

الف) برای هر کدام از ویژگی‌های زیر جدول گیندگی را حساب کنید:

Gini Index for Heavy :

$$Gini(Heavy=NO) = 1 - \left(\left(\frac{12}{15} \right)^2 + \left(\frac{3}{15} \right)^2 \right) = \frac{12}{15}$$

$$Gini(Heavy=Yes) = 1 - \left(\left(\frac{1}{4} \right)^2 + \left(\frac{3}{4} \right)^2 \right) = \frac{2}{9}$$

$$Gini(Heavy) = \frac{15}{18} \times \frac{12}{15} + \frac{3}{18} \times \frac{2}{9} = \frac{3}{10} + \frac{1}{9} = .1444$$

Gini Index for Spotted :

$$Gini(Spotted=NO) = 1 - \left(\left(\frac{12}{15} \right)^2 + \left(\frac{3}{15} \right)^2 \right) = \frac{12}{15}$$

$$Gini(Spotted=Yes) = 1 - \left(\left(\frac{1}{4} \right)^2 + \left(\frac{3}{4} \right)^2 \right) = \frac{2}{9}$$

$$Gini(Spotted) = \frac{15}{18} \times \frac{12}{15} + \frac{3}{18} \times \frac{2}{9} = .1444$$

Gini Index for Smooth :

$$Gini(Smooth=NO) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{1}{2}$$

$$Gini(Smooth=Yes) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{1}{2}$$

$$Gini(Smooth) = \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} = \frac{1}{2} + \frac{1}{4} = \frac{3}{4} = .75$$

لذا انتخاب می‌کنیم Gini آن کمترین است.

$$I(\text{parent}) = -\frac{3}{4} \log \frac{3}{4} - \frac{1}{4} \log \frac{1}{4} = 0.9182 + 0.3219 = 1.2401$$

$$I(\text{smooth} = \text{NO}) = -\frac{1}{2} \log \frac{1}{2} - \frac{1}{2} \log \frac{1}{2} = 1$$

$$I(\text{smooth} = \text{Yes}) = -\frac{3}{4} \log \frac{3}{4} - \frac{1}{4} \log \frac{1}{4} = 0.9182 + 0.3219 = 1.2401$$

~~Gain~~

$$\text{Gain}(\text{smooth}) = 1.2401 - \left(\frac{1}{2} \times 1 + \frac{1}{2} \times 1.2401 \right) = 1.2401 - 1.12005 = 0.11995$$

$$= 0.2175$$

class smooth = NO

Heavy	Spotted	Poisonous
NO	NO	NO
NO	Yes	NO
NO	Yes	Yes
Yes	NO	Yes

class smooth = Yes

Heavy	Spotted	Poisonous
Yes	NO	NO
Yes	NO	Yes
NO	Yes	Yes
NO	NO	Yes

Gini for Heavy:

$$\text{Gini}(\text{Heavy} = \text{NO}) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{2}{4}$$

$$\text{Gini}(\text{Heavy} = \text{Yes}) = 0$$

$$\text{Gini}(\text{Heavy}) = \frac{3}{4} \times \frac{2}{4} + \frac{1}{4} \times 0 = \frac{1}{4} = 0.25$$

Gini for spotted:

$$\text{Gini}(\text{Spotted} = \text{NO}) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{2}{4}$$

$$\text{Gini}(\text{Spotted} = \text{Yes}) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{2}{4}$$

$$\text{Gini}(\text{Spotted}) = \frac{1}{4} \times \frac{2}{4} + \frac{1}{4} \times \frac{2}{4} = 0.25$$

$$\text{Gini}(\text{Heavy} = \text{NO}) = 1 - 1 = 0$$

$$\text{Gini}(\text{Heavy} = \text{Yes}) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{2}{4}$$

$$\text{Gini}(\text{Heavy}) = \frac{1}{2} \times \frac{2}{4} + \frac{1}{2} \times 0 = 0.25$$

$$\text{Gini}(\text{Spotted} = \text{NO}) = 1 - \left(\left(\frac{1}{2} \right)^2 + \left(\frac{1}{2} \right)^2 \right) = \frac{2}{4}$$

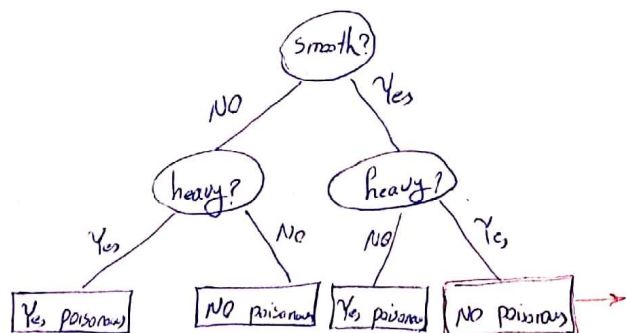
$$\text{Gini}(\text{Spotted} = \text{Yes}) = 0$$

$$\text{Gini}(\text{Spotted}) = \frac{3}{4} \times \frac{2}{4} + \frac{1}{4} \times 0 = 0.75$$

Heavy انتاب

Heavy انتاب

لذا حاد انه على نفس القسم واهم

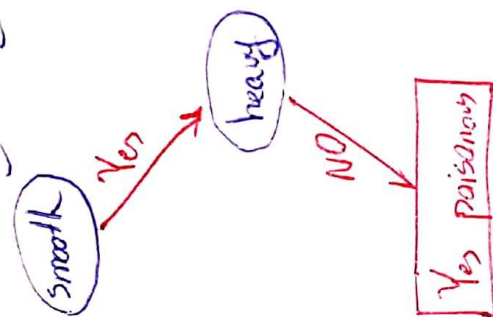


ليس
صافي
انتاب

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طردی سمی‌پای (آ) عبارت از $Smooth = No, Heavy = No$ $Smooth = Yes$

مثال در دقت تصمیم‌گیری:



پایه به دقت تصمیم این نوع مدار نمی‌تواند