Md. Saiful Islam

18-36363-1

Sorce throat	Fever	Dyspnea	Sneezing	Headache	Diagnonis
Yes	Yes	Yes	Yes	Yes	Covid
NO	NO	NO	Yes	Yes	Allergy
Yes	Yes	NO	Yes	No	cold
Yes	NO	Yes	No	NO	covid
NO	Yes	No	Yes	No	cold
NO	No	NO	Yes	No	Allergy
NO	No	Yes	NO	NO	covid
Yes	No	No	Yes	Yes	Allergy
NO	Yes	No	Yes	Yes	cold
Yes	Yes	NO	Yes	Yes	cold

Step-1

Find the Entropy of class

$$\text{Entropy}_{\text{Class}} = -\frac{p}{p+n+q}\left(\log_2 \frac{p}{p+n+q}\right) - \frac{n}{p+n+q}\left(\log_2 \frac{n}{p+n+q}\right)$$

$$- \frac{q}{p+n+q}\left(\log_2 \frac{q}{p+n+q}\right)$$

Lets assume, p = covid; n = Allergy; q = cold

$= 3 \qquad = 3 \qquad = 4$

$$E_{\text{Diagnonis}} = -\frac{3}{3+3+4}\left(\log_2 \frac{3}{3+3+4}\right) - \frac{3}{3+3+4}\left(\log_2 \frac{3}{3+3+4}\right)$$

$$- \frac{4}{3+3+4}\left(\log_2 \frac{4}{3+3+4}\right)$$

$$= -\frac{3}{10}(\log_2 0.3) - \frac{3}{10}(\log_2 0.3) - \frac{4}{10}(\log_2 0.4)$$

$$= -0.3(\log_2 0.3) - 0.3(\log_2 0.3) - 0.4(\log_2 0.4)$$

$$= -0.3(-1.74) - 0.3(-1.74) - 0.4(-1.32)$$

$$= 0.522 + 0.522 + 0.528$$

$$= 1.572$$

Step-2

For each attribute the following

~~$I(P_i, n_i, q_i) =$~~ P

Sore throat	P_i	n_i	q_i	$I(P_i n_i q_i)$
Yes	2	2	1	1.522
No	1	2	2	1.522

$$I(P_i \cdot n_i \cdot q_i)_{Yes} = -\frac{2}{5}(\log_2 2/5) - 2/5(\log_2 2/5) - 1/5(\log_2 1/5)$$

$$= 1.522$$

$$I(P_i n_i q_i)_{No} = -\frac{1}{5}(\log_2 1/5) + \frac{2}{5}(\log_2 2/5) - 2/5(\log_2 2/5)$$

$$= 1.522$$

$$E_{\text{sore throat}} = \sum \frac{p_i+n_i+q_i}{p+n+q} \times I(p_i, n_i, q_i)$$

$$= \left(\frac{5}{10} \times 1.522\right) + \left(\frac{5}{10} \times 1.522\right)$$

$$= 1.522$$

$$\text{Gain}_{\text{sore}} = E_{\text{class}} - E_{\text{sore throat}}$$

$$= 1.571 - 1.522 = 0.049$$

Fever,

	p_i	n_i	q_i	$I(p_i\ n_i\ q_i)$
Yes	1	4	0	0.722
No	2	0	3	0.971

$$I(p_i n_i q_i)_{\text{yes}} = -1/5(\log_2 1/5) - 4/5(\log_2 4/5) - 0/5(\log_2 0/5)$$

$$= 0.722$$

$$I(p_i n_i q_i)_{\text{no}} = -2/5(\log_2 2/5) - 0/5(\log_2 0/5) - 3/5(\log_2 3/5)$$

$$= 0.971$$

$$E_{\text{Fever}} = 5/10 \times 0.722 + 5/10 \times 0.971 = 0.847$$

$$\text{Gain}_{\text{Fever}} = E_{\text{class}} - E_{\text{Fever}}$$

$$= 1.571 - 0.847$$

$$= 0.724$$