Naive Bayes' Classifier

* For theory refer textbook.

Ex: 1 Refer textbook

Ex: 2 Car theft

Dataset

Ex. No.	Color	Type	Origin	Stolen?
1	Red	Sports	Domestic	Yes
2	Red	Sports	Domestic	No
3	Red	Sports	Domestic	Yes
4	Yellow	Sports	Domestic	No
5	Yellow	Sports	Imported	Yes
6	Yellow	SUV	Imported	No
7	Yellow	SUV	Imported	Yes
8	Yellow	SUV	Domestic	No
9	Red	SUV	Imported	No
10	Red	Sports	Imported	Yes

Find the likelihood / probability of {Red, SUV, Domestic} being stolen

~~Red, Domestic, SUV~~

Sol²:- Prior probabilities

$$P(Yes) = \frac{5}{10} = 0.5$$

$$P(No) = \frac{5}{10} = 0.5$$

} Refer stolen column

To find Conditional probabilities

Color	Yes	No
Red	3/5	2/5
Yellow	2/5	3/5

→ Refer Color & Stolen Column

Type	Yes	No
Sports	4/5	2/5
SUV	1/5	3/5

→ Refer Type & stolen Column

Origin	Yes	No
Domestic	2/5	3/5
Imported	3/5	2/5

→ Refer Origin & stolen Column

New instance to be classified = <Red, SUV, Domestic>

$$P(\text{Yes} \mid \text{New Instance}) = P(\text{Yes}) \cdot P(\text{Red} \mid \text{Yes}) \cdot P(\text{SUV} \mid \text{Yes}) \cdot P(\text{Domestic} \mid \text{Yes})$$

$$= 0.5 \times \frac{3}{5} \times \frac{1}{5} \times \frac{2}{5}$$

$$P(\text{Yes} \mid \text{New Instance}) = 0.024$$

Similarly, $P(\text{No} \mid \text{New Instance}) = P(\text{No}) \cdot P(\text{Red} \mid \text{No}) \cdot P(\text{SUV} \mid \text{No}) \cdot P(\text{Domestic} \mid \text{No})$

$$= 0.5 \times \frac{2}{5} \times \frac{3}{5} \times \frac{3}{5}$$

$$P(\text{No} \mid \text{New Instance}) = 0.072$$

Since $P(\text{No} \mid \text{New Instance}) > P(\text{Yes} \mid \text{New Instance})$, the new instance can be classified as No.
i.e Red, SUV, Domestic is not stolen