Example 2. May 2017 (10M)

Apply the Naive Bayes classifier algorithm for buys computer classification and classify the tuple.

$X = (age = young, income = medium, student = yes, credit\_rating = fair)$

RID	age	income	student	credit_rating	Class: buys_comp
1.	young	high	no	fair	no
2.	young	high	no	good	no
3.	middle	high	no	fair	yes
4.	old	medium	no	fair	yes
5.	old	low	yes	fair	yes
6.	old	low	yes	good	no
7.	middle	low	yes	good	yes
8.	young	medium	no	fair	no
9.	young	low	yes	fair	yes
10.	old	medium	yes	fair	yes
11.	young	medium	yes	good	yes
12.	middle	medium	no	good	yes
13.	middle	high	yes	fair	yes
14.	old	medium	no	good	no

⇒ Solution :- Calculate the probability of each class.

Step 1 :- $P(buys\_computer = Yes) = \frac{9}{14}$.

$P(buys\_computer = No) = \frac{5}{14}$

Step2 :-

$P(\text{age} = \text{young} \mid \text{buys\_computer} = \text{Yes}) = \frac{2}{9} = 0.222$

$P(\text{age} = \text{young} \mid \text{buys\_computer} = \text{No}) = \frac{3}{5} = 0.600$

$P(\text{age} = \text{middle} \mid \text{Yes}) = \frac{4}{9}$

$P(\text{age} = \text{middle} \mid \text{No}) = \frac{0}{5} = 0$

$P(\text{age} = \text{old} \mid \text{Yes}) = \frac{3}{9}$

$P(\text{age} = \text{old} \mid \text{No}) = \frac{2}{5}$

Now,

$P(\text{income} = \text{high} \mid \text{Yes}) = \frac{2}{9}$

$P(\text{income} = \text{high} \mid \text{No}) = \frac{2}{5}$

$P(\text{income} = \text{medium} \mid \text{Yes}) = \frac{4}{9}$

$P(\text{income} = \text{medium} \mid \text{No}) = \frac{2}{5}$

$P(\text{income} = \text{low} \mid \text{Yes}) = \frac{3}{9}$

$P(\text{income} = \text{low} \mid \text{No}) = \frac{1}{5}$

Now,

$P(\text{student} = \text{Yes} \mid \text{Yes}) = \frac{6}{9}$

$P(\text{student} = \text{Yes} \mid \text{No}) = \frac{1}{5}$

$P(\text{student} = \text{No} \mid \text{Yes}) = \frac{3}{9}$

$P(\text{student} = \text{Yes} \mid \text{No}) = \frac{4}{5}$

$P(\text{credit\_rating} = \text{fair} \mid \text{Yes}) = \frac{6}{9} = 0.667$.

$P(\text{credit\_rating} = \text{fair} \mid \text{No}) = \frac{2}{5} = 0.400$

$P(\text{credit\_rating} = \text{good} \mid \text{Yes}) = \frac{3}{9}$

$P(\text{credit\_rating} = \text{good} \mid \text{No}) = \frac{3}{5}$.

ow,

$X = \langle \text{young}, \text{medium}, \text{Yes}, \text{fair} \rangle$ we need classify the label.

$P(X \mid \text{buys\_computer=Yes}) = P(\text{young} \mid \text{Yes}) \times P(\text{medium} \mid \text{Yes}) \times P(\text{student=Yes} \mid \text{Yes}) \times P(\text{credit\_rating=fair} \mid \text{buys\_comp=Yes})$

$= \frac{2}{9} \times \frac{4}{9} \times \frac{6}{9} \times \frac{6}{9}$

$= 0.222 \times 0.444 \times 0.667 \times 0.667$

$= 0.044$.

ilarly,

$(X \mid \text{buys\_computer} = \text{No}) = P(\text{young} \mid \text{No}) \times P(\text{medium} \mid \text{No}) \times P(\text{student} = \text{Yes} \mid \text{No}) \times P(\text{credit\_rating} = \text{fair} \mid \text{buys\_comp} = \text{No})$

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

$= 0.6 \times 0.4 \times 0.2 \times 0.4$.

$P(X \mid \text{No})$. $= 0.0192$.

Now,

$$P(X \mid buys\_computer = Yes) \times P(buys\_comp = Yes)$$

$$= 0.044 \times 0.643$$

$$= 0.028.$$

and

$$P(X \mid buys\_computer = No) \times P(buys\_computer = No).$$

$$= 0.019 \times 0.357$$

$$= 0.007.$$

$$P(X \mid Yes) > P(X \mid No)$$

Therefore, the naive Bayesian classifier predicts buys_computer = yes for tuple X.