



Inspiring Excellence

Assignment: 01

Course Code: CSE427

Date of Submission: 07-12-2025

Name: YASIR

Department: Computer Science & Engineering

Student ID: 23101122

Section: 04

for

"Student";

$$\text{Gini (Junior)} = \frac{5}{10} \left\{ 1 - \left(\frac{2}{5}\right)^2 - \left(\frac{1}{5}\right)^2 - \left(\frac{2}{5}\right)^2 \right\}$$
$$= 0.64 \times \frac{5}{10} = 0.32$$

$$\text{Gini (Senior)} = \frac{5}{10} \left\{ 1 - \left(\frac{4}{5}\right)^2 - \left(\frac{1}{5}\right)^2 \right\}$$
$$= 0.32 \times \frac{5}{10} = 0.16$$

$$\therefore \text{Gini (Student)} = 0.32 + 0.16$$
$$= 0.48$$

for

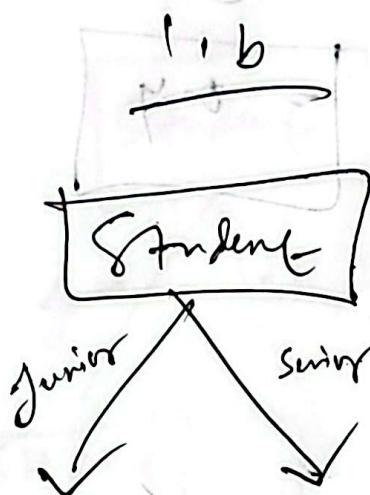
"Department";

$$\text{Gini (CSE)} = \frac{5}{10} \left\{ 1 - \left(\frac{3}{5}\right)^2 - \left(\frac{1}{5}\right)^2 - \left(\frac{1}{5}\right)^2 \right\}$$
$$= 0.28$$

$$\text{Gini (EEE)} = \frac{5}{10} \left\{ 1 - \left(\frac{2}{5}\right)^2 - \left(\frac{1}{5}\right)^2 - \left(\frac{2}{5}\right)^2 \right\}$$
$$= 0.32$$

$$Gini(\text{Department}) = 0.32 + 0.28 \boxed{0.60} \quad (\text{min})$$

$\frac{1}{2} + \left\{ \left(\frac{1}{2} \right) \cdot \left(\frac{1}{2} \right) - 1 \right\} \frac{1}{2} = \text{Student} \rightarrow H2$



"min2" &

$$\frac{1}{2} + \left\{ \left(\frac{1}{2} \right) \cdot \left(\frac{1}{2} \right) - 1 \right\} \frac{1}{2} = \text{Instructor} \quad (\text{min})$$

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

$$\left\{ \left(\frac{1}{2} \right) \cdot \left(\frac{1}{2} \right) - 1 \right\} \frac{1}{2} = \left\{ 1 - \frac{1}{4} \right\} \frac{1}{2} = 0.14 \quad (\text{min})$$

$$Gini(SH \angle 2.75) = \frac{1}{5} \left(1 - 1 \right) + \frac{4}{5} \left(1 - \left(\frac{2}{5} \right)^2 - 2 \left(\frac{1}{5} \right) \right)$$

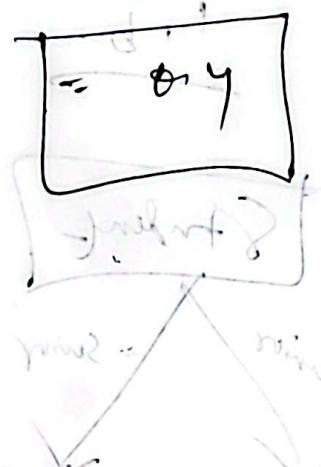
$$\left\{ 1 - 1 \right\} \frac{1}{2} + \left\{ \left(\frac{1}{5} \right) \cdot \left(\frac{1}{5} \right) - 1 \right\} \frac{1}{5} = 0.15 \quad (\text{min})$$

$$Gini(SH \angle 3.5) = \frac{2}{5} \left\{ 1 - \left(\frac{1}{2} \right) - \left(\frac{1}{2} \right) \right\} + \frac{3}{5} \left\{ 1 - 3 \left(\frac{1}{3} \right) \right\}$$

$$\left\{ 1 - 1 \right\} \frac{1}{2} + \left\{ \left(\frac{1}{3} \right) \cdot \left(\frac{1}{3} \right) - 1 \right\} \frac{1}{3} = 0.16 \quad (\text{min})$$

$$\text{Given } (S+L+U) = 0.6$$

$$\text{Given } (S+L+U \cdot S) = \frac{4}{5} \left\{ 1 - \left(\frac{2}{5} \right)^2 - \left(\frac{2}{5} \right)^2 \right\} + \frac{1}{5} (1-1)$$



For "Senior":

$$\text{Given (Department)} = \frac{3}{5} \left\{ 1 - \left(\frac{1}{3} \right)^2 - \left(\frac{2}{3} \right)^2 \right\} + \frac{2}{5} (1-1)$$

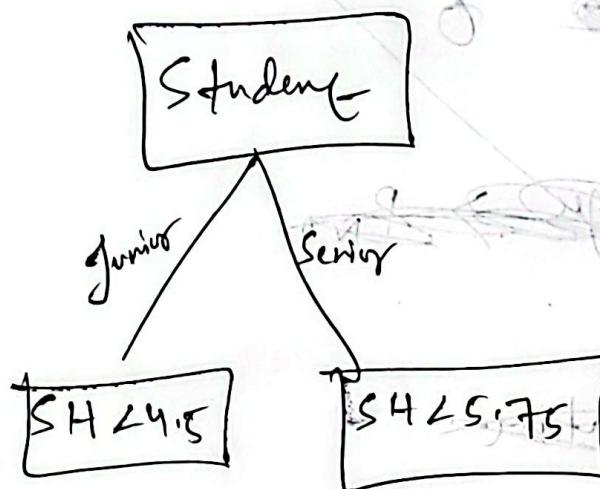
$$= 0.22$$

$$S+L+U \cdot S = \frac{1}{5} \left\{ 1-1 \right\} + \frac{4}{5} \left\{ 1 - \left(\frac{2}{5} \right)^2 - \left(\frac{2}{5} \right)^2 \right\}$$

$$S+L+U \cdot S = \frac{2}{5} \left\{ 1 - 2 \left(\frac{1}{2} \right)^2 \right\} + \frac{3}{5} \left\{ 1-1 \right\}$$

$$S+L+U \cdot S = \frac{3}{5} \left\{ 1 - \left(\frac{2}{3} \right)^2 - \left(\frac{1}{3} \right)^2 \right\} + \frac{2}{5} (1-1) = 0.27$$

$$SH \leq 7.5 = \frac{4}{5} \left\{ 1 - \left(\frac{3}{4} \right)^5 - \left(\frac{1}{4} \right)^5 \right\} + \frac{1}{5} \left\{ 1 - 1 \right\}$$



$P(\text{Yes} | 99^\circ\text{F, Cough, Antibiotic, Female})$

$$= P(99^\circ\text{F} | \text{Yes}) \times P(\text{Cough} | \text{Yes}) \times P(\text{Antibiotic} | \text{Yes}) \times P(\text{Female} | \text{Yes})$$

$$= \frac{2}{5} \times \frac{1}{5} \times \frac{1}{5} \times \frac{4}{5} \times \frac{5}{10} = \frac{4}{625} = 6.4 \times 10^{-3}$$

Here

as $P(99/N) = 0.$

For "no" values = $(103, 102, 100, 104, 101)$

$\therefore \text{Mean, } M = 102$

$\therefore \text{Variance, } \sigma^2 = \frac{(103-102)^2 + (102-102)^2 + (100-102)^2 + (104-102)^2 + (101-102)^2}{5}$

$\Rightarrow \sigma^2 = 2$

$\Rightarrow \sigma = \sqrt{2} = 1.41$

6

$$\begin{aligned}
 P(99/N) &= \frac{1}{\sigma \sqrt{2\pi}} e^{-\left(\frac{(99-102)^2}{2 \times 2}\right)} \\
 &= \frac{1}{1.41 \times \sqrt{2\pi}} e^{-\left(\frac{(99-102)^2}{4}\right)} \\
 &= 0.0298
 \end{aligned}$$

$\therefore p(N|99, \text{cough, Antibiotic, Female})$

$$= P(99/N) \times p(\text{cough}/N) \times p(\text{Antib}/N) \times p(\text{Female})$$

$$= 0.0298 \times \frac{2}{5} \times \frac{3}{5} \times \frac{1}{5} \times \frac{9}{10} = 7.15 \times 10^{-4}$$

$$\Rightarrow 0.72 \times 10^{-3}$$

$P(\text{Yes}) > P(\text{No})$

The patient is more likely to recover.

The patient will recover.

From the report.

The only side effect is diarrhea.

Initial Guess:

Ex5 : Cough = Yes (as at another "Yes" target variable, it's "Yes")

$$\text{Percentage} = \frac{94 + 92}{2} = 93 \quad [\text{at "yes"}]$$

$$\text{Age} = \frac{30 + 35}{2} = 37.5$$

for "Cough":

$$\therefore \text{For Yes} = \frac{3}{4} \times \frac{0.25 + 0.4 + 0.1}{0.15 + 0.35 + 0.4 + 0.1}$$

$$= \boxed{0.293}$$

$$\therefore \text{No} = \frac{1}{4} \times \frac{0.15}{0.15 + 0.35 + 0.4 + 0.1}$$

$$= 0.038$$

revised "Cough" = Yes

$$\begin{aligned}
 \text{for Percentage} &= \left(98 \times \frac{0.15}{0.1} \right) + \\
 &\quad \left(94 \times \frac{0.35}{0.15 + 0.35 + 0.4 + 0.1} \right) + \\
 &\quad \left(92 \times \frac{0.4}{0.15 + 0.35 + 0.4 + 0.1} \right) + \\
 &\quad \left(96 \times \frac{(1.1 + 1.2) - 1}{0.15 + 0.35 + 0.4 + 0.1} \right) \quad \text{in } \boxed{1} \\
 &= \frac{14.7}{10} + \frac{32.9}{10} + \frac{18.4}{5} + \frac{98}{5}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \boxed{94} \times \left\{ \frac{(1.1 + 1.2) - 1}{0.15 + 0.35 + 0.4 + 0.1} \right\} \quad \text{in } \boxed{2} \\
 \xrightarrow{\text{revised value}} \boxed{94}
 \end{aligned}$$

$$\begin{aligned}
 \text{For Age} &= (92 \times 0.15) + 30 \times 0.35 + \\
 &\quad 45 \times 0.4 + 26 \times 0.1 = 34.6 \quad \text{in } \boxed{3}
 \end{aligned}$$

$$\boxed{94} \times \left\{ \frac{(1.1 + 1.2) - 1}{0.15 + 0.35 + 0.4 + 0.1} \right\} \xrightarrow{\text{revised age}} \boxed{34.6}$$

9.

S.A

$$\text{Initial weight} = \frac{1 \times 80}{10} = 80 \text{ kg}$$

$$140 + 28 + 21$$

$$x 50 +$$

S.B

$$280 \times 100$$

$$\text{Gini (Color)} = \frac{4}{10} \left\{ 1 - \left(\frac{3}{4} \right)^2 - \left(\frac{1}{4} \right)^2 \right\} + \frac{3}{10} \left\{ 1 - \left(\frac{2}{3} \right)^2 - \left(\frac{1}{3} \right)^2 \right\} + \frac{3}{10} (1-1)$$

PM
01 01

$$= 0.28$$

$$\text{Gini (Device)} = \frac{5}{10} \left\{ 1 - \left(\frac{2}{3} \right)^2 - \left(\frac{1}{3} \right)^2 \right\} + \frac{5}{10} \left\{ 1 - \left(\frac{2}{5} \right)^2 - \left(\frac{3}{5} \right)^2 \right\}$$

PM
0.48

$$\text{Gini (Se. C28)} = 0.15 \times 25 + 0.85 \times 25$$

$$\text{Gini (Se. C29)} = \frac{2}{10} \left\{ 1 - 1 \right\} + \frac{8}{10} \left\{ 1 - \left(\frac{5}{8} \right)^2 - \left(\frac{3}{8} \right)^2 \right\}$$

0.38

$$\text{Given } (\text{sc} < 30) : \boxed{0.38} \quad \text{(initial value)}$$

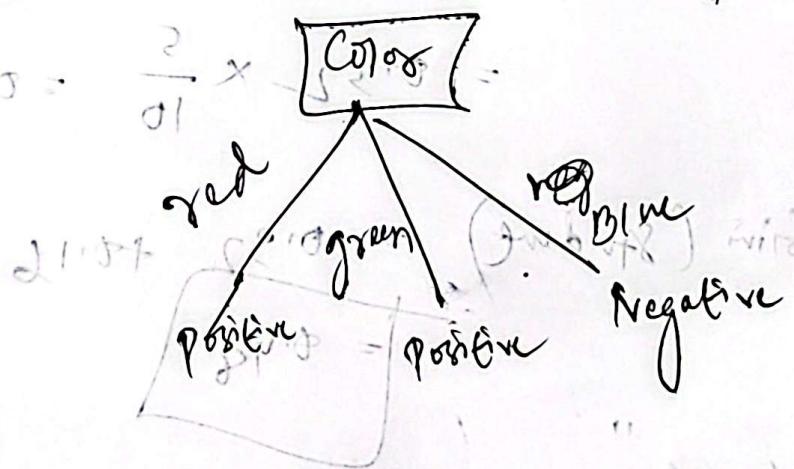
$$\begin{aligned} \text{Given } (\text{sc} < 32.5) &= \frac{9}{10} \left\{ 1 - \left(\frac{1}{4} \right)^2 - \left(\frac{3}{4} \right)^2 \right\} + \frac{6}{10} \left\{ 1 - \left(\frac{4}{6} \right)^2 - \left(\frac{2}{6} \right)^2 \right\} \\ &= 0.42 \end{aligned}$$

$$\text{Given } (\text{sc} < 35) = 0.42$$

$$\begin{aligned} \text{Given } (\text{sc} < 38.5) &= \frac{7}{10} \left\{ 1 - \left(\frac{3}{2} \right)^2 - \left(\frac{4}{7} \right)^2 \right\} + \frac{3}{10} \left\{ 1 - \left(\frac{5}{3} \right)^2 - \left(\frac{1}{3} \right)^2 \right\} \\ &= 0.48 \end{aligned}$$

$$\text{Given } (\text{sc} < 41.2) = 0.48 \quad \text{Final value}$$

Stump:



$$\begin{aligned} \text{Amount of say} &= \frac{1}{2} \ln \left(\frac{1 - TE}{TE} \right) \quad \text{Total error, } TE = 1 \times \frac{1}{10} + 1 \times \frac{1}{10} \\ &= 0.12 \\ &= 0.69 \end{aligned}$$

ξ, d

→ updated:

$$\text{weights for correctly classified} = \frac{1}{10} \times e^{-\ln 2}$$

$$= 0.05$$

$$\text{weights for incorrectly classified} = \frac{1}{10} \times e^{\ln 2}$$

$$\frac{0.1}{0.1+1} + \frac{0.2}{0.2+1} = 0.2$$

$$\frac{0.1}{0.1+1} = 0.05$$

Cross entropy loss function:

$$= -\frac{1}{n} \sum_{i=1}^n (y_i \log \hat{y}_i + (1-y_i) \log(1-\hat{y}_i))$$

$$z = w_1 m_1 + w_2 m_2 + b$$

$$\hat{y} = \sigma(z) = \frac{1}{1 + e^{-z}}$$

$$\frac{dL}{dw_1} = \frac{dL}{dy} \times \frac{\hat{y}}{dz} \times \frac{dz}{dw_1} \quad \text{reg. step 1} \quad \textcircled{1}$$

$$\frac{dL}{dy} = -\frac{y}{\hat{y}} - \frac{1-y}{1+\hat{y}} \frac{d}{dy}(1+y)$$

$$= -\frac{y}{\hat{y}} + \frac{1-y}{1+\hat{y}}$$

$$= \frac{\hat{y}-y}{\hat{y}(1+y)}$$

$$\frac{d\hat{y}}{dz} = (\hat{y}) \frac{d}{dz} (1 + e^{-z})$$

$$= (-1) \times (1 + e^{-z})^{-2} \times \frac{d}{dz} (1 + e^{-z})$$

$$= e^{-z} \times \frac{1}{(1 + e^{-z})^2}$$

$$\begin{aligned}
 &= e^{-z} \times (\hat{y})^z \times (1-\hat{y})^{1-z} \\
 &= \frac{1-\hat{y}}{\hat{y}} \times (\hat{y})^z \\
 &= \hat{y} (1-\hat{y})
 \end{aligned}$$

$$\hat{y} = \frac{1}{1+e^{-z}}$$

$$\begin{aligned}
 \Rightarrow \hat{y} e^{-z} &= 1 - \hat{y} \\
 \Rightarrow e^{-z} &= \frac{1-\hat{y}}{\hat{y}}
 \end{aligned}$$

$$\frac{dz}{dw_1} = m_1$$

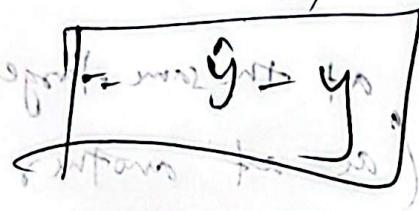
① \Rightarrow

$$\frac{dL}{dw_1} = \frac{\hat{y}-y}{\hat{y}(1-\hat{y})} \times \hat{y}(1-\hat{y}) \times m_1$$

$$= (\hat{y}-y) m_1$$

$$\begin{aligned}
 \frac{dL}{db} &= \frac{dL}{dy} \times \frac{dy}{dz} \times \frac{dz}{db} \quad - ⑪ \\
 &= (\hat{y}-y) \times \frac{dz}{db}
 \end{aligned}$$

$$= (\hat{y} - y) \times 1$$



total error = sum of individual errors

$\Sigma e_i^2 = \text{sum of } (y_i - \hat{y}_i)^2$

$$\frac{d\hat{y}}{dy_2} = \frac{\partial L}{\partial \hat{y}} \times \frac{dy}{dy_2} \times \frac{d2}{dy_2}$$

"dL" to $L_{EP} = \frac{1}{n} \sum \hat{y} - y$

similarly repeat $(\hat{y} - y) \times \alpha_2$

Diagram showing a rectangle with width labeled "y" and height labeled " $\hat{y} - y$ ". A bracket below the rectangle indicates its width is "y".

$= \alpha_2$

d11

$$\frac{10 + 15 + 20 + 25 + 30}{5} \times \frac{1}{2} = 25 \text{ kg}$$

Diagram showing a rectangle with width labeled "y" and height labeled " $\hat{y} - y$ ". A bracket below the rectangle indicates its width is "y".

$$\frac{10 + 15 + 20 + 25 + 30}{5} \times \frac{1}{2} = 25 \text{ kg}$$

$\Rightarrow 25 \text{ kg}$

total error = sum of individual errors