

ID	Fever	Cough	Breathing issue	Infected.
1	No	No	No	No
2	Yes	Yes	Yes	Yes
3	Yes	Yes	No	No
4	Yes	No	Yes	Yes
5	Yes	Yes	Yes	Yes
6	No	Yes	No	No
7	Yes	No	Yes	Yes
8	Yes	No	Yes	Yes
9	No	Yes	Yes	Yes
10	Yes	Yes	No	Yes
11	No	Yes	No	No
12	No	Yes	Yes	Yes
13	No	Yes	Yes	No
14	Yes	Yes	No	No

Now, we'll find entropy for each attribute.

$$\text{Entropy}(s) = - \sum p_i \log_2(p_i) \quad ; \quad i=1 \text{ to } n$$

$$\text{Entropy}(\text{fever}) = \left(\frac{8}{14}\right) \log_2\left(\frac{14}{8}\right) + \left(\frac{6}{14}\right) \log_2\left(\frac{14}{6}\right)$$

$$= 0.4613 + 0.5228 = 0.9841$$

$$\text{Entropy}(\text{Cough}) = \left(\frac{10}{14}\right) \log_2\left(\frac{14}{10}\right) + \left(\frac{4}{14}\right) \log_2\left(\frac{14}{4}\right)$$

$$= 0.3464 + 0.5142 = 0.8606$$

$$\text{Entropy}(\text{Breathing}) = \left(\frac{8}{14}\right) \log_2\left(\frac{14}{8}\right) + \left(\frac{6}{14}\right) \log_2\left(\frac{14}{6}\right)$$

$$= 0.9841$$

$$\text{Entropy}(\text{Infected}) = 0.9841$$

Now Information Gain.

$$I.G(S, A) = Entropy(S) - \sum \left(\frac{|S_v|}{|S|} \times Entropy(S_v) \right)$$

Now,

$$I.G(S, Fever) = 0.99 - \left(\frac{8}{14} \right) \times 0.81 - \left(\frac{6}{14} \right) \times 0.91$$

$$= 0.13$$

$$I.G(S, Cough) = 0.99 - \left(\frac{10}{14} \right) \times \left[\left(\frac{5}{10} \right) \times \log_2 \left(\frac{10}{5} \right) + \left(\frac{5}{10} \right) \log_2 \left(\frac{10}{5} \right) \right]$$

$$- \left(\frac{4}{14} \right) \times \left[\left(\frac{3}{4} \right) \log_2 \left(\frac{4}{3} \right) + \left(\frac{1}{4} \right) \log_2 \left(\frac{4}{1} \right) \right]$$

$$= 0.99 - \left(\frac{10}{14} \right) \left[\frac{2 \times 1 \log_2 2}{2} \right] - \left(\frac{2}{7} \right) \left[\frac{3 \times 0.415}{4} \right]$$

$$+ \left(\frac{1}{4} \right) \times 2$$

$$= 0.99 - \frac{10}{14} [1] - \left(\frac{2}{7} \right) [0.311 + 0.5]$$

$$= 0.99 - 0.714 - 0.231$$

$$= 0.046$$

$$I.G(S, Breathing) = 0.99 - \left(\frac{8}{14} \right) \left[\frac{7}{8} \log_2 \left(\frac{8}{7} \right) + \frac{1}{8} \log_2 \left(\frac{8}{1} \right) \right]$$

$$- \left(\frac{6}{14} \right) \left[\frac{1}{6} \log_2 \left(\frac{6}{1} \right) + \frac{5}{6} \log_2 \left(\frac{6}{5} \right) \right]$$

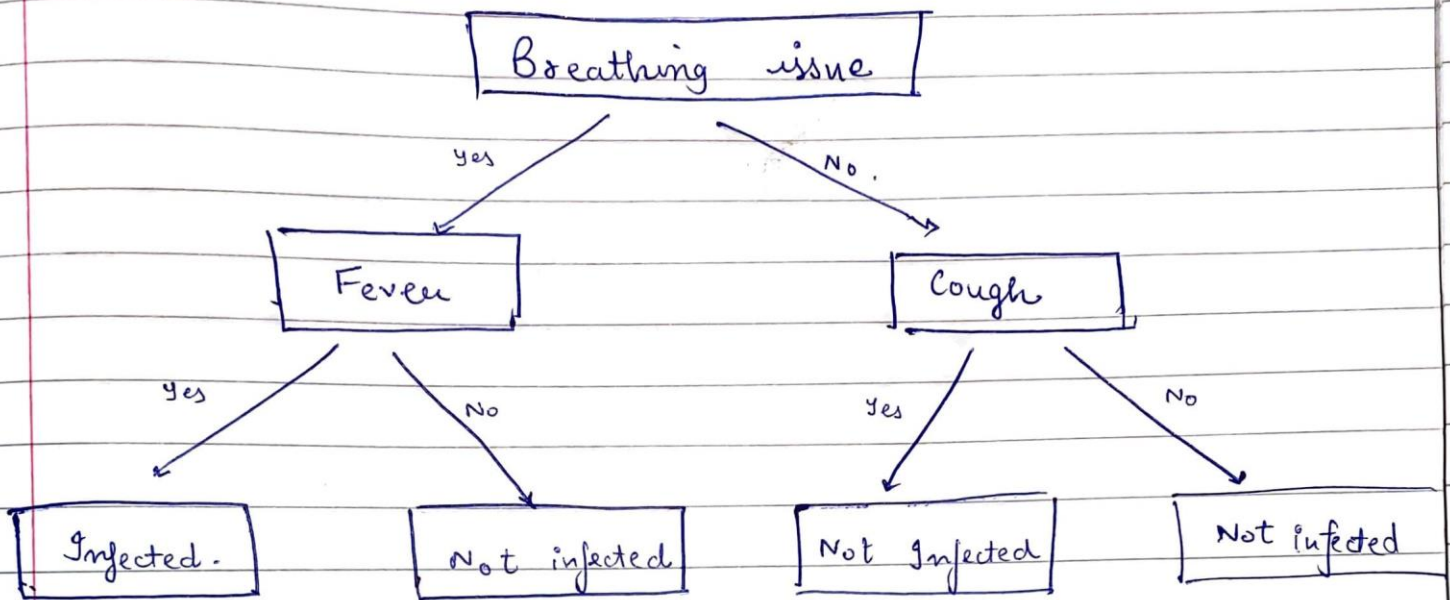
$$= 0.99 - 0.57 [0.875 \times 0.192 + 0.375]$$

$$- 0.428 [0.167 \times 2.58 + 0.84 \times 0.263]$$

$$= 0.99 - 0.57 [0.198] - 0.428 [0.430 + 0.220]$$

$$= 0.99 - 0.1128 - 0.2782$$

$$= 0.60$$



②
20/4/22