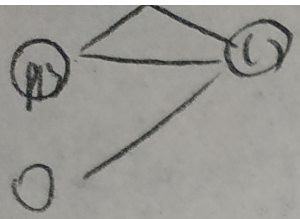
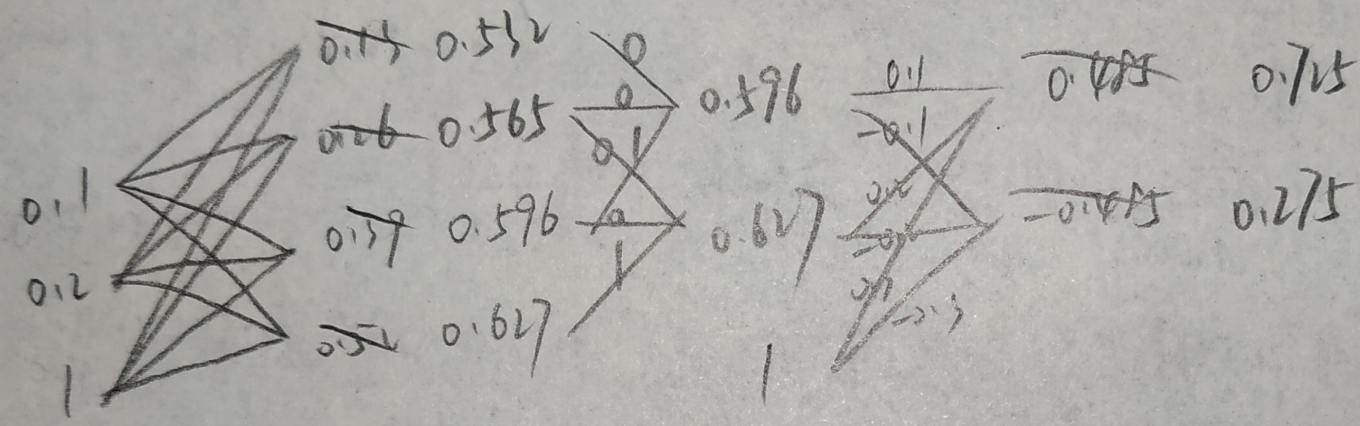
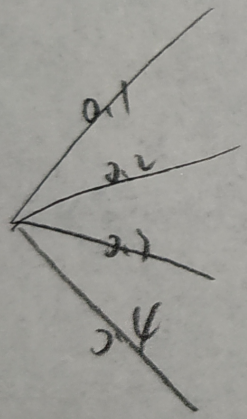
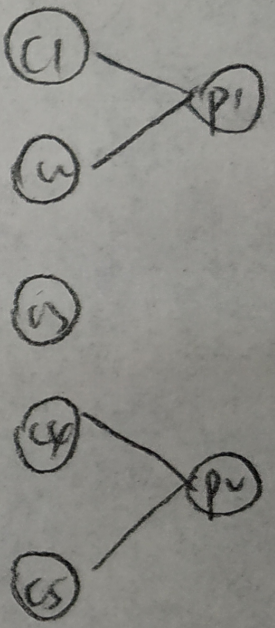
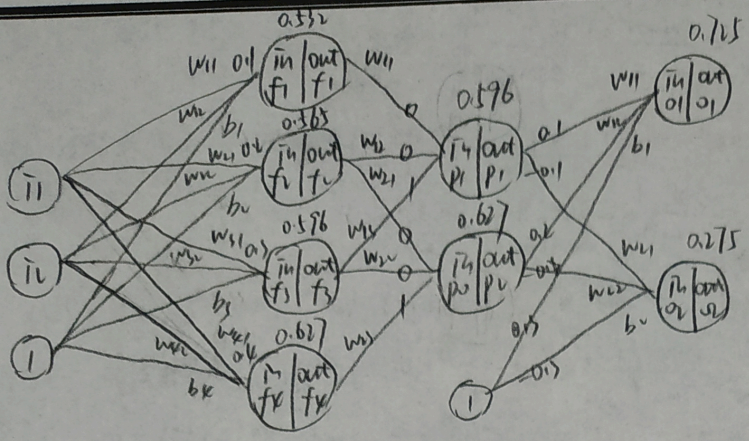



0.1
0.2
1
0.532
0.565
0.596
0.627
0.596
0.627
1
0.715
0.275







正向传播

$in_{f1} = w_{11} * i_1 + w_{12} * i_2 + w_{13} * i_3 + b_1$

$in_{f2} = w_{21} * i_1 + w_{22} * i_2 + w_{23} * i_3 + b_2$

$in_{f3} = w_{31} * i_1 + w_{32} * i_2 + w_{33} * i_3 + b_3$

$in_{f4} = w_{41} * i_1 + w_{42} * i_2 + w_{43} * i_3 + b_4$

$in_{p1} = \max(out_{f1}, out_{f2}, out_{f3})$

$in_{p2} = \max(out_{f1}, out_{f3}, out_{f4})$

$in_{o1} = w_{11} * out_{p1} + w_{12} * out_{p2} + b_1$

$in_{o2} = w_{21} * out_{p1} + w_{22} * out_{p2} + b_2$

反向传播

$coef_{o1} = \frac{\partial E_{sum}}{\partial in_{o1}} = out_1 - o_1 = 0.715 - 1 = -0.275$

$coef_{o2} = \frac{\partial E_{sum}}{\partial in_{o2}} = out_2 - o_2 = 0.275 - 0 = 0.275$

$w_{11} = w_{11} - \alpha \frac{\partial E_{sum}}{\partial w_{11}} = w_{11} - \alpha \frac{\partial E_{sum}}{\partial in_{o1}} \cdot \frac{\partial in_{o1}}{\partial w_{11}} = w_{11} - \alpha \cdot coef_{o1} \cdot out_{p1} = 0.1 - 0.7 * (-0.275) * 0.596$

$= 0.215$

$w_{12} = w_{12} - \alpha \frac{\partial E_{sum}}{\partial w_{12}} = w_{12} - \alpha \frac{\partial E_{sum}}{\partial in_{o1}} \cdot \frac{\partial in_{o1}}{\partial w_{12}} = w_{12} - \alpha \cdot coef_{o1} \cdot out_{p2} = 0.2 - 0.7 * (-0.275) * 0.621$

$= 0.321$

$b_1 = b_1 - \alpha \frac{\partial E_{sum}}{\partial b_1} = b_1 - \alpha \frac{\partial E_{sum}}{\partial in_{o1}} \cdot \frac{\partial in_{o1}}{\partial b_1} = b_1 - \alpha \cdot coef_{o1} \cdot 1 = 0.5 - 0.7 * (-0.275) = 0.693$

$w_{21} = w_{21} - \alpha \frac{\partial E_{sum}}{\partial w_{21}} = w_{21} - \alpha \frac{\partial E_{sum}}{\partial in_{o2}} \cdot \frac{\partial in_{o2}}{\partial w_{21}} = w_{21} - \alpha \cdot coef_{o2} \cdot out_{p1} = -0.1 - 0.7 * 0.275 * 0.596$

$= -0.215$

$w_{22} = w_{22} - \alpha \frac{\partial E_{sum}}{\partial w_{22}} = w_{22} - \alpha \frac{\partial E_{sum}}{\partial in_{o2}} \cdot \frac{\partial in_{o2}}{\partial w_{22}} = w_{22} - \alpha \cdot coef_{o2} \cdot out_{p2} = -0.2 - 0.7 * 0.275 * 0.621$

$= -0.321$

$b_2 = b_2 - \alpha \frac{\partial E_{sum}}{\partial b_2} = b_2 - \alpha \frac{\partial E_{sum}}{\partial in_{o2}} \cdot \frac{\partial in_{o2}}{\partial b_2} = b_2 - \alpha \cdot coef_{o2} \cdot 1 = -0.5 - 0.7 * 0.275 = -0.693$

装……订……线

$$coef_{p1} = \frac{\partial E_{total}}{\partial in_{p1}} = \left(\frac{\partial E_{total}}{\partial in_{o1}} \cdot \frac{\partial in_{o1}}{\partial out_{p1}} + \frac{\partial E_{total}}{\partial in_{o2}} \cdot \frac{\partial in_{o2}}{\partial out_{p1}}\right) \cdot \frac{\partial out_{p1}}{\partial in_{p1}}$$

$$= (coef_{o1} \cdot w_{11} + coef_{o2} \cdot w_{21}) \cdot 1 = (-0.275) * 0.215 + 0.275 * (-0.215) = -0.118$$

$$coef_{p2} = \frac{\partial E_{total}}{\partial in_{p2}} = \left(\frac{\partial E_{total}}{\partial in_{o1}} \cdot \frac{\partial in_{o1}}{\partial out_{p2}} + \frac{\partial E_{total}}{\partial in_{o2}} \cdot \frac{\partial in_{o2}}{\partial out_{p2}}\right) \frac{\partial out_{p2}}{\partial in_{p2}}$$

$$= (coef_{o1} \cdot v_{12} + coef_{o2} \cdot v_{22}) \cdot 1 = (-0.275) * 0.321 + 0.275 * (-0.321) = -0.177$$

$$coef_{f1} = \frac{\partial E_{total}}{\partial in_{f1}} = \frac{\partial E_{total}}{\partial in_{p1}} \cdot \frac{\partial in_{p1}}{\partial out_{f1}} \cdot \frac{\partial out_{f1}}{\partial in_{f1}} = coef_{p1} \cdot w_{11} \cdot out_{f1}(1 - out_{f1})$$

$$= -0.118 * 0 * 0.532(1 - 0.532) = 0$$

$$coef_{f2} = \frac{\partial E_{total}}{\partial in_{f2}} = \left(\frac{\partial E_{total}}{\partial in_{p1}} \cdot \frac{\partial in_{p1}}{\partial out_{f2}} + \frac{\partial E_{total}}{\partial in_{p2}} \cdot \frac{\partial in_{p2}}{\partial out_{f2}}\right) \cdot \frac{\partial out_{f2}}{\partial in_{f2}} = (coef_{p1} \cdot v_{12} + coef_{p2} \cdot v_{22})\, out_{f2}(1 - out_{f2})$$

$$= (-0.118 * 0 + (-0.177) * 0) * 0.565(1 - 0.565)$$

$$= 0$$

$$coef_{f3} = \frac{\partial E_{total}}{\partial in_{f3}} = \left(\frac{\partial E_{total}}{\partial in_{p1}} \cdot \frac{\partial in_{p1}}{\partial out_{f3}} + \frac{\partial E_{total}}{\partial in_{p2}} \cdot \frac{\partial in_{p2}}{\partial out_{f3}}\right) \cdot \frac{\partial out_{f3}}{\partial in_{f3}} = (coef_{p1} * w_{13} + coef_{p2} \cdot v_{23}) \cdot out_{f3}(1 - out_{f3})$$

$$= (-0.118 * 1 + (-0.177) * 0) * 0.596 * (1 - 0.596)$$

$$= -0.028$$

$$coef_{f4} = \frac{\partial E_{total}}{\partial in_{f4}} = \frac{\partial E_{total}}{\partial in_{p2}} \cdot \frac{\partial in_{p2}}{\partial out_{f4}} \cdot \frac{\partial out_{f4}}{\partial in_{f4}} = coef_{p2} * w_{23} * out_{f4}(1 - out_{f4}) = -0.177 * 1 * 0.627 * (1 - 0.627)$$

$$= -0.041$$

$$w_{11} = w_{11} - \alpha \frac{\partial E_{total}}{\partial w_{11}} = w_{11} - \alpha \frac{\partial E_{total}}{\partial in_{f1}} \cdot \frac{\partial in_{f1}}{\partial w_{11}} = w_{11} - \alpha \cdot coef_{f1} \cdot i_1 = 0.1 - 0.7 * 0 * 0.1 = 0.1$$

$$w_{12} = w_{12} - \alpha \frac{\partial E_{total}}{\partial w_{12}} = w_{12} - \alpha \frac{\partial E_{total}}{\partial in_{f1}} \cdot \frac{\partial in_{f1}}{\partial w_{12}} = w_{12} - \alpha \cdot coef_{f1} \cdot i_2 = 0.1 - 0.7 * 0 * 0.2 = 0.1$$

$$b_1 = b_1 - \alpha \frac{\partial E_{total}}{\partial b_1} = b_1 - \alpha \frac{\partial E_{total}}{\partial in_{f1}} \cdot \frac{\partial in_{f1}}{\partial b_1} = b_1 - \alpha \cdot coef_{f1} \cdot 1 = 0.1 - 0.7 * 0 * 1 = 0.1$$

$$w_{21} = w_{21} - \alpha \frac{\partial E_{total}}{\partial w_{21}} = w_{21} - \alpha \frac{\partial E_{total}}{\partial in_{f2}} \cdot \frac{\partial in_{f2}}{\partial w_{21}} = w_{21} - \alpha \cdot coef_{f2} \cdot i_1 = 0.2 - 0.7 * 0 * 0.1 = 0.2$$

$$w_{22} = w_{22} - \alpha \frac{\partial E_{total}}{\partial w_{22}} = w_{22} - \alpha \frac{\partial E_{total}}{\partial in_{f2}} \cdot \frac{\partial in_{f2}}{\partial w_{22}} = w_{22} - \alpha \cdot coef_{f2} \cdot i_2 = 0.2 - 0.7 * 0 * 0.2 = 0.2$$

$$b_2 = b_2 - \alpha \frac{\partial E_{total}}{\partial b_2} = b_2 - \alpha \frac{\partial E_{total}}{\partial in_{f2}} \cdot \frac{\partial in_{f2}}{\partial b_2} = b_2 - \alpha \cdot coef_{f2} \cdot 1 = 0.2 - 0.7 * 0 * 1 = 0.2$$

$$w_{31} = w_{31} - \alpha \frac{\partial E_{total}}{\partial w_{31}} = w_{31} - \alpha \frac{\partial E_{total}}{\partial in_{f3}} \cdot \frac{\partial in_{f3}}{\partial w_{31}} = w_{31} - \alpha \cdot coef_{f3} \cdot i_1 = 0.3 - 0.7 * (-0.028) * 0.1 = 0.302$$

$$w_{32} = w_{32} - \alpha \frac{\partial E_{total}}{\partial w_{32}} = w_{32} - \alpha \frac{\partial E_{total}}{\partial in_{f3}} \cdot \frac{\partial in_{f3}}{\partial w_{32}} = w_{32} - \alpha \cdot coef_{f3} \cdot i_2 = 0.3 - 0.7 * (-0.028) * 0.2 = 0.304$$

$$b_3 = b_3 - \alpha \frac{\partial E_{total}}{\partial b_3} = b_3 - \alpha \frac{\partial E_{total}}{\partial in_{f3}} \cdot \frac{\partial in_{f3}}{\partial b_3} = b_3 - \alpha \cdot coef_{f3} \cdot 1 = 0.3 - 0.7 * (-0.028) * 1 = 0.320$$

$$w_{41} = w_{41} - \alpha \frac{\partial E_{total}}{\partial w_{41}} = w_{41} - \alpha \frac{\partial E_{total}}{\partial in_{f4}} \cdot \frac{\partial in_{f4}}{\partial w_{41}} = w_{41} - \alpha \cdot coef_{f4} \cdot i_1 = 0.4 - 0.7 * (-0.041) * 0.1 = 0.403$$

$$w_{42} = w_{42} - \alpha \frac{\partial E_{total}}{\partial w_{42}} = w_{42} - \alpha \frac{\partial E_{total}}{\partial in_{f4}} \cdot \frac{\partial in_{f4}}{\partial w_{42}} = w_{42} - \alpha \cdot coef_{f4} \cdot i_2 = 0.4 - 0.7 * (-0.041) * 0.2 = 0.406$$

$$b_4 = b_4 - \alpha \frac{\partial E_{total}}{\partial b_4} = b_4 - \alpha \frac{\partial E_{total}}{\partial in_{f4}} \cdot \frac{\partial in_{f4}}{\partial b_4} = b_4 - \alpha \cdot coef_{f4} \cdot 1 = 0.4 - 0.7 * (-0.041) * 1 = 0.429$$