3. Naive Bayes Estimation

Naive Bayes method is a simple MAP method

Suppose we have classes $C_1, C_2, \cdots C_k$

Parameter $x_1, x_2, x_3, \cdots x_N$

We have a dataset with

	X_1	X_2	X_3	$\cdots$	X_N	C
1	0.1	0.7	0.3	$\cdots$	0.9	C_1
2	$\cdots$	$\cdots$	$\cdots$	$\vdots$	$\cdots$	C_1
3	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	C_2
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
M	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	C_1

We can easily have $p(x_n \mid C_k)$ & $p(C_k)$

Because we can think our dataset is i.i.d sampled from true distribution.

Our target is to do

$$i = \max_i P(C_i \mid X)$$

$p(C_i \mid X) = \frac{P(X \mid C_i) P(C_i)}{P(X)}$ and we find that $p(X)$ exists for any class's posterior, so, we can reduce it to

$i = \max_i P(X \mid C_i) \cdot P(C_i)$ We use another simple assumption

$$p(X \mid C_i) = \prod_{n=1}^{N} p(x_n \mid C_i)$$