

第3章作业 周子涵 2018011218014

$$1. p(x|w_1) = \begin{cases} x & 0 \leq x < 1 \\ 2-x & 1 \leq x \leq 2 \\ 0 & \text{其他} \end{cases} \quad p(x|w_2) = \begin{cases} x-1 & 1 \leq x < 2 \\ 3-x & 2 \leq x < 3 \\ 0 & \text{其他} \end{cases}$$

$$(1) \cancel{p(x)} \quad p(w_1|x) = \frac{p(x|w_1) p(w_1)}{\cancel{p(x)}}$$

$$\cancel{p(x)} = \frac{\cancel{p(x|w_1)}}{\cancel{p(x|w_1)}}$$

$$\frac{p(w_1)}{p(w_1) + p(w_2)}$$

$$p(x|w_1) p(w_1) = \begin{cases} 0.6x & 0 \leq x < 1 \\ 1.2-0.6x & 1 \leq x < 2 \\ 0 & \text{其他} \end{cases}$$

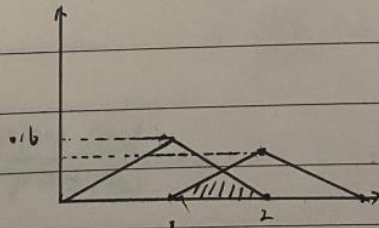
$$p(x|w_2) p(w_2) = \begin{cases} 0.4x-0.4 & 1 \leq x < 2 \\ 1.2-0.4x & 2 \leq x < 3 \\ 0 & \text{其他} \end{cases}$$

$x \leq 0$  或  $x > 3$  时无法判决

$0 \leq x < 1.6$  时,  $x \in w_1$

$1.6 \leq x < 3$  时,  $x \in w_2$

(2) 总错误概率



总错误概率为阴影面积

$$\frac{1}{2} \times 1 \times 0.24 = 0.12$$

$$(3) \frac{p(w_2)}{p(w_1)} = \frac{2}{3}$$

$\therefore x_1, x_2, x_3 \in w_1$

$x_4 \in w_2$

$$2. (a) P(w_1) = P(w_2) = 0.5$$

$$P(x|w_1)P(w_1) = \begin{cases} \frac{1}{2}x - \frac{1}{2}, & 0 < x < 2 \\ 0, & \text{其他} \end{cases}$$

$$P(x|w_2)P(w_2) = \begin{cases} \frac{1}{2}x - \frac{1}{2}, & 1 < x < 3 \\ 0, & \text{其他} \end{cases}$$

$$(b) P(x|w_1)P(w_1) = P(x|w_2)P(w_2) \quad (0 < x < 3)$$

$$\Rightarrow x = \frac{3}{2}$$

$$\therefore i) P(x = \frac{3}{2})$$

$$3. R_1 = \int_0^2 + 0.5x P(x|w_1)P(w_1) / P(x)$$

$$R_2 = \int_1^3 x P(x|w_1)P(w_1) / P(x)$$

$$P(x) = 0.75$$

$$R_1 = \frac{10}{32} < R_2 = \frac{12}{32}$$

$$x \in w_1$$

$$4. (1) P(x_1|w_1)P(w_1) = 0.48 > P(x_1|w_2)P(w_2) = 0.08$$

$$\therefore x_1 \in w_1$$

$$P(x_2|w_1)P(w_1) = 0.06 < P(x_2|w_2)P(w_2) = 0.36$$

$$\therefore x_2 \in w_2$$

$$(2) x_1 R_1 = \int \lambda_{12} P(x_1|w_2)P(w_2) / P(x) = \frac{4}{7}$$

$$R_2 = \int \lambda_{21} P(x_1|w_1)P(w_1) / P(x) = \frac{6}{7} \lambda_2$$

$$x_2 = R_1 = \frac{24}{7}$$

$$R_2 = \frac{\lambda_{21}}{7}$$

$$\frac{4}{7} < \frac{6}{7} \lambda_{21} \quad \frac{4}{7} < \frac{\lambda_{21}}{7}$$

$$\Rightarrow \lambda_{21} > 24$$

$\therefore \lambda_{21}$  对大影响向分类结果

$$5. L(\theta) = \sum_{i=1}^N \ln p(x_i, \theta)$$

$$\ln L(\theta) = 2N \ln \theta + \ln \left( \sum_{i=1}^N x_i \right) - \theta \left( \sum_{i=1}^N x_i \right)$$

$$\frac{\partial \ln L}{\partial \theta} = \frac{2N}{\theta} - \bar{X} = 0$$

$$\therefore \hat{\theta} = \frac{2}{\bar{X}}$$

$$6. \hat{f}: p(x=5) = \frac{1}{N h_N} \sum_{i=1}^N \varphi\left(\frac{x_i - 5}{h_N}\right)$$

$$= \frac{5}{48}$$

$$p(x=14) = \frac{1}{12 \times 4} \sum_{i=1}^{12} \varphi\left(\frac{x_i - 14}{4}\right)$$

$$= \frac{5}{48}$$

$$\text{正态: } p(x=5) = \frac{1}{N h_N} \sum_{i=1}^{12} \varphi\left(\frac{x_i - 5}{h_N}\right)$$

$$= \frac{0.8251}{48 \sqrt{4}} = 0.0730$$

$$p(x=14) = \frac{1}{12 \times 4} \sum_{i=1}^{12} \varphi\left(\frac{x_i - 14}{4}\right)$$

$$= \frac{4.2698}{48 \sqrt{4}} = 0.0455$$

$$7. \frac{p(x=2/w_1)}{p(x=2/w_2)} = 2.71 \quad \therefore x=2 \text{ 属于 } w_1$$

$$P_{w_1}(x=2) = \frac{1}{1045} (0+0+0+\dots+1+1) \times 2.5$$

$$= \frac{2}{50}$$

$$P_{w_2}(x=2) = \frac{1}{27}$$