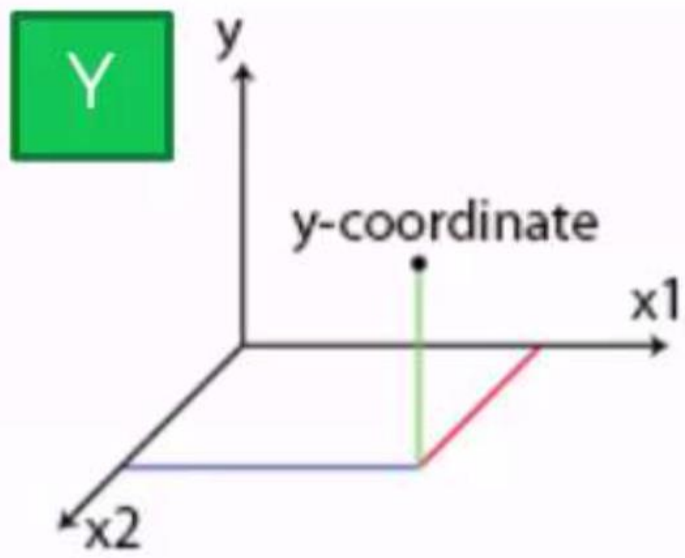
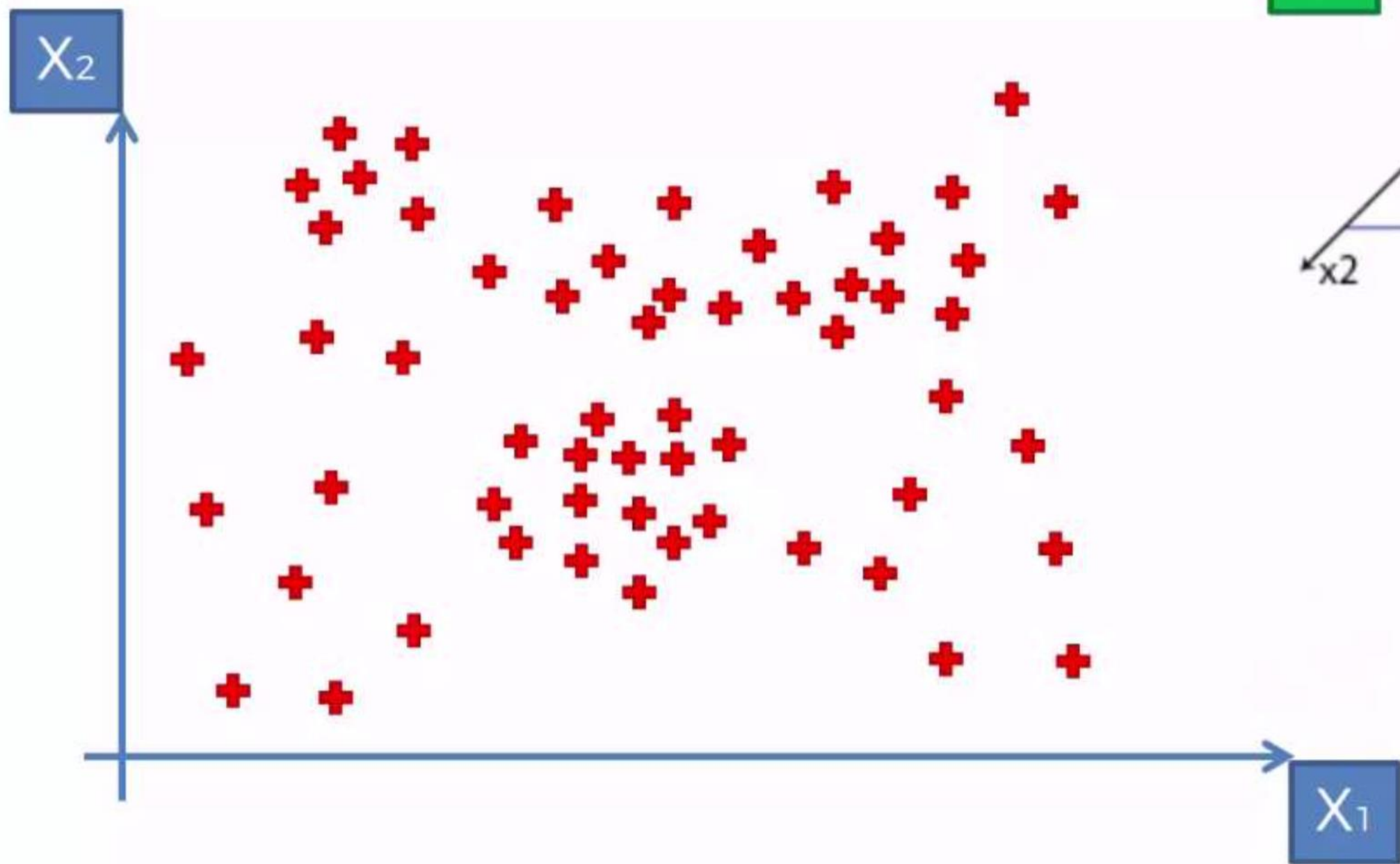
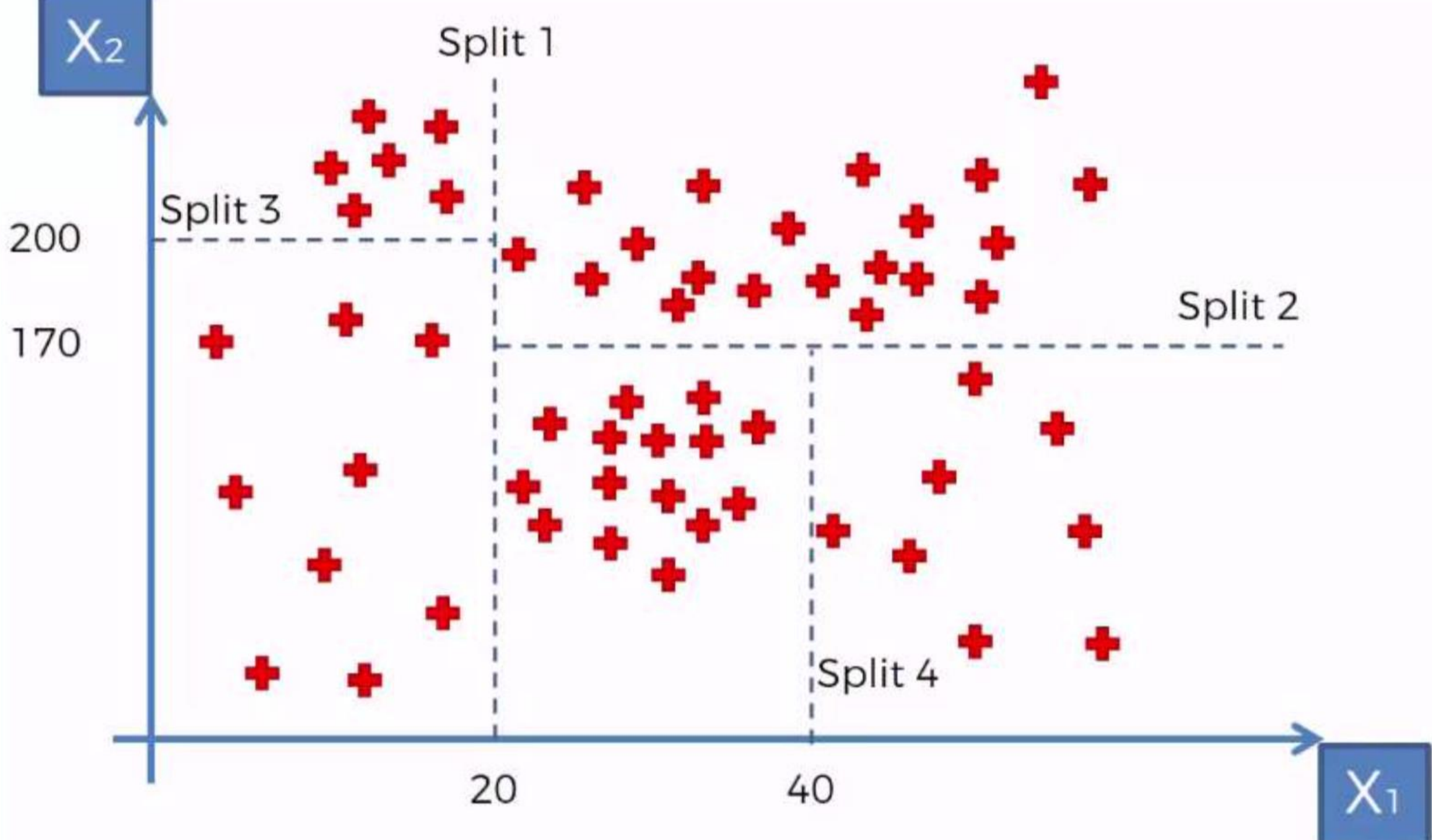


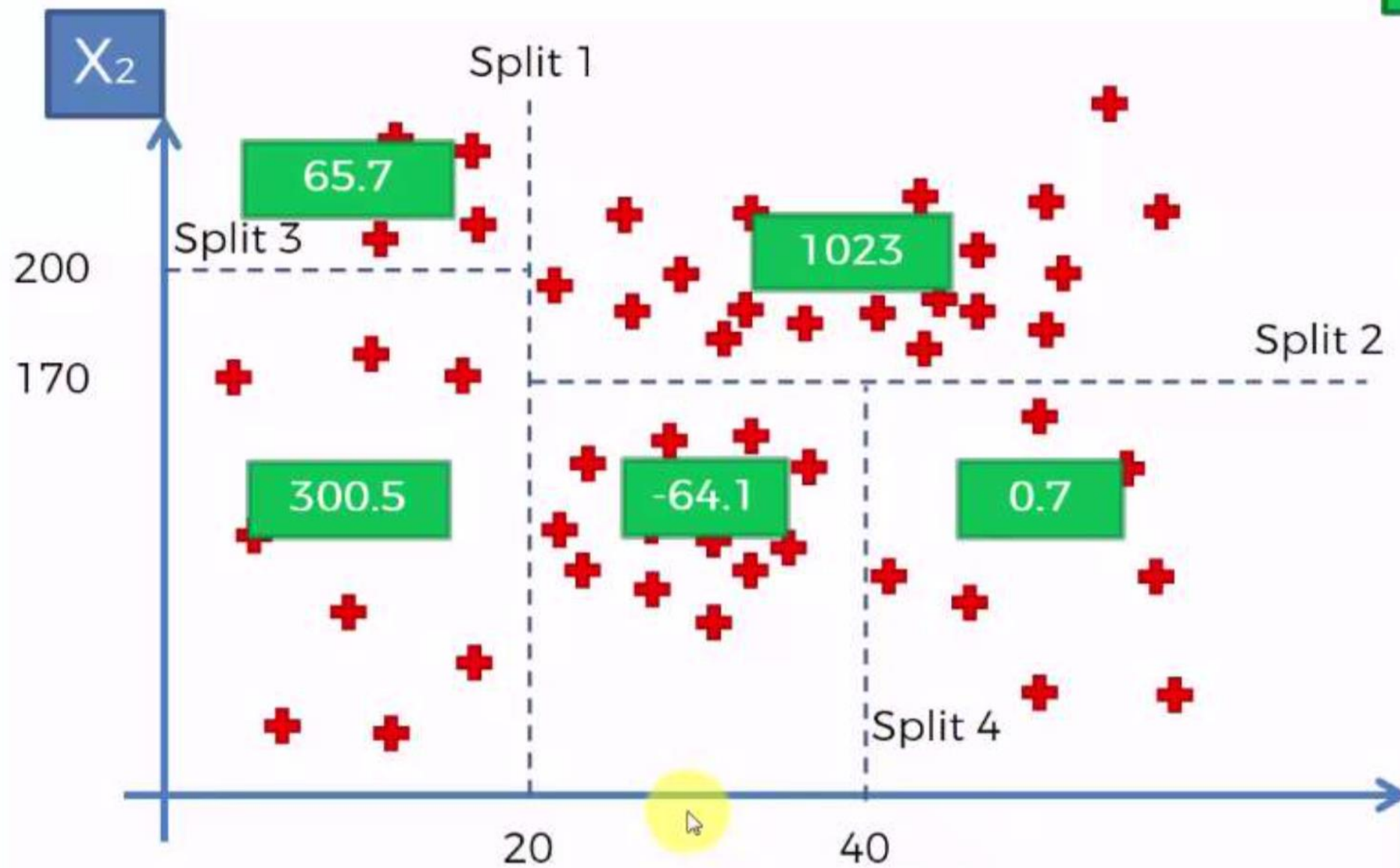
Decision Tree Regression

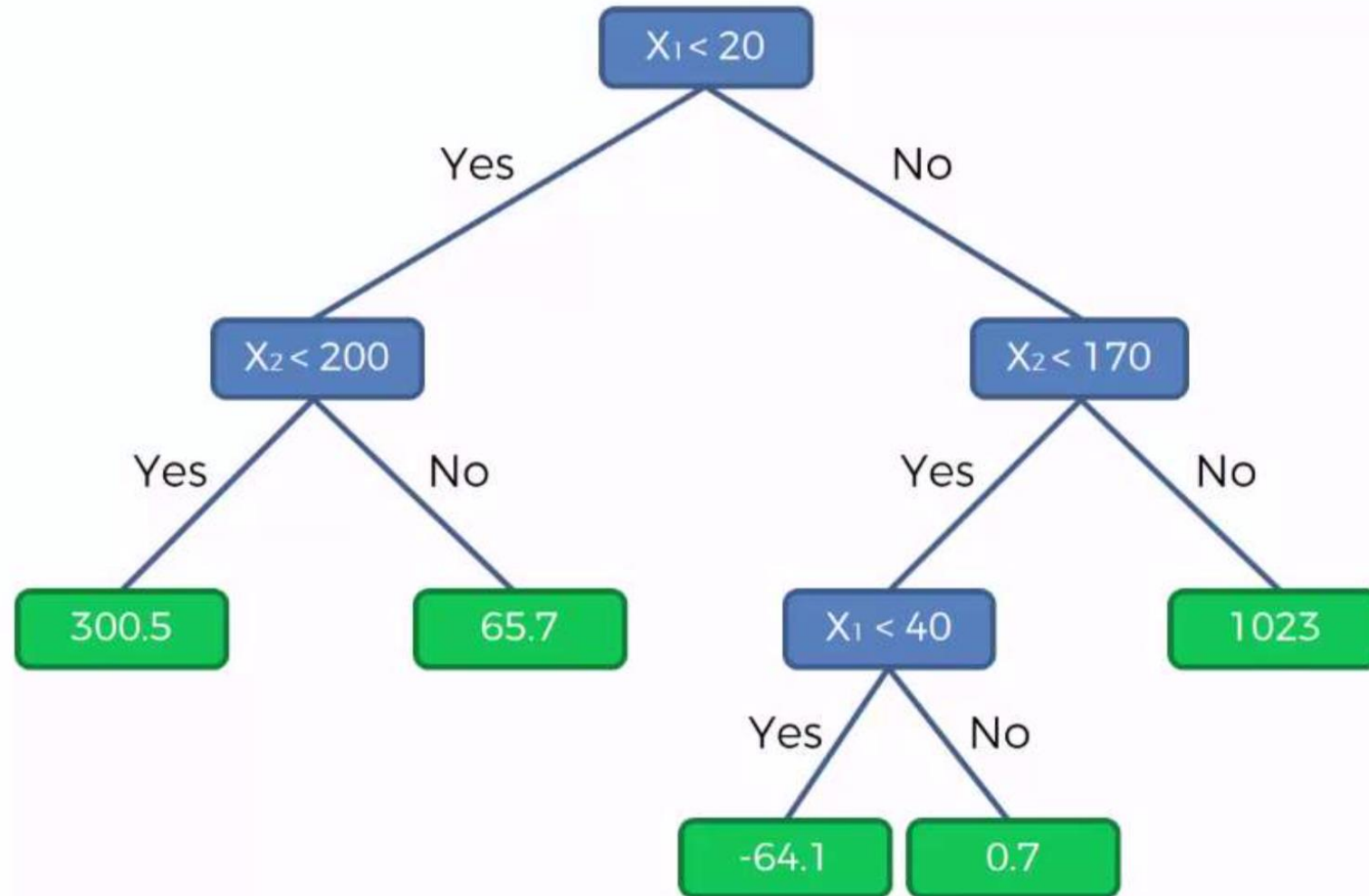
Predictors				Target
Outlook	Temp.	Humidity	Windy	Hours Played
Rainy	Hot	High	False	26
Rainy	Hot	High	True	30
Overcast	Hot	High	False	48
Sunny	Mild	High	False	46
Sunny	Cool	Normal	False	62
Sunny	Cool	Normal	True	23
Overcast	Cool	Normal	True	43
Rainy	Mild	High	False	36
Rainy	Cool	Normal	False	38
Sunny	Mild	Normal	False	48
Rainy	Mild	Normal	True	48
Overcast	Mild	High	True	62
Overcast	Hot	Normal	False	44
Sunny	Mild	High	True	30



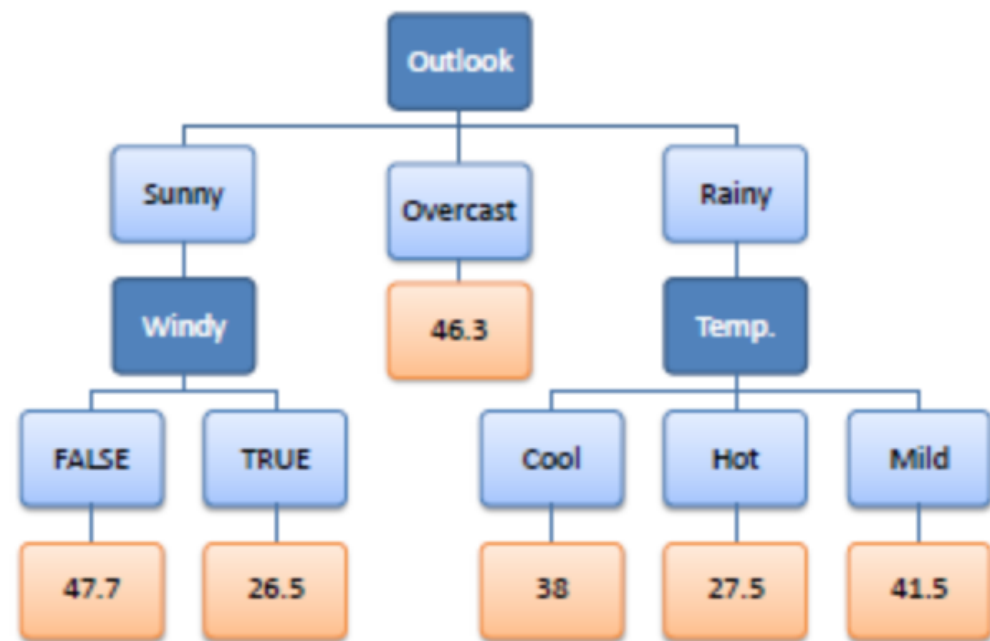


The value in green box represents the average of data points in that split





Predictors				Target
Outlook	Temp.	Humidity	Windy	Hours Played
Rainy	Hot	High	False	26
Rainy	Hot	High	True	30
Overcast	Hot	High	False	48
Sunny	Mild	High	False	46
Sunny	Cool	Normal	False	62
Sunny	Cool	Normal	True	23
Overcast	Cool	Normal	True	43
Rainy	Mild	High	False	36
Rainy	Cool	Normal	False	38
Sunny	Mild	Normal	False	48
Rainy	Mild	Normal	True	48
Overcast	Mild	High	True	62
Overcast	Hot	Normal	False	44
Sunny	Mild	High	True	30



Hours Played
25
30
46
45
52
23
43
35
38
46
48
52
44
30



$$\text{Count} = n = 14$$

$$\text{Average} = \bar{x} = \frac{\sum x}{n} = 39.8$$

$$\text{Standard Deviation} = S = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = 9.32$$

$$\text{Coefficient of Variation} = CV = \frac{S}{\bar{x}} * 100\% = 23\%$$

$$S(T, X) = \sum_{c \in X} P(c)S(c)$$

		Hours Played (StDev)	Count
Outlook	Overcast	3.49	4
	Rainy	7.78	5
	Sunny	10.87	5
			14



$$\begin{aligned}
 S(\text{Hours}, \text{Outlook}) &= P(\text{Sunny}) * S(\text{Sunny}) + P(\text{Overcast}) * S(\text{Overcast}) + P(\text{Rainy}) * S(\text{Rainy}) \\
 &= (4/14) * 3.49 + (5/14) * 7.78 + (5/14) * 10.87 \\
 &= 7.66
 \end{aligned}$$

		Hours Played (StDev)
Outlook	Overcast	3.49
	Rainy	7.78
	Sunny	10.87
SDR=1.66		

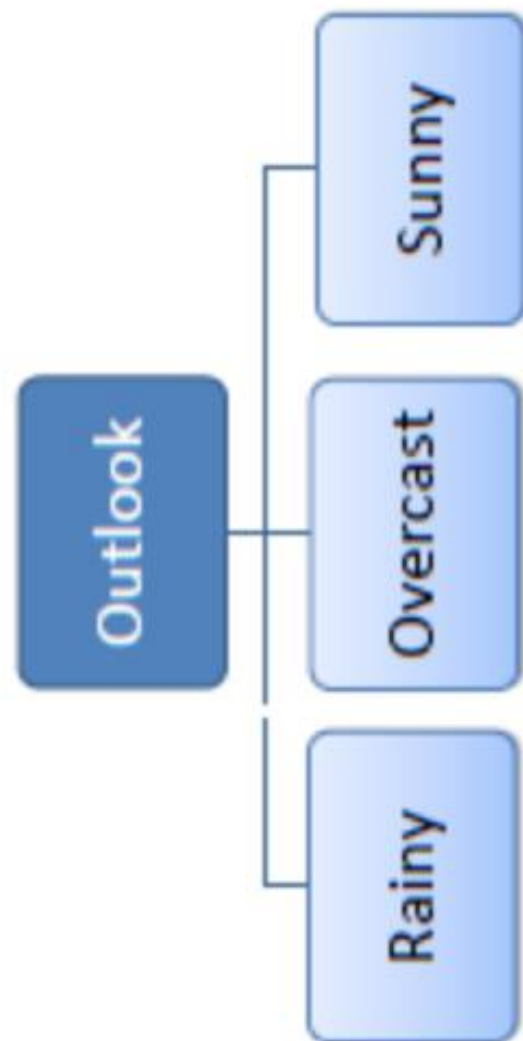
		Hours Played (StDev)
Temp.	Cool	10.51
	Hot	8.95
	Mild	7.65
SDR=0.17		

		Hours Played (StDev)
Humidity	High	9.36
	Normal	8.37
SDR=0.28		

		Hours Played (StDev)
Windy	False	7.87
	True	10.59
SDR=0.29		

$$SDR(T, X) = S(T) - S(T, X)$$

★		Hours Played (StDev)
Outlook	Overcast	3.49
	Rainy	7.78
	Sunny	10.87
SDR=1.66		



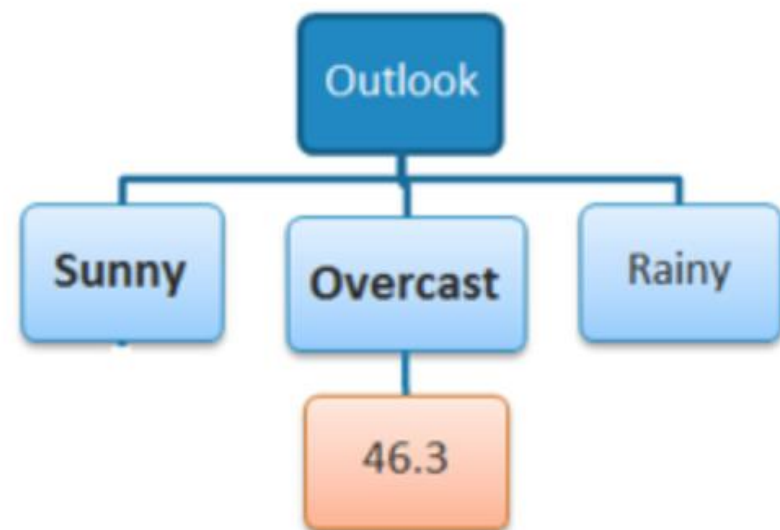
Outlook	Temp	Humidity	Windy	Hours Played
Sunny	Mild	High	FALSE	45
Sunny	Cool	Normal	FALSE	52
Sunny	Cool	Normal	TRUE	23
Sunny	Mild	Normal	FALSE	46
Sunny	Mild	High	TRUE	30

Overcast	Hot	High	FALSE	46
Overcast	Cool	Normal	TRUE	43
Overcast	Mild	High	TRUE	52
Overcast	Hot	Normal	FALSE	44

Rainy	Hot	High	FALSE	25
Rainy	Hot	High	TRUE	30
Rainy	Mild	High	FALSE	35
Rainy	Cool	Normal	FALSE	38
Rainy	Mild	Normal	TRUE	48

Outlook - Overcast

		Hours Played (StDev)	Hours Played (AVG)	Hours Played (CV)	Count
Outlook	Overcast	3.49	46.3	8%	4
	Rainy	7.78	35.2	22%	5
	Sunny	10.87	39.2	28%	5



Outlook - Sunny

Temp	Humidity	Windy	Hours Played
Mild	High	FALSE	45
Cool	Normal	FALSE	52
Cool	Normal	TRUE	23
Mild	Normal	FALSE	46
Mild	High	TRUE	30
			$S = 10.87$
			$AVG = 39.2$
			$CV = 28\%$

		Hours Played (StDev)	Count
Temp	Cool	14.50	2
	Mild	7.32	3

$$SDR = 10.87 - ((2/5) * 14.5 + (3/5) * 7.32) = 0.678$$

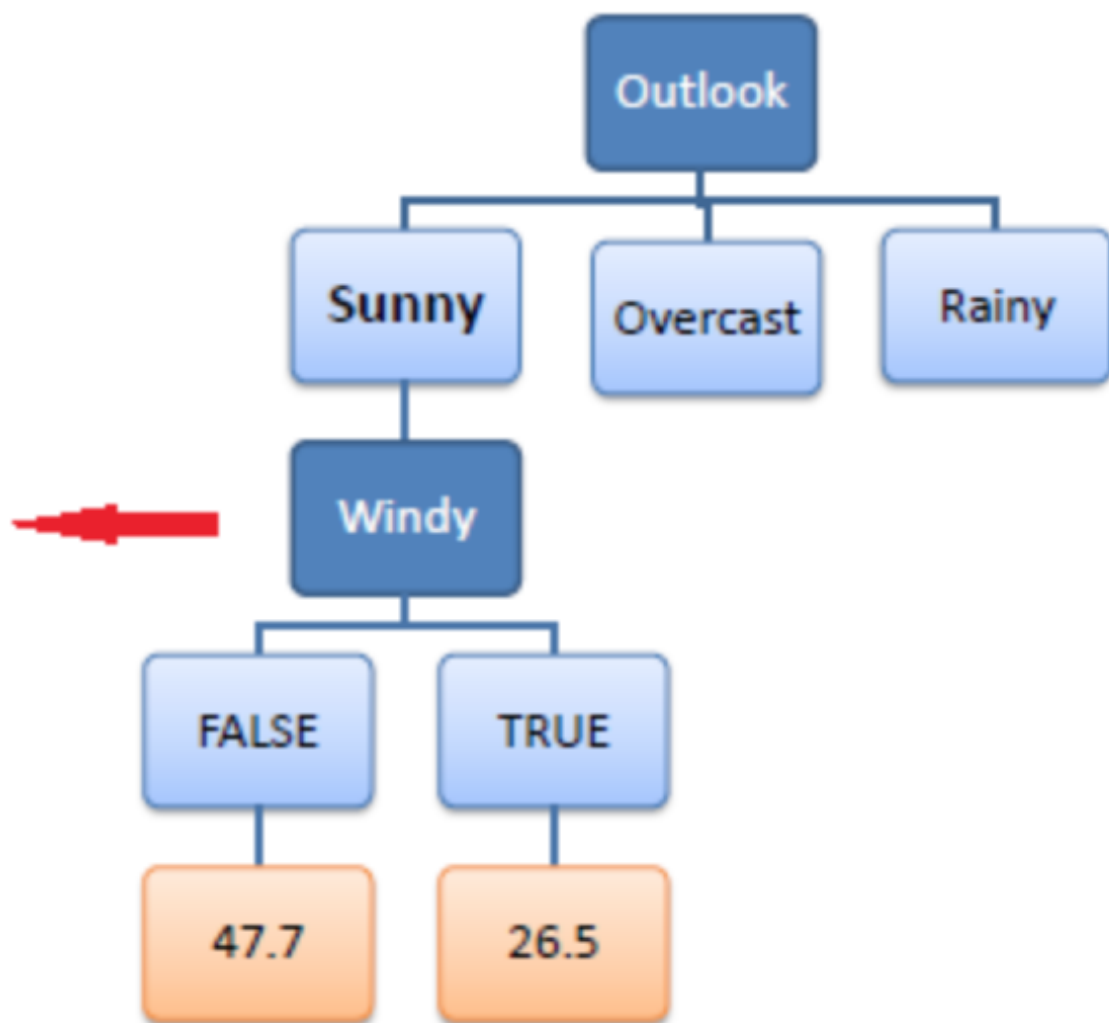
		Hours Played (StDev)	Count
Humidity	High	7.50	2
	Normal	12.50	3

$$SDR = 10.87 - ((2/5) * 7.5 + (3/5) * 12.5) = 0.370$$

		Hours Played (StDev)	Count
Windy	False	3.09	3
	True	3.50	2

$$SDR = 10.87 - ((3/5) * 3.09 + (2/5) * 3.5) = 7.62$$

Temp.	Humidity	Windy	Hours Played
Mild	High	FALSE	45
Cool	Normal	FALSE	52
Mild	Normal	FALSE	46
Cool	Normal	TRUE	23
Mild	High	TRUE	30



Outlook - Rainy

Temp	Humidity	Windy	Hours Played
Hot	High	FALSE	25
Hot	High	TRUE	30
Mild	High	FALSE	35
Cool	Normal	FALSE	38
Mild	Normal	TRUE	48
			S = 7.78
			AVG = 35.2
			CV = 22%

		Hours Played (StDev)	Count
Temp	Cool	0	1
	Hot	2.5	2
	Mild	6.5	2

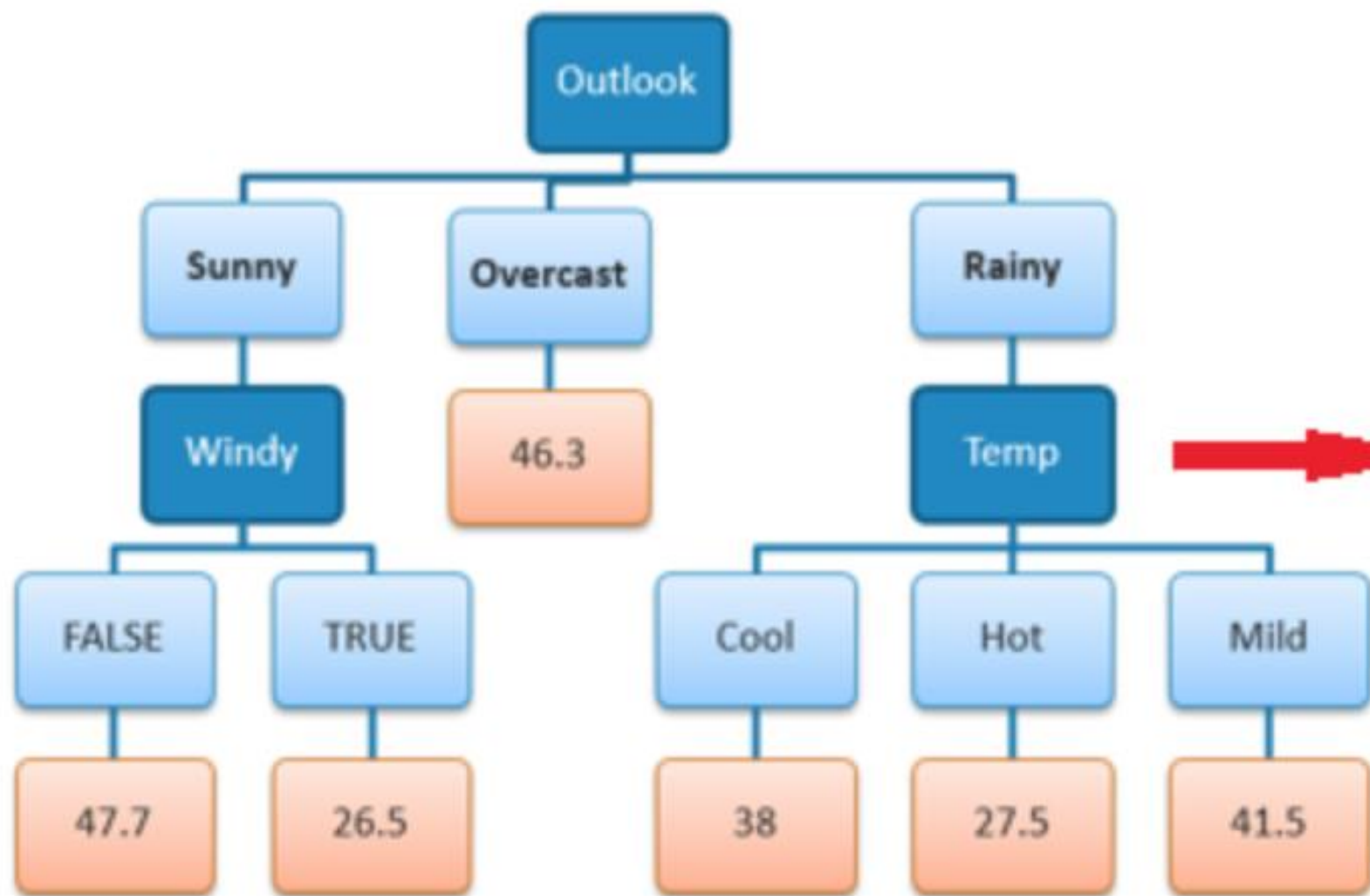
$$\text{SDR} = 7.78 - ((1/5)*0 + (2/5)*2.5 + (2/5)*6.5) = 4.18$$

		Hours Played (StDev)	Count
Humidity	High	4.1	3
	Normal	5.0	2

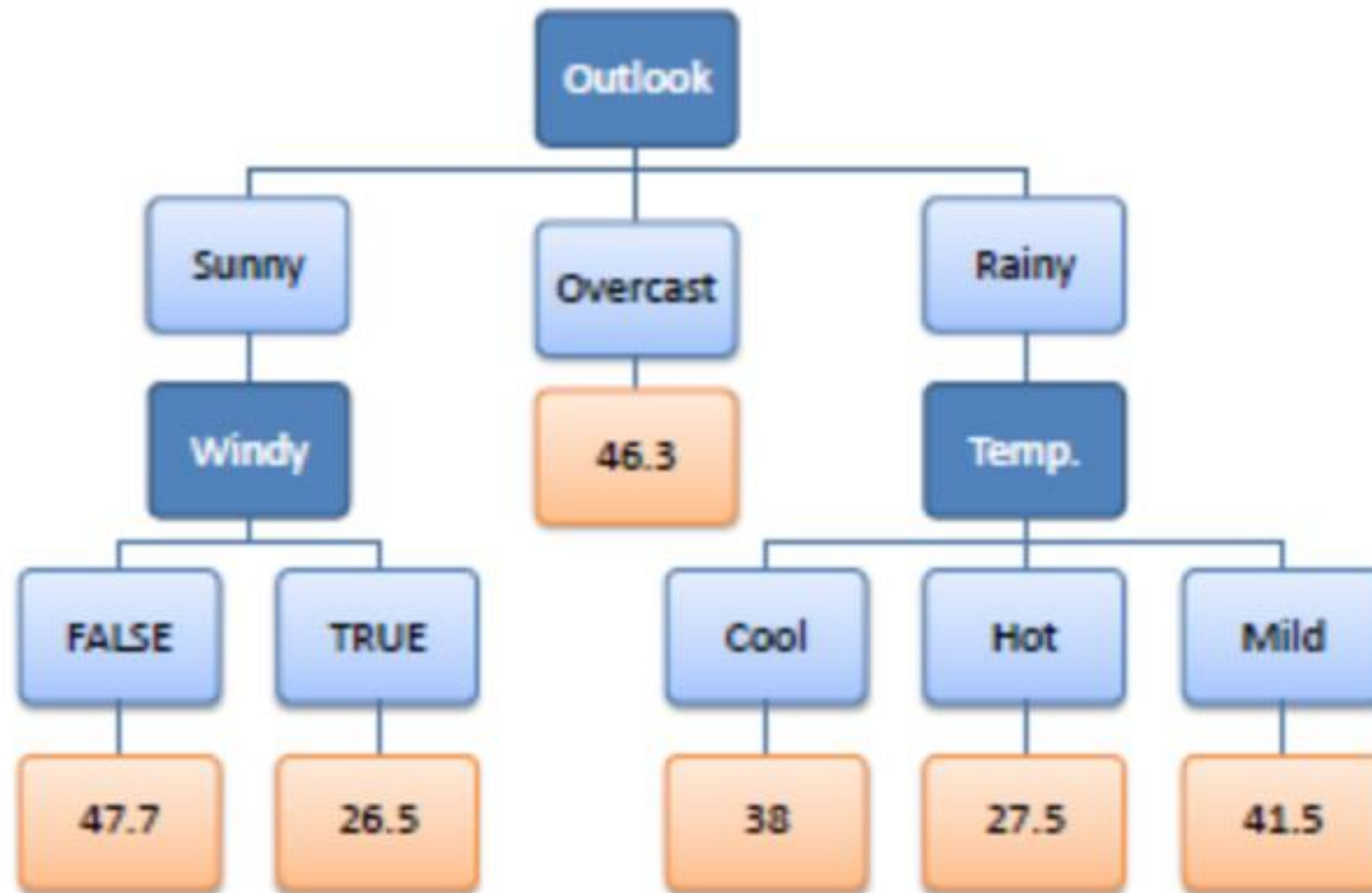
$$\text{SDR} = 7.78 - ((3/5)*4.1 + (2/5)*5.0) = 3.32$$

		Hours Played (StDev)	Count
Windy	False	5.6	3
	True	9.0	2

$$\text{SDR} = 7.78 - ((3/5)*5.6 + (2/5)*9.0) = 0.82$$



Temp	Hours Played
Cool	38
Hot	25
Hot	30
Mild	35
Mild	48



Thank You

Credits : [https://www.saedsayad.com/decision tree reg.htm](https://www.saedsayad.com/decision_tree_reg.htm)