机器学习期末试卷

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一、判断：

1、✓ 2. ✗ 3. ✓ 4. ✗. 5. ✓

6. ✗ 7. ✓ 8. ✗ 9. ✓ 10. ✓

二、填空

1、array([3, 64, 169]) 2、10 3. 11行 4. $(x_1^2, x_2^2, \sqrt{2}x_1x_2)$

5. $-\frac{3}{10}\log_2\frac{3}{10}-\frac{2}{10}\log_2\frac{2}{10}-\frac{5}{10}\log_2\frac{5}{10}$ 6. 3 7. 越小

8. MC.

三、解：x, θ 为 n 维列向量.

$$\frac{\partial L(\theta)}{\partial\theta}=\frac{\partial(t\log y+(1-t)\log(1-y))}{\partial\theta}=\frac{\partial(t\log y)}{\partial\theta}+\frac{\partial((1-t)\log(1-y))}{\partial\theta}$$

$$=t\cdot\frac{\partial(\log y)}{\partial y}\cdot\frac{\partial y}{\partial\theta}+(1-t)\frac{\partial(\log(1-y))}{\partial y}\cdot\frac{\partial y}{\partial\theta}=t\cdot\frac{1}{y}\frac{\partial y}{\partial\theta}+(1-t)\cdot\frac{-1}{1-y}\cdot\frac{\partial y}{\partial\theta}$$

$$=\cancel{\frac{t}{y}+\frac{t-1}{1-y}}\left(\frac{t}{y}-\frac{1-t}{1-y}\right)\frac{\partial y}{\partial\theta}$$

$$\because y=\frac{1}{1+e^{-\theta^T x}} \qquad \therefore \frac{\partial y}{\partial\theta}=\begin{pmatrix}\frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_1\\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_2\\ \vdots\\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_n\end{pmatrix} \qquad \cancel{\therefore \frac{\partial L(\theta)}{\partial\theta}=\left(\frac{t}{y}-\frac{1-t}{1-y}\right)}$$

$$\therefore \frac{\partial L(\theta)}{\partial\theta}=\left(\frac{t}{y}-\frac{1-t}{1-y}\right)\begin{pmatrix}\frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_1\\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_2\\ \vdots\\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2}x_n\end{pmatrix}$$

四.

1. 23×23 的 image 经过 5×5 的 kernel 作用后得到 $23-5+1=19\times19$ 的 image.

19×19 的 imge 要变~~得~~成 21×21 需要 padding: 2

21×21 的 imge 经过 3×3 的 kernel 得到 $21-3+1=19\times19$ 的 image.

答案: 2, 2.

2. 设 探索率为 p.

由 $p\cdot1+(1-p)\cdot(-1)<0.3$ 得 $p<0.65$

答案: 65%

五. $V_*(s)=\max\limits_a \sum\limits_{s',r} p(r,s'|s,a)[r+\gamma V_*(s')]$. $\gamma=0.8$.

上: $v_1=1\times[0+0.8\times19.8]=15.84$.

右: $V_2=1\times[0+0.8\times16.0]=12.8$

下: $V_3=1\times[0+0.8\times16.0]=12.8$

左: $V_4=1\times[0+0.8\times19.8]=15.84$.

∴ $V_*(s)=15.84$. 最优策略: 向上 或 向左

∴ $V_*(s) =$ [illegible]

六. 解:

P(单独=是) $= \frac{3}{7}$.　P(单独=否) $= \frac{4}{7}$.

G(单独=是) $= 1-\left[\left(\frac{2}{3}\right)^2+\left(\frac{1}{3}\right)^2\right] = \frac{4}{9}$.　G(单独=否) $= 1-\left[\left(\frac{1}{4}\right)^2+\left(\frac{2}{4}\right)^2+\left(\frac{1}{4}\right)^2\right] = \frac{5}{8}$

∴ G(单独,就餐) $= \frac{3}{7}\times\frac{4}{9}+\frac{4}{7}\times\frac{5}{8} = \frac{23}{42} \approx 0.548$

P(周末=是) $= \frac{5}{7}$.　P(周末=否) $= \frac{2}{7}$.

G(周末=是) $= 1-\left[\left(\frac{3}{5}\right)^2+\left(\frac{1}{5}\right)^2+\left(\frac{1}{5}\right)^2\right] = \frac{14}{25}$

G(周末=否) $= 1-\left[\left(\frac{2}{2}\right)^2\right] = 0$.

∴ G(是否周末) $= \frac{5}{7}\times\frac{14}{25}+\frac{2}{7}\times 0 = \frac{2}{5} = 0.4$

P(时间=早) $= \frac{3}{7}$　P(时间=适中) $= \frac{2}{7}$.　P(时间=晚) $= \frac{2}{7}$.

G(时间=早) $= 1-\left[\left(\frac{1}{3}\right)^2+\left(\frac{1}{3}\right)^2+\left(\frac{1}{3}\right)^2\right] = \frac{2}{3}$.

G(时间=适中) $= 1-\left[\left(\frac{1}{2}\right)^2+\left(\frac{1}{2}\right)^2\right] = \frac{1}{2}$

G(时间=晚) $= 1-\left[\left(\frac{1}{2}\right)^2+\left(\frac{1}{2}\right)^2\right] = \frac{1}{2}$.

II

$\therefore G(\text{就餐时间}) = \frac{3}{7}\times\frac{2}{3} + \frac{2}{7}\times\frac{1}{2} + \frac{2}{7}\times\frac{1}{2} = \frac{4}{7} \approx 0.571$

$\therefore G(\text{就餐时间}) > G(\text{单独就餐}) > G(\text{是否周末})$

$\therefore$ 根节点：是否周末.