3.6.9 Naïve Bayes Example

Play Tennis:

Day	Outlook	Temp.	Humidity	Wind	PlayTennis
D1	Sunny ✓	Hot	High ✓	Weak	No
D2	Sunny ✓	Hot	High ✓	Strong	No
D3	Overcast	Hot	High ✓	Weak	Yes
D4	Rain	Mild	High ✓	Weak	Yes
D5	Rain	Cool ✓	Normal	Weak	Yes
D6	Rain	Cool ✓	Normal	Strong	No
D7	Overcast	Cool ✓	Normal	Strong	Yes
D8	Sunny ✓	Mild	High ✓	Weak	No
D9	Sunny ✓	Cool ✓	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny ✓	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High ✓	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High ✓	Strong	No

New Observation: **<Sunny,Cool,High,Strong>, do you play tennis?**

Solution:

① $P(Yes) = \dfrac{9}{14}$ $\qquad\qquad P(No) = \dfrac{5}{14}$

② $P(S|yes) = \dfrac{2}{9}$

$P(C|yes) = \dfrac{3}{9}$

$P(H|yes) = \dfrac{3}{9}$

$P(S|yes) = \dfrac{3}{9}$

② $P(\text{yes}, \langle s, c, H, s\rangle)$ compare $P(\text{no}, \langle sc \text{ } HS\rangle)$

$P(\langle s, c, H, s\rangle \mid \text{yes})$

$= P(s \mid \text{yes}) \, P(c \mid \text{yes}) \, P(H \mid \text{yes}) \, P(s \mid \text{yes})$

$= \dfrac{2}{9} \times \dfrac{3}{9} \times \dfrac{3}{9} \times \dfrac{3}{9}$

$= \dfrac{2}{243}$

$= 8.2305 \times 10^{-3}$

$P(\text{yes}, \langle s, c, H, s\rangle) = \dfrac{9}{14} \times 8.2305 \times 10^{-3}$

$= 0.005291$

③ $P(\langle sc \text{ } HS\rangle \mid \text{no})$

$= \dfrac{3}{5} \times \dfrac{1}{5} \times \dfrac{4}{5} \times \dfrac{3}{5}$

$= 0.0576$

$P(\text{no}, \langle sc \text{ } H \text{ } s\rangle) = \dfrac{5}{14} \times 0.0576$

$= 0.02057$

$P(\text{no}, \langle scHs\rangle) > P(\text{yes}, csc \text{ } HS\rangle)$ So, No.