

机器学习期末试卷

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一. 判断:

1. \checkmark

2. \times

3. \checkmark

4. \times

5. \checkmark

6. \times

7. \checkmark

8. \times

9. \checkmark

10. \checkmark

二. 填空

1. `array([3, 64, 169])`

2. 10

3. 11行

4. $(x_1^2, x_2^2, \sqrt{2} x_1 x_2)$

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.

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

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

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

$$\therefore y = \frac{1}{1+e^{-\theta^T x}}$$

$$\therefore \frac{\partial y}{\partial \theta} =$$

$$\begin{pmatrix} \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2} x_1 \\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2} x_2 \\ \vdots \\ \frac{e^{-\theta^T x}}{(1+e^{-\theta^T x})^2} x_n \end{pmatrix}$$

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

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

I



扫描全能王 创建

四.

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

19×19 的 image 要变成 21×21 需要 padding: 2

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

答案: 2, 2.

2. 设概率为 p .

$$\text{由 } p \cdot 1 + (1-p) \cdot 1 = 0.3 \quad \text{得 } p < 0.65$$

答案: 65%

$$\text{五. } V_*(s) = \max_a \sum_{s', r} P(r, s' | s, a) [r + \gamma V_*(s')]. \quad \gamma = 0.8.$$

$$\text{上: } V_1 = 1 \times [0 + 0.8 \times 19.8] = 15.84.$$

$$\text{右: } V_2 = 1 \times [0 + 0.8 \times 16.0] = 12.8$$

$$\text{下: } V_3 = 1 \times [0 + 0.8 \times 16.0] = 12.8$$

$$\text{左: } V_4 = 1 \times [0 + 0.8 \times 19.8] = 15.84.$$

$\therefore V_*(s) = 15.84.$ 最优策略: 向上或向左



$$\therefore V^*(S) = 10.07.$$

9x114 ↑

六. 解:

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

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

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

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

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

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

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

$$P(\text{时间} = \text{早}) = \frac{3}{7}, \quad P(\text{时间} = \text{正中}) = \frac{2}{7}, \quad P(\text{时间} = \text{晚}) = \frac{2}{7}.$$

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

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

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

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.

