

Práctica 5 - Introducción a los Sistemas Inteligentes

Modelos probabilísticos

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	x_1	x_2	x_3	C
1	0	1	1	c
2	1	0	1	a
3	1	1	0	b
4	0	0	0	a
5	0	0	1	b
6	1	0	1	a
7	1	1	0	b
8	0	0	0	c

1. Calcule las probabilidades condicionales necesarias para un modelo naïve Bayes.

- **Probabilidades por clase:**

- $P(a) = 3/8$
- $P(b) = 3/8$
- $P(c) = 2/8$

- **Probabilidades por atributos:**

- a
 - $P(x_1 = 0 \mid a) = 1/3$
 - $P(x_1 = 1 \mid a) = 2/3$
 - $P(x_2 = 0 \mid a) = 3/3$
 - $P(x_2 = 1 \mid a) = 0/3$
 - $P(x_3 = 0 \mid a) = 1/3$
 - $P(x_3 = 1 \mid a) = 2/3$
- b
 - $P(x_1 = 0 \mid b) = 1/3$
 - $P(x_1 = 1 \mid b) = 2/3$
 - $P(x_2 = 0 \mid b) = 1/3$
 - $P(x_2 = 1 \mid b) = 2/3$
 - $P(x_3 = 0 \mid b) = 2/3$
 - $P(x_3 = 1 \mid b) = 1/3$
- c
 - $P(x_1 = 0 \mid c) = 2/2$

- $P(x_1 = 1 \mid c) = 0/2$
- $P(x_2 = 0 \mid c) = 1/2$
- $P(x_2 = 1 \mid c) = 1/2$
- $P(x_3 = 0 \mid c) = 1/2$
- $P(x_3 = 1 \mid c) = 1/2$

2. Clasifique el ejemplo $x = (0, 0, 1)$.

$$P(\text{Clase} \mid X) \propto P(\text{Clase}) \cdot P(x_1 = 0 \mid \text{Clase}) \cdot P(x_2 = 0 \mid \text{Clase}) \cdot P(x_3 = 1 \mid \text{Clase})$$

- Para a:
 $P(a \mid (0,0,1)) = 3/8 \cdot 1/3 \cdot 3/3 \cdot 2/3 = 1/12$
- Para b:
 $P(b \mid (0,0,1)) = 3/8 \cdot 1/3 \cdot 1/3 \cdot 1/3 = 1/72$
- Para c:
 $P(c \mid (0,0,1)) = 2/8 \cdot 2/2 \cdot 1/2 \cdot 1/2 = 1/16$

3. Calcule la siguiente probabilidad de manera exacta: $P(C = a \mid x = (1, 1, 0))$

$$P(\text{clase} \mid x) = [P(\text{clase}) \times P(x \mid \text{clase})] / P(x)$$

$$\text{Siendo } P(x) = [P(a) \cdot P(x \mid a)] + [P(b) \cdot P(x \mid b)] + [P(c) \cdot P(x \mid c)]$$

Entonces:

- $P(a) \cdot P(x \mid a) = 3/8 \cdot 2/3 \cdot 0 \cdot 1/3 = 0$
- $P(b) \cdot P(x \mid b) = 3/8 \cdot 2/3 \cdot 2/3 \cdot 2/3 = 1/9$
- $P(c) \cdot P(x \mid c) = 2/8 \cdot 0 \cdot 1/2 \cdot 1/2 = 0$

$$P(x) = 0 + 1/9 + 0$$

$$P(C = a \mid x = (1, 1, 0)) = 0 / (1/9) = 0$$