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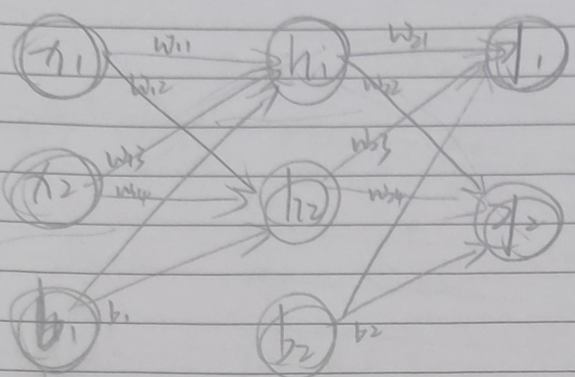

$w_{11}=0.24$ $w_{21}=0.5$

$w_{12}=0.3$ $w_{22}=0.45$

$w_{13}=0.2$ $w_{23}=0.55$

$w_{14}=0.16$ $w_{24}=0.4$

$b_1=0.28$ $b_2=0.6$

$x_1=0.08$ $x_2=0.12$

$Label_1=0.05$ $Label=0.95$

$\alpha=0.5$

forward:

$net_{h1}=w_{11}x_1+w_{13}x_2+b_1=0.24\times0.08+0.2\times0.12+0.28=0.3232$

$net_{h2}=w_{12}x_1+w_{14}x_2+b_1=0.3\times0.08+0.16\times0.12+0.28=0.3232$

$out_{h1}=1/(1+e^{-net_{h1}})=0.58004$

$out_{h2}=1/(1+e^{-net_{h2}})=0.58004$

$y_1=w_{21}\cdot out_{h1}+w_{23}\cdot out_{h2}+b_2$
$=1.209109$

$y_2=w_{22}\cdot out_{h1}+w_{24}\cdot out_{h2}+b_2$
$=1.093088$

$E_{total}=\sum\frac{1}{2}(target-output)^2=$
$=\frac{1}{2}[(1.209109-0.05)^2+(1.093088-0.95)^2]=[\underset{E_1}{0.671767}+\underset{E_2}{0.01023}]$
$=0.682004$

backward
输出层

$\frac{\partial E_{total}}{\partial w_{21}}=\frac{\partial E_{total}}{\partial y_1}\cdot\frac{\partial y_1}{\partial w_{21}}=\frac{\partial\sum\frac{1}{2}(y_i-Label_i)^2}{\partial y_1}\cdot\frac{\partial y_1}{\partial w_{21}}$

$=(y_1-Label_1)\cdot out_{h1}=0.672404$

$w_{21}^+=w_{21}-\alpha\cdot\frac{\partial E_{total}}{\partial w_{21}}=0.1638$ 同理,可以求得

$w_{22}^+=0.4085$ $w_{23}^+=0.2138$ $w_{24}^+=0.3585$

对于 b_2,同样有 $\frac{\partial E_{total}}{\partial b_2}=\frac{\partial E_{total}}{\partial y_1}\cdot\frac{\partial y_1}{\partial b_2}+\frac{\partial E_{total}}{\partial y_2}\cdot\frac{\partial y_2}{\partial b_2}=(y_1+y_2-Label_1-Label_2)$
$=1.30219$

$b_2^+=b_2-\alpha\cdot\frac{\partial E_{total}}{\partial b_2}=0.3489$

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backward 隐藏层、

$$\frac{\partial E_{total}}{\partial w_{11}} = \frac{\partial E_{total}}{\partial out_{h_1}} \cdot \frac{\partial out_{h_1}}{\partial net_{h_1}} \cdot \frac{\partial net_{h_1}}{\partial w_{11}}$$

而 ① $\frac{\partial E_{total}}{\partial out_{h_1}} = \frac{\partial E_1}{\partial out_{h_1}} + \frac{\partial E_2}{\partial out_{h_1}}$

又：$\frac{\partial E_1}{\partial out_{h_1}} = \frac{\partial E_1}{\partial y_1} \cdot \frac{\partial y_1}{\partial out_{h_1}}$

$= (y_1 - Label_1) \cdot w_{21}$

$\frac{\partial E_2}{\partial out_{h_1}} = \frac{\partial E_2}{\partial y_2} \cdot \frac{\partial y_2}{\partial out_{h_1}}$

$= (y_2 - Label_2) \cdot w_{22}$

② $\frac{\partial out_{h_1}}{\partial net_{h_1}} = \frac{\partial (1/(1+e^{-net_{h_1}}))}{\partial net_{h_1}} = out_{h_1}(1-out_{h_1})$

③ $\frac{\partial net_{h_1}}{\partial w_{11}} = x_1$

故有：$\frac{\partial E_{total}}{\partial w_{11}} = [(y_1 - Label_1) \cdot w_{21} + (y_2 - Label_2) \cdot w_{22}] \cdot out_{h_1}(1-out_{h_1}) \cdot x_1$

最终 有 $w_{11}^+ = w_{11} - \partial \cdot \frac{\partial E_{total}}{\partial w_{11}} = 0.2578$ 同理，

$w_{12}^+ = 0.3198$ $w_{13}^+ = 0.2268$ $w_{14}^+ = 0.1896$

$b_1^+ = b_1 - \partial \cdot \frac{\partial E_{total}}{\partial b_1}$

而 $\frac{\partial E_{total}}{\partial b_1} = [(y_1 - Label_1) \cdot w_{21} + (y_2 - Label_2) \cdot w_{22}] \cdot out_{h_1}(1-out_{h_1}) +$

$[(y_1 - Label_1) \cdot w_{23} + (y_2 - Label_2) \cdot w_{24}] \cdot out_{h_2}(1-out_{h_2})$

得 $b_1^+ = 1.6700$

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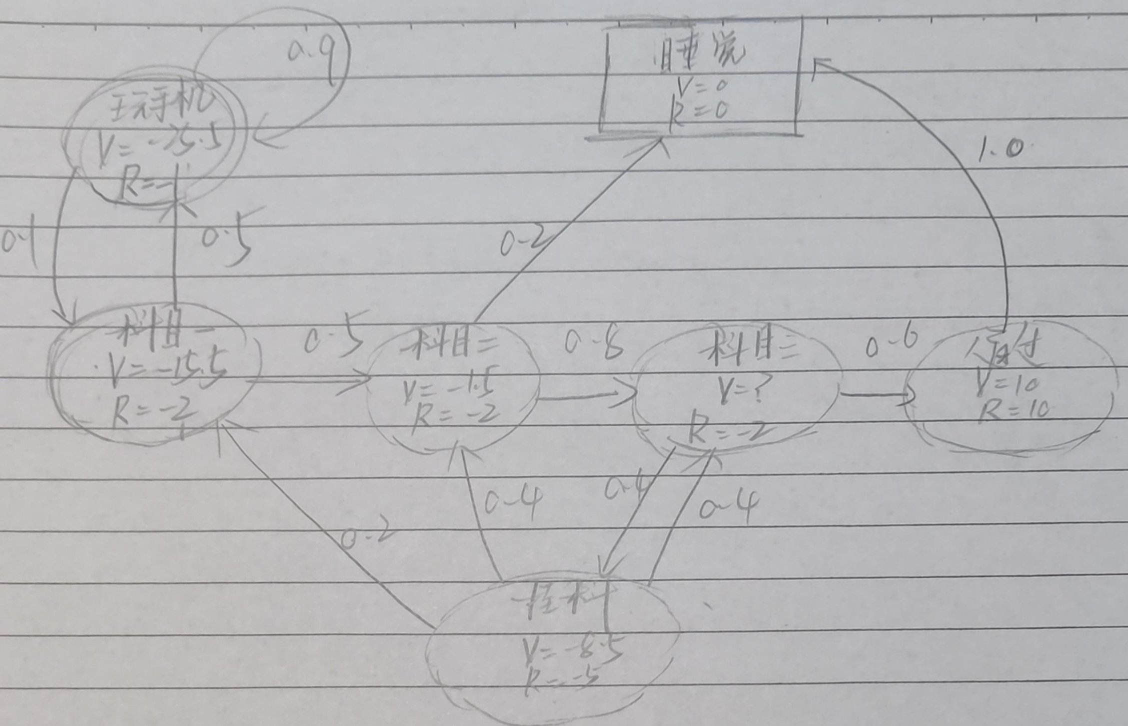

(1): $\gamma=0.5$ ①轨迹"科目一，科目二，科目三，通过，睡觉"

②轨迹"科目一，玩手机，玩手机，科目一，科目二，睡觉"

① $U_t = -2 + (-2)\times 0.5 + (-2)\times 0.5^2 + 10\times 0.5^3 + 0\times 0.5^4$

$= -2.25$

② $U_t = -2 + (-1)\times 0.5 + (-1)\times 0.5^2 + (-2)\times 0.5^3 + (-2)\times 0.5^4 + 0\times 0.5^5$

$= -3.125$

(2): $\gamma=1$, $V_\pi(s_t) = E_A[Q_\pi(s_t, A)] = E[U_t \mid S_t = s_t]$

$= E[R_t + \gamma U_{t+1} \mid S_t]$

$= E[R_t \mid S_t = s_t] + \gamma E[U_{t+1} \mid S_t = s_t]$

$= R_s + \gamma \sum_{s'} P_{ss'} E[U_{t+1} \mid S_t = s_t, S_{t+1} = s']$

由马尔可夫性质 $= R_s + \gamma \sum P_{ss'} E[U_{t+1} \mid S_{t+1} = s']$

$= R_s + \gamma \sum_{s'} P_{ss'} V(s')$，故算得 $V = -2 + 0.6\times 10 + 0.4\times$

$= 0.6$