 0.284$$

$$w_1 = w_1 - \alpha \frac{\partial E_M}{\partial w_1} = w_1 - \alpha \frac{\partial \bar{w}_1}{\partial h_{01}} \cdot \frac{\partial h_{01}}{\partial w_1} = w_1 - \alpha \cdot \text{coef}_{01} \cdot \text{out}_{p1} = 0.1 - 0.5 * (-0.284) * 0.593 \\ = 0.184$$

$$w_2 = w_2 - \alpha \frac{\partial \bar{w}_1}{\partial w_2} = w_2 - \alpha \frac{\partial \bar{w}_1}{\partial h_{01}} \cdot \frac{\partial h_{01}}{\partial w_2} = w_2 - \alpha \cdot \text{coef}_{01} \cdot \text{out}_{p2} = 0.2 - 0.5 * (-0.284) * 0.51 \\ = 0.272$$

$$w_3 = w_3 - \alpha \frac{\partial \bar{w}_1}{\partial w_3} = w_3 - \alpha \frac{\partial \bar{w}_1}{\partial h_{02}} \cdot \frac{\partial h_{02}}{\partial w_3} = w_3 - \alpha \cdot \text{coef}_{01} \cdot \text{out}_{p1} = -0.1 - 0.5 * 0.284 * 0.593 = -0.184$$

$$w_4 = w_4 - \alpha \frac{\partial \bar{w}_1}{\partial w_4} = w_4 - \alpha \frac{\partial \bar{w}_1}{\partial h_{02}} \cdot \frac{\partial h_{02}}{\partial w_4} = w_4 - \alpha \cdot \text{coef}_{01} \cdot \text{out}_{p2} = -0.1 - 0.5 * 0.284 * 0.51 = -0.171$$

$$b_1 = b_1 - \alpha \frac{\partial \bar{w}_1}{\partial b_1} = b_1 - \alpha \frac{\partial \bar{w}_1}{\partial h_{01}} \cdot \frac{\partial h_{01}}{\partial b_1} = b_1 - \alpha \cdot \text{coef}_{01} \cdot 1 = 0.1 - 0.5 * (-0.284) * 1 = 0.442$$

$$b_2 = b_2 - \alpha \frac{\partial \bar{w}_1}{\partial b_2} = b_2 - \alpha \frac{\partial \bar{w}_1}{\partial h_{02}} \cdot \frac{\partial h_{02}}{\partial b_2} = b_2 - \alpha \cdot \text{coef}_{01} \cdot 1 = -0.1 - 0.5 * 0.284 * 1 = -0.442$$

$$\text{coef}_{p1} = \frac{\partial \bar{w}_1}{\partial h_{p1}} = \left(\frac{\partial \bar{w}_1}{\partial h_{01}} \cdot \frac{\partial h_{01}}{\partial \text{out}_{p1}} + \frac{\partial \bar{w}_1}{\partial h_{02}} \cdot \frac{\partial h_{02}}{\partial \text{out}_{p1}} \right) \cdot \frac{\partial \text{out}_{p1}}{\partial h_{p1}} = (\text{coef}_{01} \cdot w_1 + \text{coef}_{02} \cdot w_2) \cdot 1 \\ = -0.284 * 0.184 + 0.284 * (-0.184) \\ = -0.105$$

$$\text{coef}_{p2} = \frac{\partial \bar{w}_1}{\partial h_{p2}} = \left(\frac{\partial \bar{w}_1}{\partial h_{01}} \cdot \frac{\partial h_{01}}{\partial \text{out}_{p2}} + \frac{\partial \bar{w}_1}{\partial h_{02}} \cdot \frac{\partial h_{02}}{\partial \text{out}_{p2}} \right) \cdot \frac{\partial \text{out}_{p2}}{\partial h_{p2}} = (\text{coef}_{01} \cdot w_1 + \text{coef}_{02} \cdot w_2) \cdot 1 \\ = -0.284 * 0.272 + 0.284 * (-0.272) \\ = -0.154.$$

$$\text{coef}_{c1} = \frac{\partial \bar{w}_1}{\partial h_{c1}} = \frac{\partial \bar{w}_1}{\partial h_{p1}} \cdot \frac{\partial h_{p1}}{\partial \text{out}_{c1}} \cdot \frac{\partial \text{out}_{c1}}{\partial h_{c1}} = \text{coef}_{p1} * w_1 * \text{out}_{c1} * (1 - \text{out}_{c1}) \\ = -0.105 * \frac{1}{3} * 0.660 * (1 - 0.660) = -0.008$$

$$\text{coef}_{c2} = \frac{\partial \bar{w}_1}{\partial h_{c2}} = \left(\frac{\partial \bar{w}_1}{\partial h_{p1}} \cdot \frac{\partial h_{p1}}{\partial \text{out}_{c2}} + \frac{\partial \bar{w}_1}{\partial h_{p2}} \cdot \frac{\partial h_{p2}}{\partial \text{out}_{c2}} \right) \cdot \frac{\partial \text{out}_{c2}}{\partial h_{c2}} = (\text{coef}_{p1} * w_1 + \text{coef}_{p2} * w_2) * \text{out}_{c2} * (1 - \text{out}_{c2}) \\ = \left(-0.105 * \frac{1}{3} + (-0.154 * \frac{1}{3}) \right) * 0.683 * (1 - 0.683) \\ = -0.019$$

$$\text{coef}_{c3} = \frac{\partial \bar{w}_1}{\partial h_{c3}} = \left(\frac{\partial \bar{w}_1}{\partial h_{p1}} \cdot \frac{\partial h_{p1}}{\partial \text{out}_{c3}} + \frac{\partial \bar{w}_1}{\partial h_{p2}} \cdot \frac{\partial h_{p2}}{\partial \text{out}_{c3}} \right) \cdot \frac{\partial \text{out}_{c3}}{\partial h_{c3}} = (\text{coef}_{p1} * w_1 + \text{coef}_{p2} * w_2) * \text{out}_{c3} * (1 - \text{out}_{c3}) \\ = (-0.105 * \frac{1}{3} + (-0.154 * \frac{1}{3})) * 0.466 * (1 - 0.466) \\ = -0.021$$

$$\text{coef}_{c4} = \frac{\partial \bar{w}_1}{\partial h_{c4}} = \frac{\partial \bar{w}_1}{\partial h_{p1}} \cdot \frac{\partial h_{p1}}{\partial \text{out}_{c4}} \cdot \frac{\partial \text{out}_{c4}}{\partial h_{c4}} = \text{coef}_{p1} * w_1 * \text{out}_{c4} * (1 - \text{out}_{c4}) = (0.156 * \frac{1}{3} * 0.411 * (1 - 0.411)) \\ = -0.012$$

$$k_{11} = k_{11} - \alpha \frac{\partial E_{M1}}{\partial k_{11}} = k_{11} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial k_{11}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial k_{11}} \right) = k_{11} - \alpha (coef_{c1} \cdot outpp_2 + coef_{c2} \cdot 0) \\ = 0.1 - 0.5 (-0.008 * 0.185 + (-0.019) * 0) = 0.102$$

$$k_{12} = k_{12} - \alpha \frac{\partial E_{M1}}{\partial k_{12}} = k_{12} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial k_{12}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial k_{12}} \right) = k_{12} - \alpha (coef_{c1} \cdot outpp_1 + coef_{c2} \cdot outpp_1) \\ = 0.2 - 0.5 (-0.008 * 0.629 + (-0.019) * 0.185) = 0.204$$

$$k_{13} = k_{13} - \alpha \frac{\partial \bar{E}_{M1}}{\partial k_{13}} = k_{13} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial k_{13}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial k_{13}} \right) = k_{13} - \alpha (coef_{c1} \cdot 0 + coef_{c2} \cdot outpp_1) \\ = 0.3 - 0.5 (-0.008 * 0 + (-0.019) * 0.629) = 0.306$$

$$b_1 = b_1 - \alpha \frac{\partial \bar{E}_{M1}}{\partial b_1} = b_1 - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial b_1} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial b_1} \right) = b_1 - \alpha (coef_{c1} \cdot 1 + coef_{c2} \cdot 1) \\ = 0.5 - 0.5 (-0.008 * 1 + (-0.019) * 1) = 0.514$$

$$k_{21} = k_{21} - \alpha \frac{\partial \bar{E}_{M1}}{\partial k_{21}} = k_{21} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial k_{21}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial k_{21}} \right) = k_{21} - \alpha (coef_{c3} \cdot outpp_2 + coef_{c4} \cdot 0) \\ = 0.3 - 0.5 (-0.021 * 0.185 + (-0.016) * 0) = 0.304$$

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$$k_{22} = k_{22} - \alpha \frac{\partial \bar{E}_{M1}}{\partial k_{22}} = k_{22} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial k_{22}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial k_{22}} \right) = k_{22} - \alpha (coef_{c3} \cdot outpp_1 + coef_{c4} \cdot outpp_1) \\ = 0.2 - 0.5 (-0.021 * 0.629 + (-0.016) * 0.185) = 0.202$$

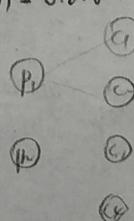
$$k_{23} = k_{23} - \alpha \frac{\partial \bar{E}_{M1}}{\partial k_{23}} = k_{23} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial k_{23}} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial k_{23}} \right) = k_{23} - \alpha (coef_{c3} \cdot 0 + coef_{c4} \cdot outpp_1) \\ = 0.1 - 0.5 (-0.021 * 0 + (-0.016) * 0.629) = 0.104$$

$$b_2 = b_2 - \alpha \frac{\partial \bar{E}_{M1}}{\partial b_2} = b_2 - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial b_2} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial b_2} \right) = b_2 - \alpha (coef_{c3} \cdot 1 + coef_{c4} \cdot 1) \\ = -0.5 - 0.5 (-0.021 * 1 + (-0.016) * 1) = -0.486$$

$$\text{coef}_{pp1} = \frac{\partial \bar{E}_{M1}}{\partial \text{outpp}_1} = \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial \text{outpp}_1} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial \text{outpp}_1} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial \text{outpp}_1} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial \text{outpp}_1} \right) \frac{\partial \text{outpp}_1}{\partial \text{outpp}_1} \\ = (coef_{c1} \cdot k_{12} + coef_{c2} \cdot k_{13} + coef_{c3} \cdot k_{21} + coef_{c4} \cdot k_{23}) \cdot 1 \\ = -0.008 * 0.206 + (-0.019) * 0.306 + (-0.021) * 0.189 + (-0.016) * 0.104 = -0.013$$

$$\text{coef}_{pp2} = \frac{\partial \bar{E}_{M1}}{\partial \text{outpp}_2} = \left(\frac{\partial \bar{E}_{M1}}{\partial \ln c_1} \cdot \frac{\partial \ln c_1}{\partial \text{outpp}_2} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_2} \cdot \frac{\partial \ln c_2}{\partial \text{outpp}_2} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_3} \cdot \frac{\partial \ln c_3}{\partial \text{outpp}_2} + \frac{\partial \bar{E}_{M1}}{\partial \ln c_4} \cdot \frac{\partial \ln c_4}{\partial \text{outpp}_2} \right) \frac{\partial \text{outpp}_2}{\partial \text{outpp}_2} \\ = (coef_{c1} \cdot k_{11} + coef_{c2} \cdot k_{12} + coef_{c3} \cdot k_{21} + coef_{c4} \cdot k_{22}) \cdot 1 \\ = (-0.008 * 0.102 + (-0.019) * 0.206 + (-0.021) * 0.189 + (-0.016) * 0.104) = -0.014$$

$$0 \quad coef_{c1} \quad coef_{c2} \quad 0 \\ k_{11} \quad k_{12} \quad k_{13} \\ k_{11} \quad k_{12} \quad k_{13}$$



$$0 \quad coef_{c1} \quad coef_{c2} \quad coef_{c3} \quad 0 \\ k_{11} \quad k_{12} \quad k_{13} \\ k_{11} \quad k_{12} \\ k_{11} \quad k_{13} \\ k_{11} \quad k_{12} \\ k_{11} \quad k_{13}$$

$$\text{cof}_{CC1} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC1}} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{PP1}} \cdot \frac{\partial \bar{m}_{PP1}}{\partial \bar{m}_{CC1}} \cdot \frac{\partial \bar{m}_{CC1}}{\partial \bar{m}_{CC1}} = \text{cof}_{PP1} * W_{11} * \text{out}_{CC1} * (1 - \text{out}_{CC1}) \\ = -0.013 * 0 * 0.625 * (1 - 0.625) = 0$$

$$\text{cof}_{CC2} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC2}} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{PP1}} \cdot \frac{\partial \bar{m}_{PP1}}{\partial \bar{m}_{CC2}} \cdot \frac{\partial \bar{m}_{CC2}}{\partial \bar{m}_{CC1}} = \text{cof}_{PP1} * W_{11} * \text{out}_{CC2} * (1 - \text{out}_{CC1}) \\ = -0.013 * 1 * 0.629 * (1 - 0.629) = -0.003$$

$$\text{cof}_{CC3} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC3}} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{PP2}} \cdot \frac{\partial \bar{m}_{PP2}}{\partial \bar{m}_{CC3}} \cdot \frac{\partial \bar{m}_{CC3}}{\partial \bar{m}_{CC1}} = \text{cof}_{PP2} * W_{11} * \text{out}_{CC3} * (1 - \text{out}_{CC1}) \\ = -0.014 * 1 * 0.385 * (1 - 0.385) = -0.003$$

$$\text{cof}_{CC4} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC4}} = \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{PP2}} \cdot \frac{\partial \bar{m}_{PP2}}{\partial \bar{m}_{CC4}} \cdot \frac{\partial \bar{m}_{CC4}}{\partial \bar{m}_{CC1}} = \text{cof}_{PP2} * W_{11} * \text{out}_{CC4} * (1 - \text{out}_{CC1}) \\ = -0.014 * 0 * 0.280 * (1 - 0.380) = 0$$

$$KK_{11} = KK_{11} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{11}} = KK_{11} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC1}} \cdot \frac{\partial \bar{m}_{CC1}}{\partial KK_{11}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC2}} \cdot \frac{\partial \bar{m}_{CC2}}{\partial KK_{11}} \right) = KK_{11} - \alpha (\text{cof}_{CC1} \cdot 1 + \text{cof}_{CC2} \cdot 0) \\ = 0.1 - 0.5 (0 * 0.1 + (-0.003) * 0) = 0.1$$

$$KK_{12} = KK_{12} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{12}} = KK_{12} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC1}} \cdot \frac{\partial \bar{m}_{CC1}}{\partial KK_{12}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC2}} \cdot \frac{\partial \bar{m}_{CC2}}{\partial KK_{12}} \right) = KK_{12} - \alpha (\text{cof}_{CC1} \cdot 0 + \text{cof}_{CC2} \cdot 0) \\ = 0.2 - 0.5 (0 * 0 + (-0.003) * 0) = 0.2$$

$$KK_{13} = KK_{13} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{13}} = KK_{13} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC3}} \cdot \frac{\partial \bar{m}_{CC3}}{\partial KK_{13}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC4}} \cdot \frac{\partial \bar{m}_{CC4}}{\partial KK_{13}} \right) = KK_{13} - \alpha (\text{cof}_{CC3} \cdot 0 + \text{cof}_{CC4} \cdot 0) \\ = 0.3 - 0.5 (0 * 0 + (-0.003) * 0) = 0.3$$

$$bb_1 = bb_1 - \alpha \frac{\partial \bar{E}_{M1}}{\partial bb_1} = bb_1 - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC1}} \cdot \frac{\partial \bar{m}_{CC1}}{\partial bb_1} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC2}} \cdot \frac{\partial \bar{m}_{CC2}}{\partial bb_1} \right) = bb_1 - \alpha (\text{cof}_{CC1} \cdot 1 + \text{cof}_{CC2} \cdot 1) \\ = 0.5 - 0.5 (0 * 1 + (-0.003) * 1) = 0.502$$

$$KK_{21} = KK_{21} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{21}} = KK_{21} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC3}} \cdot \frac{\partial \bar{m}_{CC3}}{\partial KK_{21}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC4}} \cdot \frac{\partial \bar{m}_{CC4}}{\partial KK_{21}} \right) = KK_{21} - \alpha (\text{cof}_{CC3} \cdot 0 + \text{cof}_{CC4} \cdot 0) \\ = 0.3 - 0.5 ((-0.003) * 0 + 0 * 0) = 0.3$$

$$KK_{22} = KK_{22} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{22}} = KK_{22} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC3}} \cdot \frac{\partial \bar{m}_{CC3}}{\partial KK_{22}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC4}} \cdot \frac{\partial \bar{m}_{CC4}}{\partial KK_{22}} \right) = KK_{22} - \alpha (\text{cof}_{CC3} \cdot 0 + \text{cof}_{CC4} \cdot 0) \\ = 0.2 - 0.5 (0 * 0 + 0 * 0) = 0.2$$

$$KK_{23} = KK_{23} - \alpha \frac{\partial \bar{E}_{M1}}{\partial KK_{23}} = KK_{23} - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC3}} \cdot \frac{\partial \bar{m}_{CC3}}{\partial KK_{23}} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC4}} \cdot \frac{\partial \bar{m}_{CC4}}{\partial KK_{23}} \right) = KK_{23} - \alpha (\text{cof}_{CC3} \cdot 0 + \text{cof}_{CC4} \cdot 0) \\ = 0.1 - 0.5 ((-0.003) * 0 + 0 * 0) = 0.1$$

$$bb_2 = bb_2 - \alpha \frac{\partial \bar{E}_{M1}}{\partial bb_2} = bb_2 - \alpha \left(\frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC1}} \cdot \frac{\partial \bar{m}_{CC1}}{\partial bb_2} + \frac{\partial \bar{E}_{M1}}{\partial \bar{m}_{CC2}} \cdot \frac{\partial \bar{m}_{CC2}}{\partial bb_2} \right) = bb_2 - \alpha (\text{cof}_{CC1} \cdot 1 + \text{cof}_{CC2} \cdot 1) \\ = -0.5 - 0.5 ((-0.003) * 1 + 0 * 1) = -0.499$$

0 0 0 0 0
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