机器学习理论作业3

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拉普拉斯平滑 $\Rightarrow$ $\lambda = 1$, $S_j = 3$ $S_j\lambda = 3$ $C = \{1, -1\} \Rightarrow k = 2$

$$P(Y=1) = \frac{9+\lambda}{15+k\lambda} = \frac{9+1}{15+2} = \frac{10}{17} \qquad P(Y=-1) = \frac{6+\lambda}{15+k\lambda} = \frac{6+1}{15+2} = \frac{7}{17}$$

$$P(X^{(1)}=1|Y=1) = \frac{2+\lambda}{9+S_j\lambda} = \frac{2+1}{9+3} = \frac{3}{12} \qquad P(X^{(1)}=2|Y=1) = \frac{3+1}{9+3} = \frac{4}{12}$$

$$P(X^{(1)}=3|Y=1) = \frac{4+1}{9+3} = \frac{5}{12}$$

$$P(X^{(2)}=S|Y=1) = \frac{1+1}{9+3} = \frac{2}{12} \quad P(X^{(2)}=M|Y=1) = \frac{4+1}{9+3} = \frac{5}{12} \quad P(X^{(2)}=L|Y=1) = \frac{5}{12}$$

$$P(X^{(1)}=1|Y=-1) = \frac{3+1}{6+3} = \frac{4}{9} \qquad P(X^{(1)}=2|Y=-1) = \frac{3}{9} \qquad P(X^{(1)}=3|Y=-1) = \frac{2}{9}$$

$$P(X^{(2)}=S|Y=-1) = \frac{4}{9} \qquad P(X^{(2)}=M|Y=-1) = \frac{3}{9} \qquad P(X^{(2)}=L|Y=-1) = \frac{2}{9}$$

对于给定的 $X = (3, S)^T$,计算

$$P(Y=1)P(X^{(1)}=3|Y=1)P(X^{(2)}=S|Y=1) = \frac{10}{17} \times \frac{5}{12} \times \frac{2}{12} = \frac{100}{2448} = 0.04085$$

$$P(Y=-1)P(X^{(1)}=3|Y=-1)P(X^{(2)}=S|Y=-1) = \frac{7}{17} \times \frac{2}{9} \times \frac{4}{9} = \frac{56}{1377} = 0.04067$$

由于 $P(Y=1)P(X^{(1)}=3|Y=1)P(X^{(2)}=S|Y=1)$ 最大 ,所以 $Y=1$