

Naive Bayes Classifier



Baye's Theorem

(Conditional Probability)

Probability of A given B

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$P(A \cap B) = P(B|A) * P(A)$$

$$P(A|B) \Rightarrow \frac{P(B|A) * P(A)}{P(B)}$$

$Y \quad x_1, x_2, x_3, \quad x_4$

		* <u>Outlook</u>			
		Yes	No	P(Yes)	P(No)
{	<u>Sunny</u>	3 ✓	2	<u>3/9</u>	2/5
	<u>Overcast</u>	4 ✓	0	4/9	0
	<u>Rainy</u>	<u>2 ✓</u> 9	<u>3</u> 5	2/9	3/5

Hot

false target

 $\left. \begin{matrix} Y \\ N \end{matrix} \right\} \rightarrow \text{Classification Problem}$

Outlook	Temp	Humidity	Windy	Play Golf
Rainy	Hot	High	FALSE	No
Rainy	Hot	High	TRUE	No
Overcast	Hot	High	FALSE	Yes
Sunny	Mild	High	FALSE	Yes
Sunny	Cool	Normal	FALSE	Yes
Sunny	Cool	Normal	TRUE	No
Overcast	Cool	Normal	TRUE	Yes
Rainy	Mild	High	FALSE	No
Rainy	Cool	Normal	FALSE	Yes
Sunny	Mild	Normal	FALSE	Yes
Rainy	Mild	Normal	TRUE	Yes
Overcast	Mild	High	TRUE	Yes
Overcast	Hot	Normal	FALSE	Yes
Sunny	Mild	High	TRUE	No

Naive Bayes

$$P(Y | x_1, x_2, x_3, x_4) =$$

$$\Rightarrow 0.6$$

$$P(N | \text{Sunny, Hot, Normal, false})$$

$$\Rightarrow 0.4$$

Sunny Normal (Y) ✓

f ₁ Outlook					f ₂ Temperature				
	Yes	No	P(Yes)	P(No)		Yes	No	P(Yes)	P(No)
Sunny	3	2	3/9	2/5	Hot	2	2	2/9	2/5
Overcast	4	0	4/9	0/5	Mild	4	2	4/9	2/5
Rainy	2	3	2/9	3/5	Cool	3	1	3/9	1/5
Total	9	5	100%	100%	Total	9	5	100%	100%

f ₃ Humidity					f ₄ Wind				
	Yes	No	P(Yes)	P(No)		Yes	No	P(Yes)	P(No)
High	3	4	3/9	4/5	False	6	2	6/9	2/5
Normal	6	1	6/9	1/5	True	3	3	3/9	3/5
Total	9	5	100%	100%	Total	9	5	100%	100%

Play			P(Yes)/P(No)
Yes	9		9/14 ✓
No	5		5/14 ✓
Total	14		100%

$$P(\text{sunny} | \text{yes}) * P(\text{hot} | \text{yes}) *$$

$$P(\text{normal} | \text{yes}) * P(\text{false} | \text{yes})$$

$$* P(\text{yes})$$

$$P(\text{sunny}) * P(\text{hot}) * P(\text{normal})$$

$$(D) * P(\text{false})$$

$$\Rightarrow \frac{3}{9} * \frac{2}{9} * \frac{6}{9} * \frac{6}{9} * \frac{9}{14}$$

$$\Rightarrow 0.021164 \leftarrow \text{Higher}$$

$$\frac{P(\text{sunny}|\text{no}) * P(\text{hot}|\text{no}) * P(\text{normal}|\text{no}) * P(\text{-false}|\text{no}) * P(\text{no})}{P(\text{yes})}$$

(D) $P(\text{sunny}) * P(\text{hot}) * P(\text{normal}) * P(\text{-false})$

$$2/5 * 2/5 * 1/5 * 2/5 * 5/14$$

$$\Rightarrow \underline{0.00457}$$