Assignment - 7

19K41A0539

Draw a decision tree diagram to predict number of hours to play based on weather conditions like outlook, temperature, humidity, windy. Consider dataset shown below.

outlook	Temperature	Humidity	windy	Hours to play?
Rainy	Hot	high	False	25
Rainy	Hot	high	True	30
Overcast	Hot	high	False	46
Sunny	mild	high	False	45
Sunny	cool	normal	False	57
Overcast	cool	normal	True	43
Rainy	mild	high	False	35
Rainy	cool	normal	False	38
Sunny	mild	normal	False	46
Rainy	mild	normal	True	48
Overcast	mild	high	True	52
Overcast	Hot	normal	False	44
Sunny	mild	high	True	30
Sunny	cool	normal	True	23.

539

10

44

30

Termination criteria: CV <= 10% or minimum number of samples

Calculating Mean, standard deviation (SD), co-efficient of variation (CV)

$$\text{Mean} = \frac{\Sigma x}{n} = \frac{557}{14} = 39.78$$

$$SD = \sqrt{\frac{\Sigma (x-\text{mean})^2}{n}} = 9.67$$

$$CV = \frac{SD}{\text{mean}} \times 100 = \frac{9.67}{39.78} \times 100 = 24.30$$

Now, dataset is split into different attributes the SD of each branch is calculated.

$$SD_{(attr)} = \Sigma w(\text{branch}) \cdot SD(\text{branch})$$

and the result SDR (standard derivation reduction) is calculated.

$$SDR = SD - SD(attr)$$

$$\because SD = 9.67$$

outlook:-

outlook	mean	SD	CV	n	w(v)
Rainy	35.2	8.7	24.7	5	5/14
Overcast	18.25	4.03	8.72	4	4/14
Sunny	39.2	12.2	81.0	5	5/14

$$\therefore SD(\text{outlook}) = 5/14 * 8.7 + \frac{4}{14} * 4.03 + \frac{5}{14} * 12.2 = 8.59$$

$$SDR(\text{outlook}) = SD - SD(\text{outlook}) = 9.67 - 8.59 = 1.08.$$

mperature:-

Temperature	mean	SD	CV	n	w(v)
Hot	36.25	10.34	30.6	4	4/14
cod	39	12.14	31.1	4	4/14
mild	42.6	8.38	19.65	6	6/14

∴ SD (temperature) = 4/14 * 10.34 + 4/14 * 12.14 + 6/14 * 8.38 = 10.01

SDR (temperature) = SD − SD (temperature) = 9.67 − 10.01

= −0.34

Humidity:-

Humidity	mean	SD	CV	n	w(Hv)
High	37.51	10.11	26.92	7	7/14
Normal	42	9.4	22.4	7	7/14

∴ SD (humidity) = $\frac{7}{14}$ × 10.11 + $\frac{7}{14}$ × 9.4 = 9.77

SDR (humidity) = SD − SD (humidity)

= 9.67 − 9.77 = −0.1

Windy:-

Windy	mean	SD	CV	n	w(v)
True	37.6	11.6	308	6	6/14
False	41.3	8.41	20.3	8	8/14

∴ SD (windy) = 6/14 * 11.6 + 8/14 * 8.41 = 9.77

SDR (windy) = SD − SD (windy) = 9.67 − 9.77 = −0.1

SDR (outlook) = 1.08

SDR (temperature) = -0.34

SDR (Humidity) = -0.1

SDR (windy) = -0.1

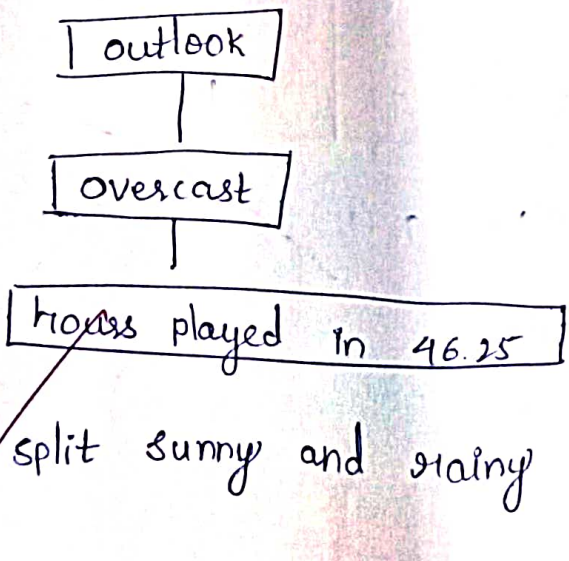
The value that has highest SDR is considered as node (i.e, decision node)

considering termination criteria

cv is 10% or cv is (n≤4)

outlook

overcast has cv of c% which is less than threshold value therefore, we need not go for further splitting



we need to split sunny and rainy columns

Sunny:-

outlook	Temperature	Humidity	Windy	Hours played
sunny	wild	high	False	45
sunny	cool	normal	False	52
sunny	cool	normal	True	23
sunny	mild	normal	False	46
sunny	mild	high	True	30.

∴ mean = 39.2

SD = 12.2

CV = 31.0

Temperature:-

Temperature	mean	SD	CV	n	w(v)
mild	40.3	8.96	22.23	3	3/5
cold	35.5	20.50	54.66	2	2/5.

$SD(\text{temperature}) = \frac{3}{5} \times 8.96 + \frac{2}{5} \times 20.50$

$= 13.576$

$SDR(\text{temperature}) = SD - SD(\text{temp})$

$= 12.2 - 13.576 = -1.37.$

Humidity:-

Humidity	Mean	SD	CV	n	w(v)
high	37.5	10.6	28.26	2	2/5
normal	40.3	15.30	37.96	3	3/5

$SD(\text{humidity}) = \frac{2}{5} \times 10.6 + \frac{3}{5} \times 15.30$

$= 13.42$

$SDR(\text{Humidity}) = SD - SD(\text{humidity})$

$= 12.2 - 13.42$

$= -1.22.$

windy..

windy	Mean	SD	CV	n	w(v)
False	47.66	3.78	7.94	3	3/5
True	26.5	4.94	18.65	2	2/5

$$SD(windy) = \frac{3}{5} \times 3.78 + 2/5 \times 4.94$$

$$= 4.23$$

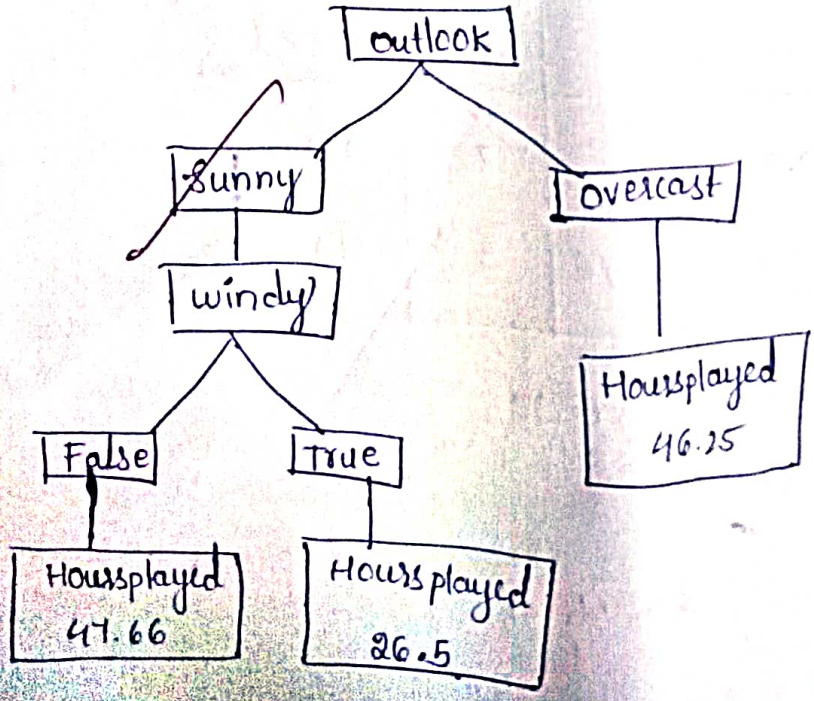
$$SDR(windy) = SD - SD(windy)$$

$$= 12.2 - 4.23 = 7.97$$

In outlook, among temperature, humidity and windy SDR value is high for windy SDR = 7.97

Then, check for cv value

both true and false satisfy the cv value.



Rainy:-

outlook	Temperature	Humidity	windy	Hoursplayed.
Rainy	hot	high	false	25
Rainy	hot	high	True	30
Rainy	mild	high	false	35
Rainy	cool	normal	false	35
Rainy	mild	normal	True	48.

mean = 35.2, SD = 8.7, CV = 24.7

Temperature:-

Temp	Mean	SD	CV	n	w(v)
Hot	27.5	3.53	12.83	2	2/5
mild	41.5	9.19	22.144	2	2/5
cool	38	0	0	1	1/5.

$$SD(temp) = \frac{2}{5} \times 3.53 + \frac{2}{5} \times 9.19 + \frac{1}{5} \times 0$$

$$= 5.088.$$

$$SDD(temperature) = SD - SD(temp)$$

$$= 8.7 - 5.068$$

$$= 3.612.$$

Humidity.

Humidity	mean	SD	CV	n	w(v)
High	30	5	16.66	3	3/5
normal	43	7.01	16.44	2	2/5

$$SD(\text{humidity}) = \frac{3}{5} \times 5 + \frac{2}{5} \times 7.01 = 5.828$$

$$SDR(\text{humidity}) = SD - SD(\text{humidity})$$
$$= 8.7 - 5.828$$
$$= 2.872.$$

windy

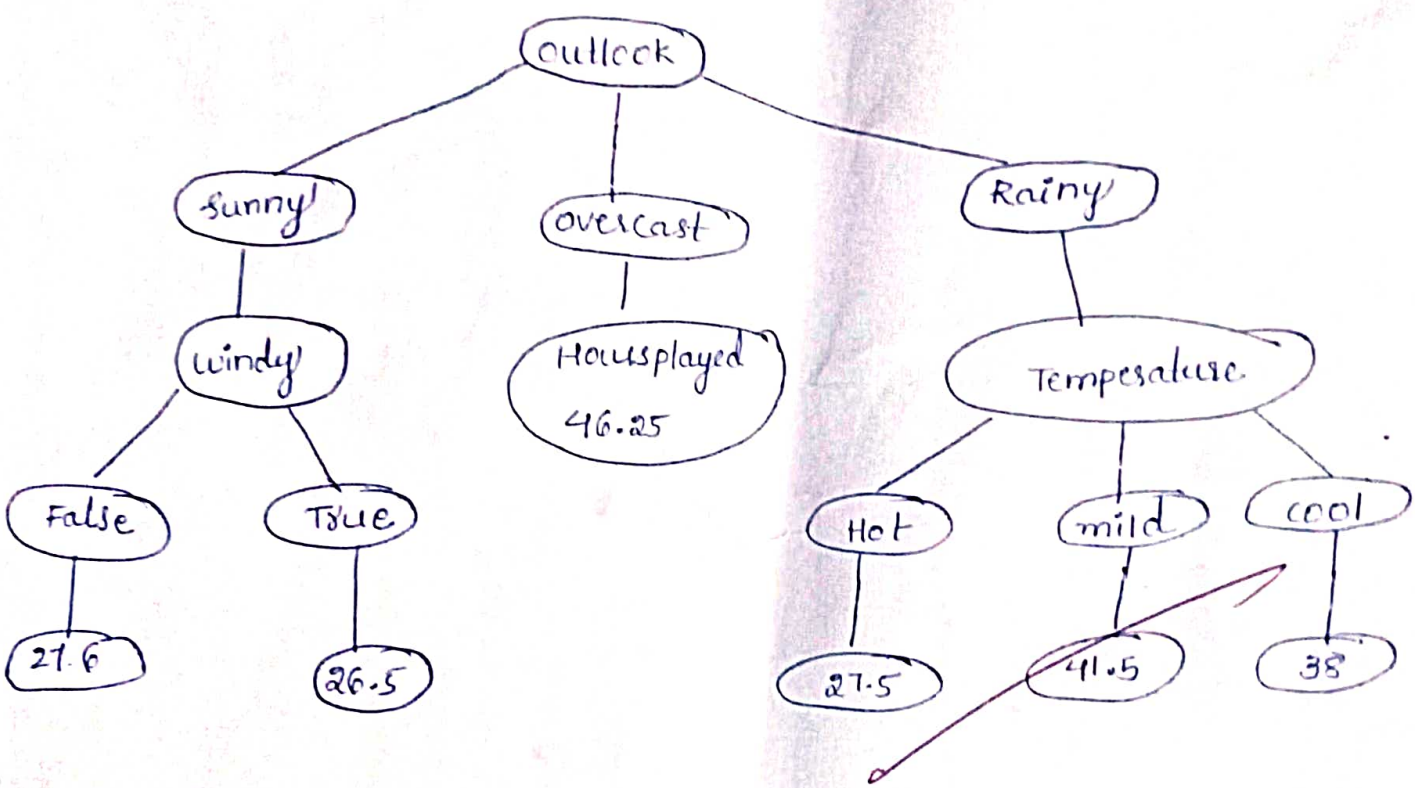
windy	Mean	SD	CV	n	w(v)
False	32.66	6.80	20.85	3	3/5
True	39	12.72	32.5	2	2/5

$$SD(\text{windy}) = \frac{3}{5} \times 6.80 + \frac{2}{5} \times 12.72$$
$$= 9.168.$$

$$SDR(\text{windy}) = SD - SD(\text{windy})$$
$$= 8.7 - 9.168$$
$$= -0.468.$$

Among temperature humidity and windy the SDR value is high for temperature (1.5, 3.612) Then check for cv value of hot, mild, cold satisfy the cv value.

Desicion tree diagram to predict number of hours to play based on weather conditions.



18/4/24