

Exercise 1 - Conditional Probabilities

Data

Assume the data as shown below:

Record	A	B	C	Class
1	0	0	0	+
2	0	0	1	-
3	0	1	1	-
4	0	1	1	-
5	0	0	1	+
6	1	0	1	+
7	1	0	1	-
8	1	0	1	-
9	1	1	1	+
10	1	0	1	+

Naive Bayes classifier

Calculate the following conditional probabilities. $P(A/+)$, $P(B/+)$, $P(C/+)$, $P(A/-)$, $P(B/-)$, $P(C/-)$. We start by calculating the probabilities of a record classified into class + and -.

$$P(+) = \frac{1}{2}, P(-) = \frac{1}{2}$$

$$P(A = 1|+) = 3/5, P(A = 1|-) = \frac{2}{5}$$

$$P(B = 1|+) = 1/5, P(B = 1|-) = \frac{2}{5}$$

$$P(C = 1|+) = 4/5, P(C = 1|-) = \frac{5}{5}$$

$$P(X|+)P(+) = P(A|+)P(B|+)P(C|+)P(+) = \frac{2}{5} \frac{1}{5} \frac{4}{5} \frac{1}{2} = 0.048$$

$$P(X|-)P(-) = P(A|-)P(B|-)P(C|-)P(-) = \frac{2}{5} \frac{2}{5} \frac{5}{5} \frac{1}{2} = 0.02$$

Estimate class for sample (A=0, B=1, C=0)

$$P(X) = P(A = 0)P(B = 1)P(C = 0)$$

$$P(X) = \frac{1}{2} \frac{3}{10} \frac{9}{10} = 0.054$$

$$\frac{P(X|+)P(+)}{P(X)} = \frac{0.048}{0.054} = 0.88$$

$$\frac{P(X|-)P(-)}{P(X)} = \frac{0.02}{0.054} = 0.37$$

Thus, the sample is classified to class “+”.