2.4.1.4.1 Information Gain: Example

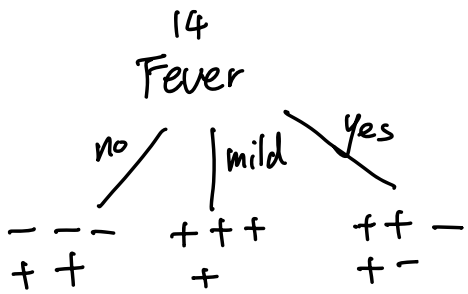
Q: compute gain information of 4 attributes.

PID	Fever	Cough	Sore Throat	Tiredness	Flu
1	no	yes	no	yes	−
2	no	yes	no	no	−
3	mild	yes	no	yes	+
4	yes	mild	no	yes	+
5	yes	no	yes	yes	+
6	yes	no	yes	no	−
7	mild	no	yes	no	+
8	no	mild	no	yes	−
9	no	no	yes	yes	+
10	yes	mild	yes	yes	+
11	no	mild	yes	no	+
12	mild	mild	no	no	+
13	mild	yes	yes	yes	+
14	yes	mild	no	no	−

Solution ① Info(D)

$$Info(D) = -\frac{9}{14}\log_2\left(\frac{9}{14}\right) - \frac{5}{14}\log_2\left(\frac{5}{14}\right) = 0.940 \text{ bits}$$

② Fever



$$Info_{Fever}(D) = \frac{5}{14}Info(D_{no}) + \frac{4}{14}Info(D_{mild}) + \frac{5}{14}Info(D_{yes})$$

$$= \frac{5}{14}\left[-\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right] + \frac{5}{14}\left[-\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right]$$

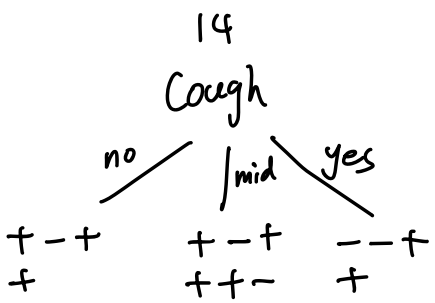
$= 2 \times \frac{5}{14} \times 0.9710$

$= 0.694$ bits

$Gain(Fever) = Info(D) - Info_{Fever}(D)$

$= 0.940 - 0.694 = 0.246$ bits

③ Similarly, cough.



$Gain(cough) = Info(D) - Info_{cough}(D)$

$= 0.940 - \left[\frac{4}{14} Info(D_{no}) + \frac{6}{14} Info(D_{mild}) + \frac{4}{14} Info(D_{yes})\right]$

$= 0.940 - \left[\frac{4}{14}\left(-\frac{3}{4}\log_2\frac{3}{4} - \frac{1}{4}\log_2\frac{1}{4}\right) + \frac{6}{14}\left(-\frac{4}{6}\log_2\frac{4}{6} - \frac{2}{6}\log_2\frac{2}{6}\right)\right.$

$\left. + \frac{4}{14}\left(-\frac{1}{2}\log_2\frac{1}{2} - \frac{1}{2}\log_2\frac{1}{2}\right)\right]$

$= 0.029$ bits

④ Sore Throat

$Gain(Sore\ Throat) = 0.151$ bits

⑤ Tiredness

Gain (Tiredness) = 0.048 bits

(b) 0.246 > 0.151 > 0.048 > 0.029

Since the "fever" attribute has the highest information gain it is selected as the splitting attribute