Bayes

Wednesday, November 22, 2023 9:51 AM

$$P(C_i|X_1,\ldots,X_p) = \frac{P(X_1,\ldots,X_p|C_i)P(C_i)}{P(X_1,\ldots,X_p|C_1)P(C_1)+\cdots+P(X_1,\ldots,X_p|C_m)P(C_m)}.$$

$$P(Buy \mid X_1 = y,\ X_2 = m) = \frac{P(X_1=y, X_2=m \mid Buy)\,P(Buy)}{P(X_1=y, X_2=m \mid Buy)P(Buy) + P(X_1=y, X_2=m \mid NB)\,P(NB)}$$

Talks for more than 100 min? (TT >= 100) (X_1)	Gender (X_2)	Response (C_1 = buying, C_2 = Not Buying)
y	male	not bought
n	male	not bought
n	female	not bought
n	female	not bought
n	male	not bought
n	male	not bought
y	male	bought
y	female	bought
n	female	bought
y	female	bought

$$p(Buys \mid TT \geq 100, 'm')$$

$$= \frac{(1/4)(4/10)}{(1/4)(4/10) + (1/6)(6/10)}$$

$$= 0.5$$

$$P(Buys \mid TT \geq 100, 'f')$$

$$= \frac{(3/4)(4/10)}{(3/4)(4/10) + 0} = 1$$

$$P(Buy \mid X_1 = y,\ X_2 = m) = \frac{P(X_1=y, X_2=m \mid Buy)\,P(Buy)}{P(X_1=y, X_2=m \mid Buy)P(Buy) + P(X_1=y, X_2=m \mid NB)\,P(NB)}$$

Treating X_1 & X_2 as independent

Talks for more than 100 min? (TT >= 100)	Gender	Response
y	male	not bought
n	male	not bought
n	female	not bought
n	female	not bought
n	male	not bought
n	male	not bought
y	male	bought
y	female	bought
n	female	bought
y	female	bought

If X_1 & X_2 are indep,

$$P(X_1 \cap X_2 | B) = P(X_1 | B)\,P(X_2 | B)$$

$$P(B \mid X_1 = y \cap X_2 = m)$$

$$= \frac{P(X_1=y|B)\,P(X_2=m|B)\,P(B)}{P(X_1=y|B)\,P(X_2=m|B)\,P(B) + P(X_1=y|NB)\,P(X_2=m|NB)\,P(NB)}$$

$$= \frac{(3/4)(1/4)(4/10)}{(3/4)(1/4)(4/10) + (1/6)(4/6)(6/10)} = 0.529$$

$$P(B \mid X_1 = y \cap X_2 = f) = \frac{P(X_1=y|B)\,P(X_2=f|B)\,P(B)}{P(X_1=y|B)\,P(X_2=f|B)\,P(B) + P(X_1=y|NB)\,P(X_2=f|NB)\,P(NB)}$$

$$= 0.8709$$