

Naïve Bayes Classifier

x1 (over 170cm)	x2 (hair length)	y (gender)
No	Short	Male
Yes	Long	Male
No	Long	Female
Yes	Long	Female
Yes	Short	Male

$X = (x1: \text{yes}, x2: \text{long})$

Male or female?

x1 (over 170cm)	x2 (hair length)	y (gender)
No	Short	Male
Yes	Long	Male
No	Long	Female
Yes	Long	Female
Yes	Short	Male

$X = (x1=yes, x2=long)$

$$\begin{aligned}
 P(y=\text{male} \mid x1 = \text{yes}, x2 = \text{long}) &\sim p(x1=\text{yes}, x2=\text{long} \mid y=\text{male}) * p(y=\text{male}) \\
 &= p(x1 = \text{yes} \mid y=\text{male}) * p(x2=\text{long} \mid y=\text{male}) * p(y=\text{male}) \\
 &= 2/3 * 1/3 * 3/5 = 2/15
 \end{aligned}$$

$$\begin{aligned}
 P(y=\text{female} \mid x1 = \text{yes}, x2 = \text{long}) &\sim p(x1=\text{yes}, x2=\text{long} \mid y=\text{female}) * p(y=\text{female}) \\
 &= p(x1 = \text{yes} \mid y=\text{female}) * p(x2=\text{long} \mid y=\text{female}) * p(y=\text{female}) \\
 &= 1/2 * 2/2 * 2/5 = 1/5
 \end{aligned}$$

Answer: $p(y=\text{female} \mid X) > p(y=\text{male} \mid X) \rightarrow \text{female}$