Machine learning | P15

Bayesian:

$$P(d) = \sum_i P(d|h_i)P(h_i)$$

$$= 0\times 1\times 0\times 0.1 + 0.75\times 0.75\times 0.25\times 0.2 + 0.5\times 0.5\times 0.5\times 0.4 + 0.75\times 0.25\times 0.75\times 0.2 + 1\times 0\times 1\times 0.1$$

$$= 0 + 0.009375 + 0.05 + 0.028125 + 0$$

$$= 0.0875$$

$$P(\text{lime}|d) = \sum_i P(\text{lime}|h_i)P(h_i|d)$$

$$= \sum_i P(\text{lime}|h_i)\frac{P(d|h_i)P(h_i)}{P(d)}$$

$$= \frac{1}{P(d)}\sum_i P(\text{lime}|h_i)P(d|h_i)P(h_i)$$

$$= \frac{1}{0.0875}\times(0\times 0\times 1\times 0\times 0.1 + 0.25\times 0.25\times 0.75\times 0.25\times 0.2 + 0.5\times 0.5\times 0.5\times 0.5\times 0.4 + 0.75\times 0.75\times 0.25\times 0.75\times 0.2 + 1\times 1\times 0\times 1\times 0.1)$$

$$= \frac{1}{0.0875}\times(0 + 0.00234375 + 0.025 + 0.021093375 + 0)$$

$$= 0.794642857$$

$$P(\text{cherry}|d) = 1 - P(\text{lime}|d) = 0.205357143$$

⇒ 预测下一颗是柠檬口味

MAP：极大后验

$P(h_1|d) \propto P(d|h_1)P(h_1) = 0\times1\times0\times0.1=0$

$P(h_2|d) \propto P(d|h_2)P(h_2) = 0.25\times0.75\times0.25\times0.2=0.009375$

$P(h_3|d) \propto P(d|h_3)P(h_3) = 0.5\times0.5\times0.5\times0.4=0.05$

$P(h_4|d) \propto P(d|h_4)P(h_4) = 0.75\times0.25\times0.75\times0.2=0.028125$

$P(h_5|d) \propto P(d|h_5)P(h_5) = 1\times0\times1\times0.1=0$

$h_{MAP}=h_3$

$P(lime|h_3)=0.5$
$P(cherry|h_3)=0.5$ $\Rightarrow$ 无法判定.

ML：极大似然

- $P(d|h_1)=0\times1\times0=0$
  $P(d|h_2)=0.25\times0.75\times0.25=0.046875$
  $P(d|h_3)=0.5\times0.5\times0.5=0.125$
  $P(d|h_4)=0.75\times0.25\times0.75=0.140625$
  $P(d|h_5)=1\times0\times1=0$

  $h_{ML}=h_4$
  $P(lime|h_4)=0.75$
  $P(cherry|h_4)=0.25$ $\Rightarrow$ 预测下一颗是柠檬口味