How to select best split point in Decision Trees?

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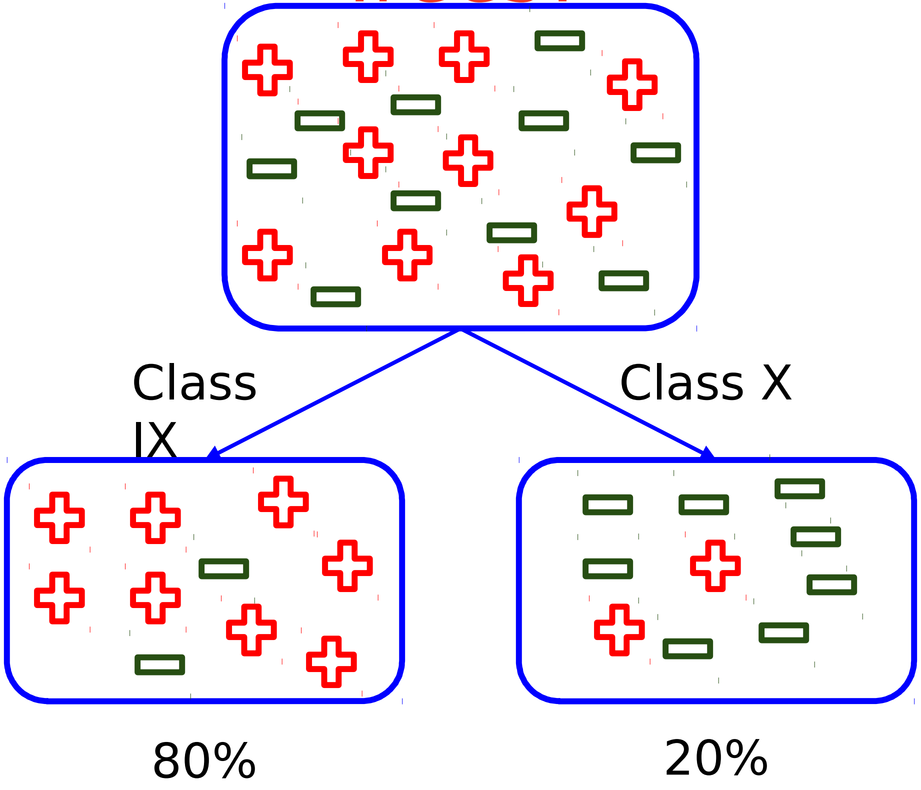
How to select best split point in Decision Trees?



Split on Class

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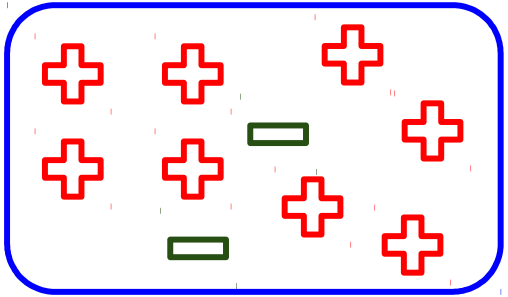
How to select best split point in Decision Trees?

- Decision tree splits the nodes on all available variables
- Selects the split which results in most homogeneous sub-nodes

Gini Impurity

Gini Impurity = 1 - Gini

Gini



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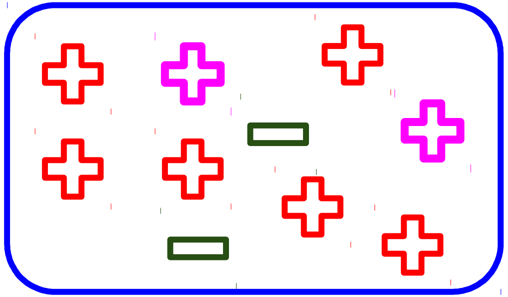
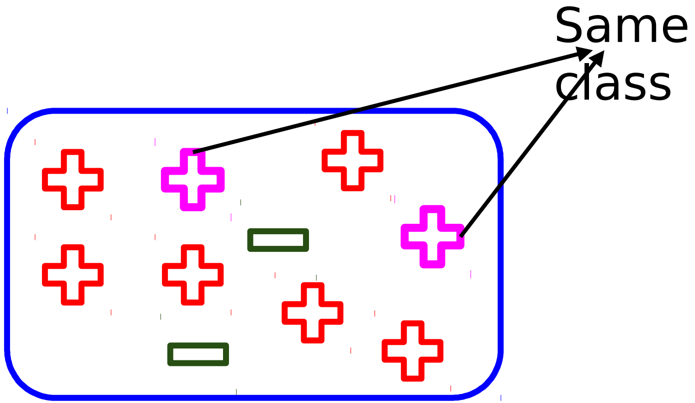
Gini



Gini



If we select two items from a population at random, they must be of same class

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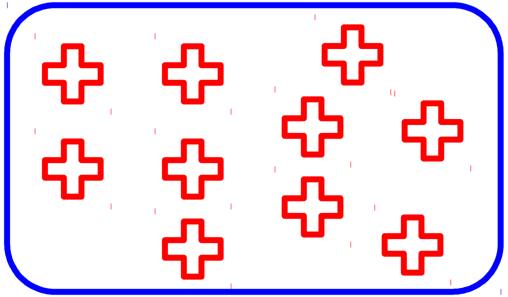
Gini



Probability that randomly picked points belong to same class?

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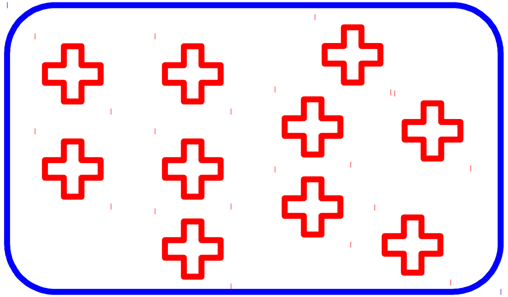
Gini



Probability = 1

Properties of Gini Impurity

- Node split is decided based on the gini impurity

$$Gini\ Impurity = 1 - Gini$$

- Lower the gini impurity, higher the homogeneity of nodes
- Works only with categorical targets
- Only performs binary splits

Steps to calculate Gini Impurity for a split

- Calculate the gini impurity for sub-nodes :

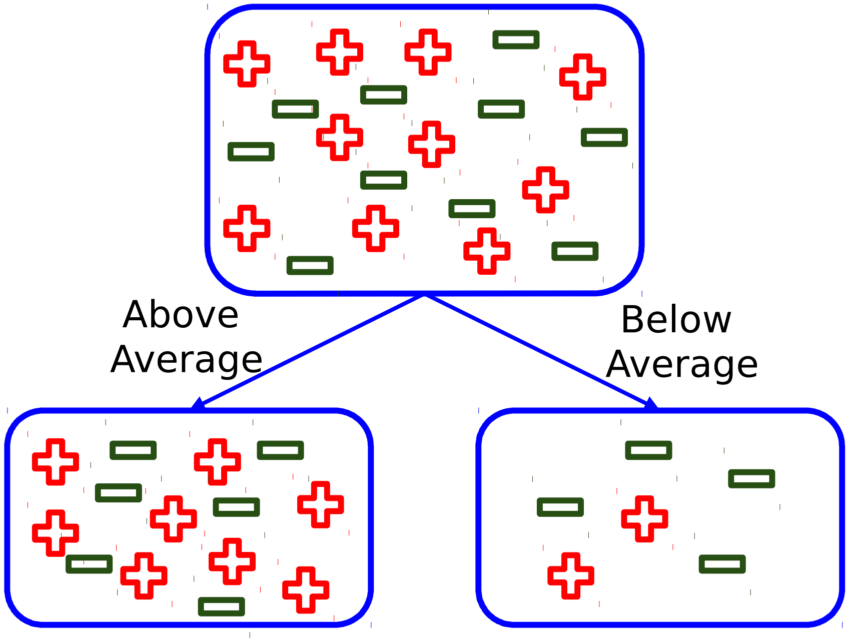
$$\textit{Gini Impurity} = 1 - \textit{Gini}$$

- Gini = Sum of square of probabilities for each class/category

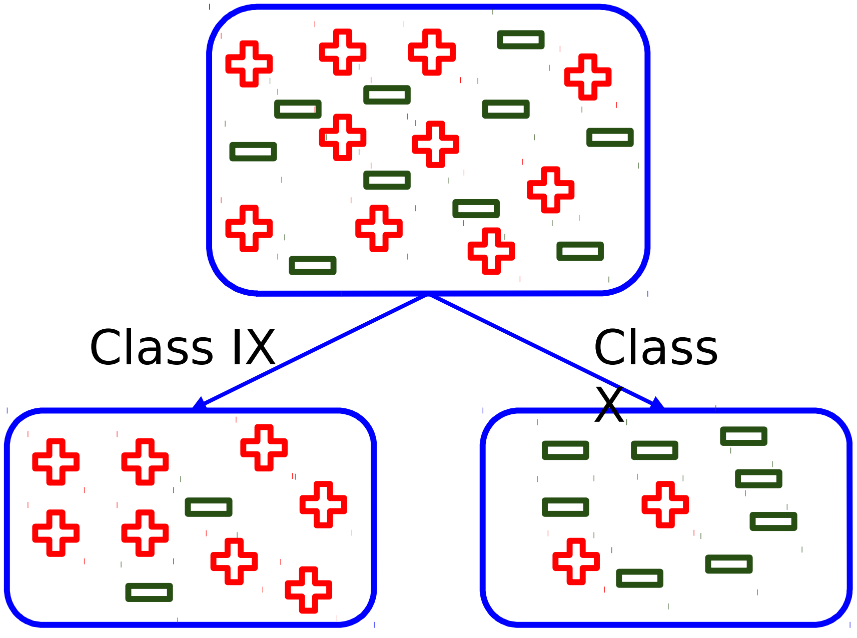
$$\textit{Gini} = (p_1^2 + p_2^2 + p_3^2 + \ldots + p_n^2)$$

- To calculate the gini impurity for split, take weighted gini impurity of both sub-nodes of that split

Steps to calculate Gini Impurity for a split



Split on Performance in Class



Split on Class

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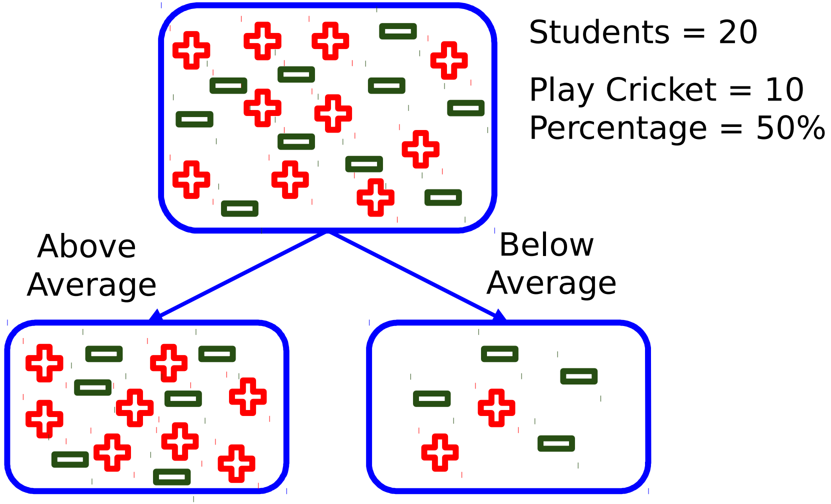
Steps to calculate Gini Impurity for a split

Split on Performance in Class

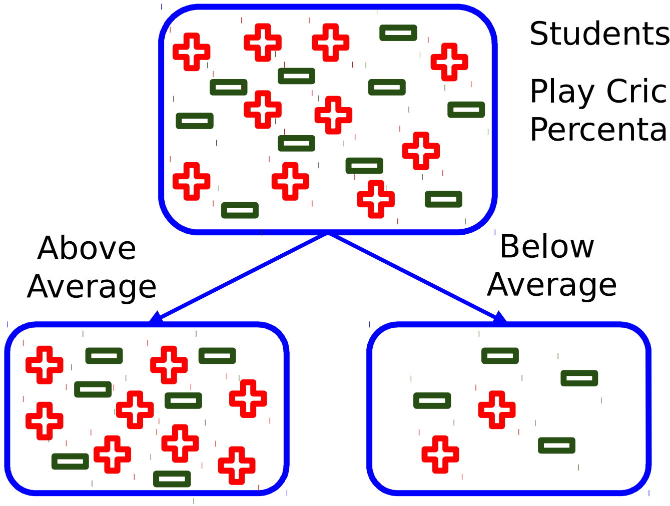
Steps to calculate Gini Impurity for a split

Split on Performance in Class



Steps to calculate Gini Impurity for a split

Split on Performance in Class



Above Average

Below Average

Students = 20

Play Cricket = 10
Percentage = 50%

Students = 14
Play Cricket = 8
Do not play = 6
Prob. play = 0.57
Prob. Not play = 0.43

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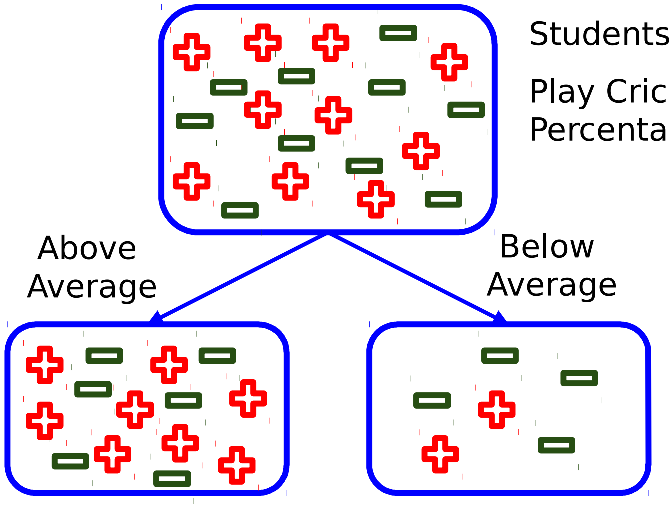
Steps to calculate Gini Impurity for a split

Split on Performance in Class

- Gini Impurity: sub-node Above Average:
  1 - [(0.57)*(0.57) + (0.43)*(0.43)] = 0.49

- Gini Impurity: sub-node Below Average:
  1 - [(0.33)*(0.33) + (0.67)*(0.67)] = 0.44



Students = 20

Play Cricket = 10
Percentage = 50%

Above Average

Below Average

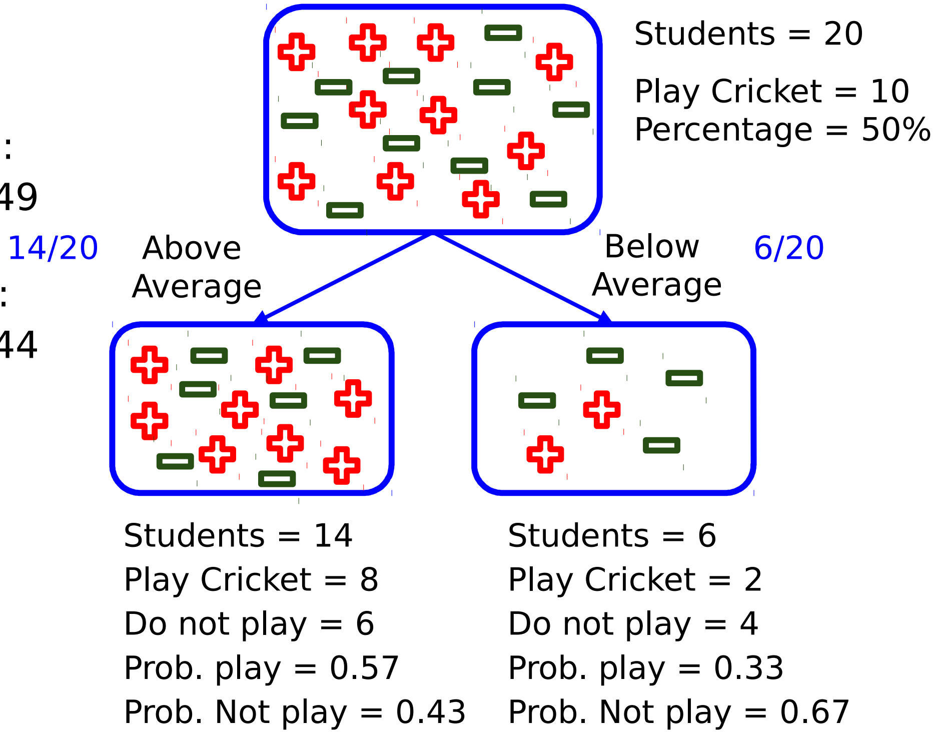
Students = 14
Play Cricket = 8
Do not play = 6
Prob. play = 0.57
Prob. Not play = 0.43

Students = 6
Play Cricket = 2
Do not play = 4
Prob. play = 0.33
Prob. Not play = 0.67

Steps to calculate Gini Impurity for a split

Split on Performance in Class

- Gini Impurity: sub-node Above Average:
  1 - [(0.57)*(0.57) + (0.43)*(0.43)] = 0.49
- Gini Impurity: sub-node Below Average:
  1 - [(0.33)*(0.33) + (0.67)*(0.67)] = 0.44



Students = 20

Play Cricket = 10
Percentage = 50%

14/20 Above Average

Below Average 6/20

Students = 14
Play Cricket = 8
Do not play = 6
Prob. play = 0.57
Prob. Not play = 0.43

Students = 6
Play Cricket = 2
Do not play = 4
Prob. play = 0.33
Prob. Not play = 0.67

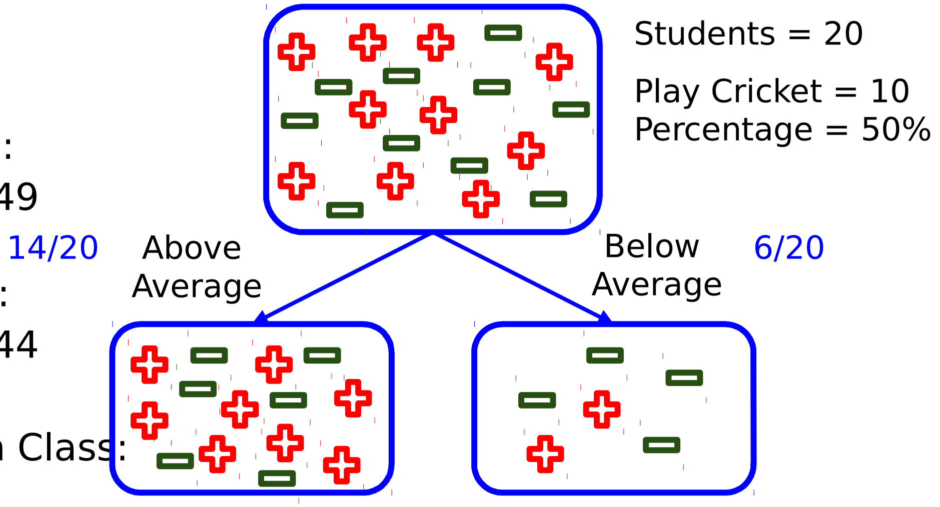
Steps to calculate Gini Impurity for a split

Split on Performance in Class

- Gini Impurity: sub-node Above Average:
  1 - [(0.57)*(0.57) + (0.43)*(0.43)] = 0.49

- Gini Impurity: sub-node Below Average:
  1 - [(0.33)*(0.33) + (0.67)*(0.67)] = 0.44

- Weighted Gini Impurity: Performance in Class:
  (14/20)*0.49 + (6/20)*0.44 = 0.475



Students = 20

Play Cricket = 10
Percentage = 50%

Students = 14
Play Cricket = 8
Do not play = 6
Prob. play = 0.57
Prob. Not play = 0.43

Students = 6
Play Cricket = 2
Do not play = 4
Prob. play = 0.33
Prob. Not play = 0.67

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Steps to calculate Gini Impurity for a split

Split on Class

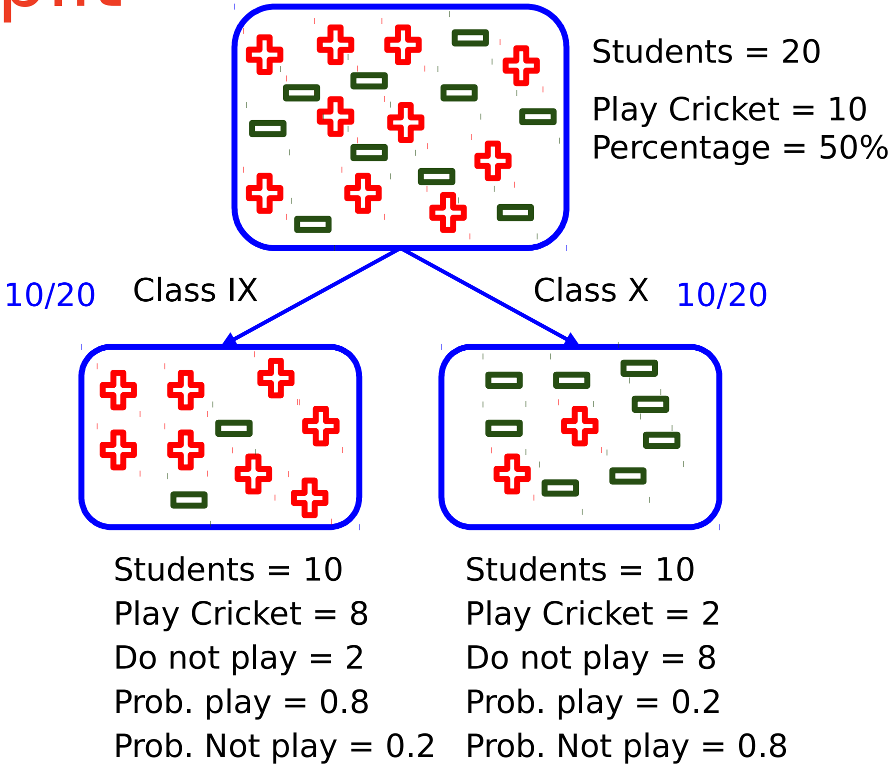
Steps to calculate Gini Impurity for a split

Split on Class

- Gini Impurity: sub-node Class IX:
  1 - [(0.8)*(0.8) + (0.2)*(0.2)] = 0.32

- Gini Impurity: sub-node Class X:
  1 - [(0.2)*(0.2) + (0.8)*(0.8)] = 0.32

- Weighted Gini Impurity: Class:
  (10/20)*0.32 + (10/20)*0.32 = 0.32



Students = 20

Play Cricket = 10
Percentage = 50%

Students = 10
Play Cricket = 8
Do not play = 2
Prob. play = 0.8
Prob. Not play = 0.2

Students = 10
Play Cricket = 2
Do not play = 8
Prob. play = 0.2
Prob. Not play = 0.8

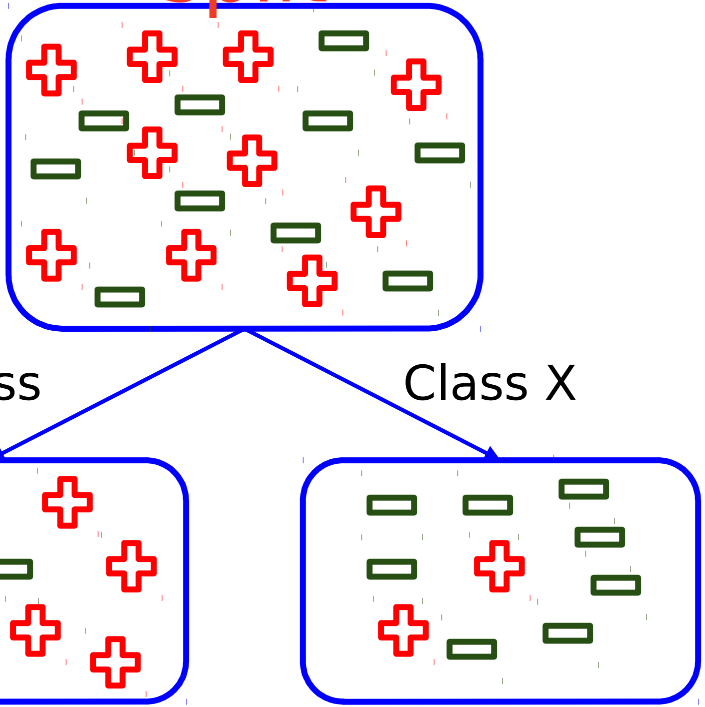
Steps to calculate Gini Impurity for a split

Split	**Weighted Gini Impurity**
Performance in Class	0.475
Class	0.32

Steps to calculate Gini Impurity for a split

Split	Weighted Gini Impurity
Performance in Class	0.475
Class	0.32

Steps to calculate Gini Impurity for a split



Split on Class

Thank You!

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