

CP-March-18-2025

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A) Yes: 8

No: 4

Total: 12

$$P(\text{Yes}) = \frac{8}{12} = \frac{2}{3}$$

$$P(\text{No}) = \frac{4}{12} = \frac{1}{3}$$

$$\text{Gini (parent)} = 1 - \left[ \left( \frac{2}{3} \right)^2 + \left( \frac{1}{3} \right)^2 \right]$$

$$= 1 - \left[ \frac{4}{9} + \frac{1}{9} \right]$$

$$= 1 - \frac{5}{9}$$

$$= \frac{4}{9}$$

$$\approx 0.44$$

Outlook

Sunny: Days: (1, 2, 8, 9, 11)

Decisions: No, No, No, Yes, Yes

$$\text{Gini (Sunny)} = 1 - \left[ \left( \frac{3}{5} \right)^2 + \left( \frac{2}{5} \right)^2 \right]$$

$$= 1 - \left[ \frac{9}{25} + \frac{4}{25} \right]$$

$$= 1 - \frac{13}{25}$$

$$= 1 - \frac{13}{25} = 0.48$$

$$= 0.48$$

$$\therefore \text{Weighted by } \frac{5}{12} = \frac{5}{12} \times 0.48$$

$$= \frac{5}{12} \times 0.48 = 0.20$$

Gini (Overcast): Days: (3, 7, 12) Decisions: Yes, Yes, Yes

$$= 1 - \left[ \left( \frac{3}{3} \right)^2 + 0^2 \right] = 1 - 1 = 0$$

$$\text{Weighted by } \frac{3}{12} = \frac{3}{12} \times 0 = 0.$$



Rain: Days: (4, 5, 6, 10)

Decisions: Yes, Yes, No, Yes

$$Gini(Rain) = 1 - \left[ \left( \frac{3}{4} \right)^2 + \left( \frac{1}{4} \right)^2 \right]$$

$$= 1 - \left[ \frac{9+1}{16} \right]$$

$$= 1 - \frac{10}{16}$$

$$= \frac{16-10}{16}$$

$$= \frac{6}{16} = 0.375$$

weighted by  $\frac{4}{12} = \frac{4}{12} \times 0.375$

$$= 0.125$$

$$\text{Total Gini} = 0.20 + 0 + 0.125$$

$$= 0.325$$

$$Gini_{\text{gam}} = 0.44 - 0.325$$

$$= 0.115$$

$$Gini_{\text{for temperature}} \approx 0.076$$

$$Gini_{\text{for Humidity}} \approx 0.0555$$

$$Gini_{\text{for wind}} \approx 0.0277$$

$\therefore$  Outlook best root split.



→ Build tree

1. Overcast Branch

Days 3, 7, 12 → all yes  
→ pure leaf = Yes.

2. Sunny Branch

Days 1, 2, 8, 9, 11 → decisions (No, No, No, Yes, Yes)

• Humidity:

• High → Days 1, 2, 8 → all No → leaf = No.

• Normal → Days 9, 11 → both Yes → leaf = Yes.

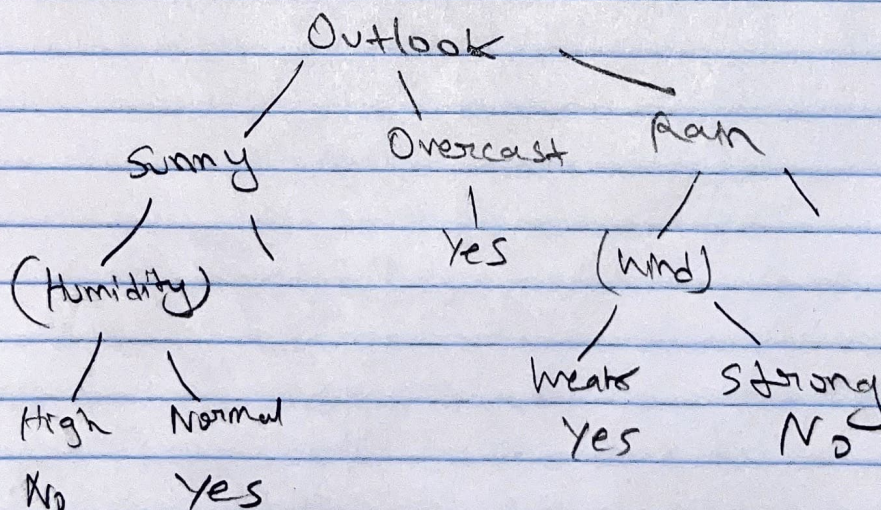
3. Rain branch

day 4, 5, 6, 10 → decisions: (Yes, Yes, No, Yes)

Wind

• weak → Days 4, 5, 10 → all yes → leaf = Yes

• strong → Day 6 → No → leaf = No



1. Sunny, Mild, High, Strong, No

2. Rain, Hot, Normal, Strong, No

3. Overcast, Mild, Normal, Weak, Yes.