

به نام خدا

علیرضا خراسانی زاده

تمرین درس هوش مصنوعی:

Decision Tree Structure:

- ram**
 - Yes (1) → HHH, HH
 - No (2) → VVV
- shadow**
 - Yes (4) → HH, VV
 - No (5) → HHH, V
- garlic**
 - Yes (6) → HH, H
 - No (7) → VVV, HH
- com**
 - Yes (8) → HH, H, V
 - No (9) → HH, VV
- pent**
 - Yes (11) → HH, V
 - No (12) → HH, V
 - Yes (13) → H, V

Entropy Calculations:

$$H = - \sum \frac{n_b}{n_{pc}} \log \frac{n_b}{n_{pc}}$$

$$H(1) = - \left(\frac{5}{5} \log \frac{5}{5} \right) = - \left(\frac{5}{5} \times 0 \right) = 0$$

$$\log \frac{5}{5} = \log_2 5 - \log_2 5 = 2,32 - 2,32 = 0$$

$$H(3) = - \left(\frac{3}{3} \log \frac{3}{3} \right) = - \left(\frac{3}{3} \times 0 \right) = 0$$

$$\log \frac{3}{3} = \log_2 3 - \log_2 3 = 1,58 - 1,58 = 0$$

$$d③ = \left(\frac{2}{4} \log_2^{2/4} + \frac{2}{4} \log_2^{2/4} \right) = +1$$

$$\log_2^{2/4} = \log_2^1 - \log_2^2 = -1$$

$$d④ = \left(\frac{3}{3} \log_2^{3/3} \right) = 0$$

$$\log_2^{3/3} = \log_2^{1.582} - \log_2^{1.582} = 0$$

$$d⑤ = \left(\frac{1}{1} \log_2^1 \right) = 0$$

$$\log_2^1 = \log_2^{1.582} - \log_2^{1.582} = 0$$

$$d⑩ = \left(\frac{1}{3} \log_2^{1/3} + \frac{2}{3} \log_2^{2/3} \right) = +0.91$$

$$d⑫ = \left(\frac{2}{3} \log_2^{2/3} + \frac{1}{3} \log_2^{1/3} \right) = +0.91$$

$$\log_2^{1/3} = \log_2^1 - \log_2^{1.582} = -1.58$$

$$\log_2^{2/3} = \log_2^2 - \log_2^{1.582} = -0.58$$

$$d⑥ = \left(\frac{3}{3} \log_2^{3/3} \right) = 0$$

$$d⑦ = \left(\frac{3}{5} \log_2^{3/5} + \frac{2}{5} \log_2^{2/5} \right) = +0.97$$

$$\log_2^{3/5} = \log_2^{1.582} - \log_2^{2.322} = -0.14$$

$$\log_2^{2/5} = \log_2^1 - \log_2^{2.322} = -1.32$$

$$d⑧ = \left(\frac{2}{2} \log_2^{2/2} \right) = 0$$

$$d⑨ = \left(\frac{2}{3} \log_2^{2/3} + \frac{1}{3} \log_2^{1/3} \right) = +0.91$$

$$d⑪ = \left(\frac{1}{3} \log_2^{1/3} + \frac{2}{3} \log_2^{2/3} \right) = +0.91$$

$$d⑬ = \left(\frac{1}{2} \log_2^{1/2} + \frac{1}{2} \log_2^{1/2} \right) = +1$$

$$\log_2^{1/2} = \log_2^1 - \log_2^{1.414} = -1$$

① shadow

yes	no
HH	HHH
VV	0
1	2

② garlic

yes	no
HHH	VVV
0	HH
0	+0.97

③ corn = ذرة

P	R	A
HH	HH	H
0	V	VV
0	+0.91	+0.91

④ Acet

M	H	0
HH	HH	H
V	V	V
+0.91	+0.91	1

$$\textcircled{1} \left(\frac{1}{2} \times 1 + \frac{1}{2} \times 0 + \frac{1}{2} \times 0 \right) = 0,5$$

$$\textcircled{2} \left(\frac{1}{2} \times 0 + \frac{1}{2} \times 0,97 \right) = 0,60$$

$$\textcircled{3} \left(\frac{1}{2} \times 0 + \frac{1}{2} \times 0,91 + \frac{1}{2} \times 0,91 \right) = 0,68$$

$$\textcircled{4} \left(\frac{1}{2} \times 0,91 + \frac{1}{2} \times 0,91 + \frac{1}{2} \times 1 \right) = 0,93$$

