

Machine Learning

| Decision Tree

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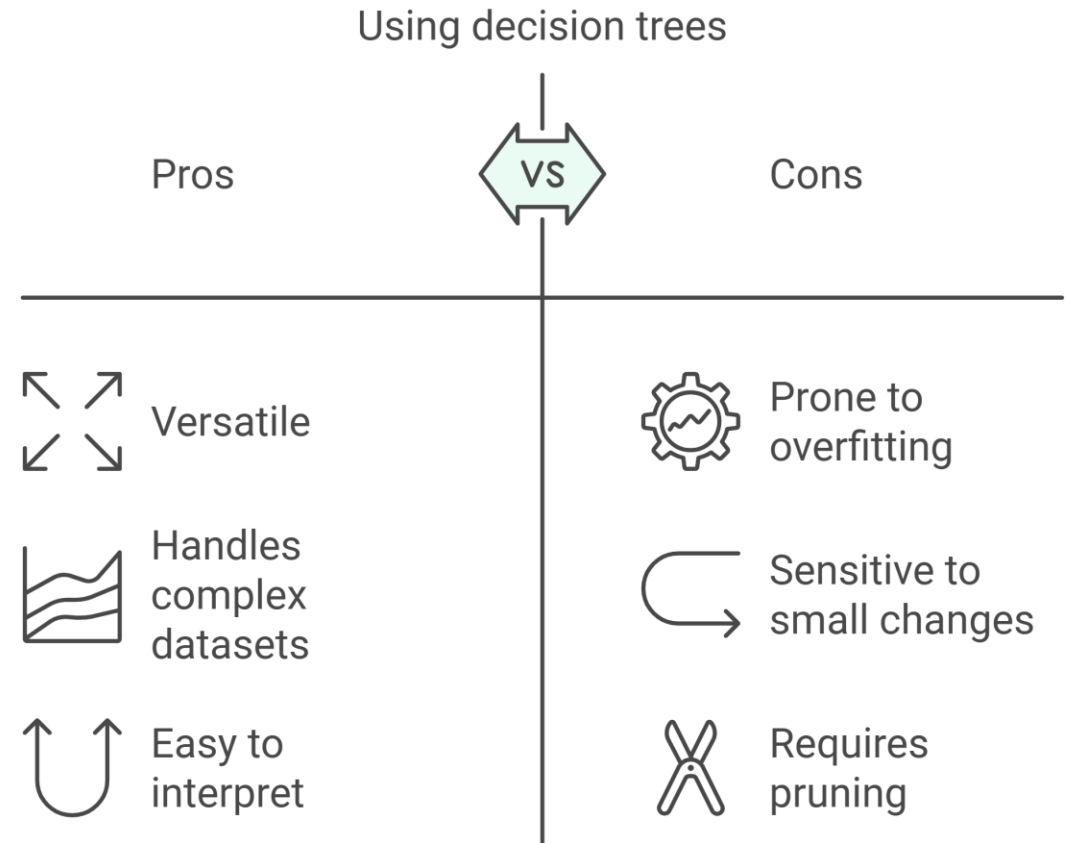
<https://youtube.com/ElhosseiniAcademy>

| Agenda

- What is Decision Tree (DT)?
- Node
- Root
- Decision Node
- Leaf Node
- Depth
- Balanced Tree

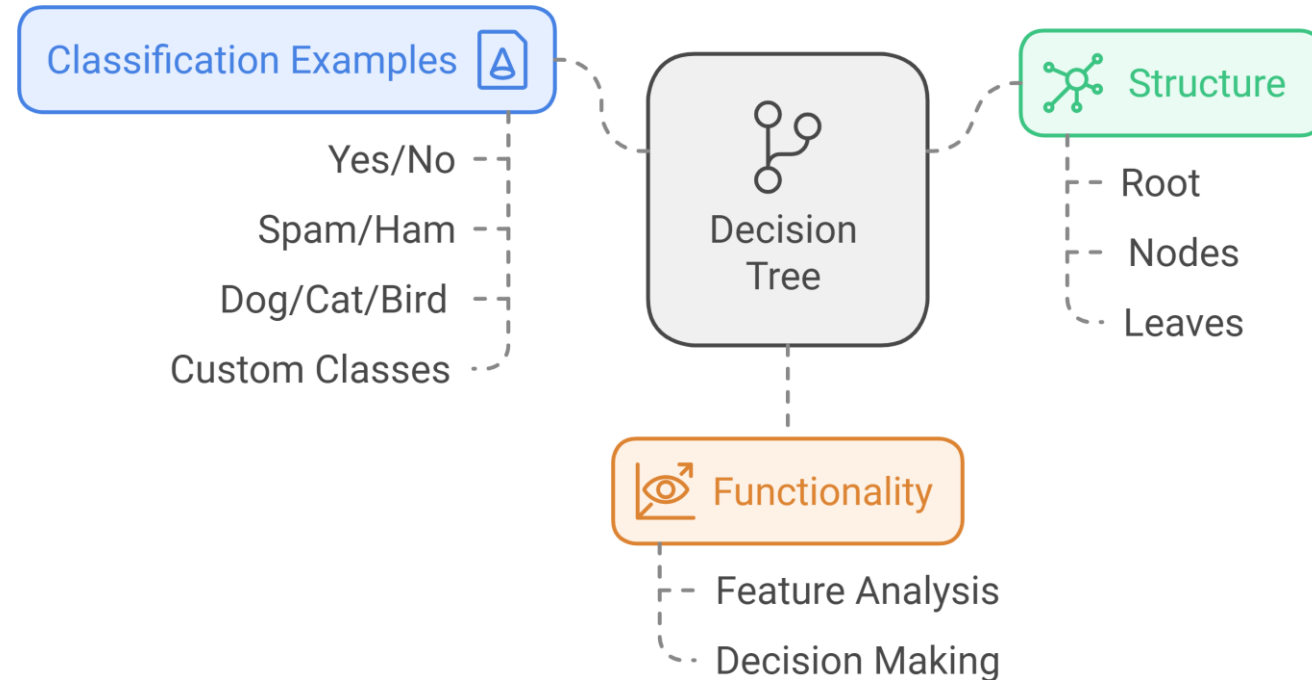
| Decision Tree

- Decision trees are **versatile** machine learning algorithms that can perform both **classification** and **regression tasks**, and even multioutput tasks



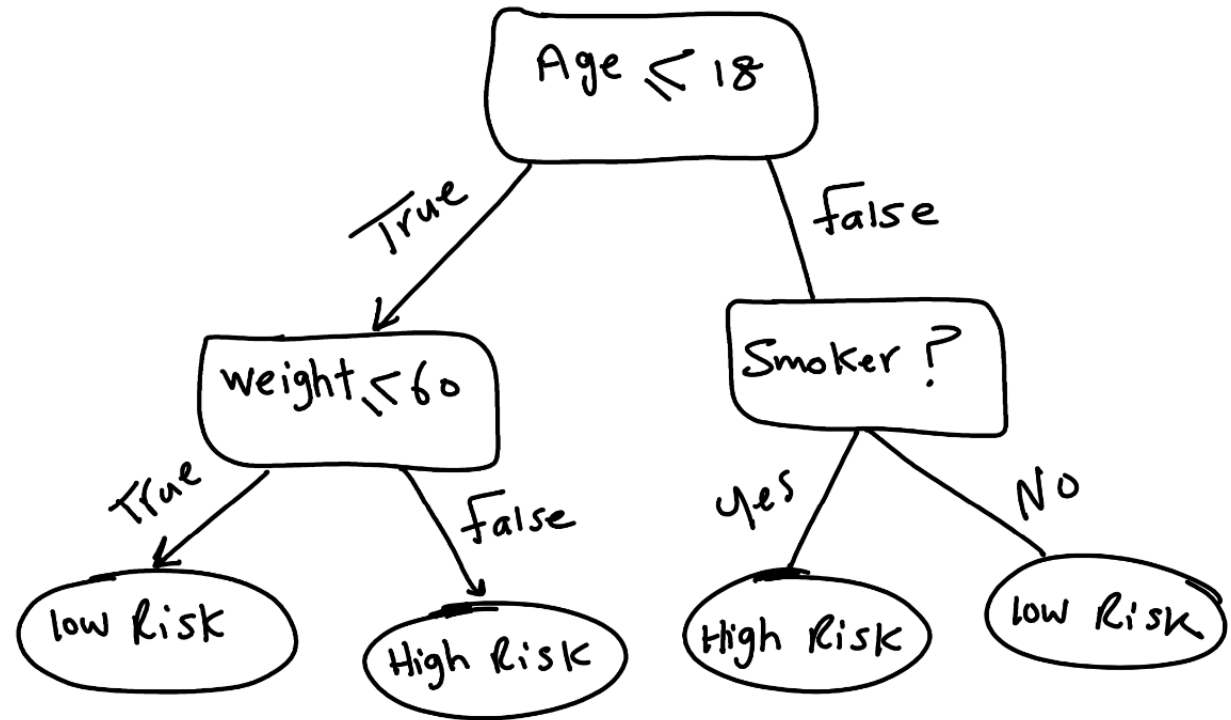
| Decision Tree

- Decision Tree is a classification model based on yes/no questions and represented by a binary tree.



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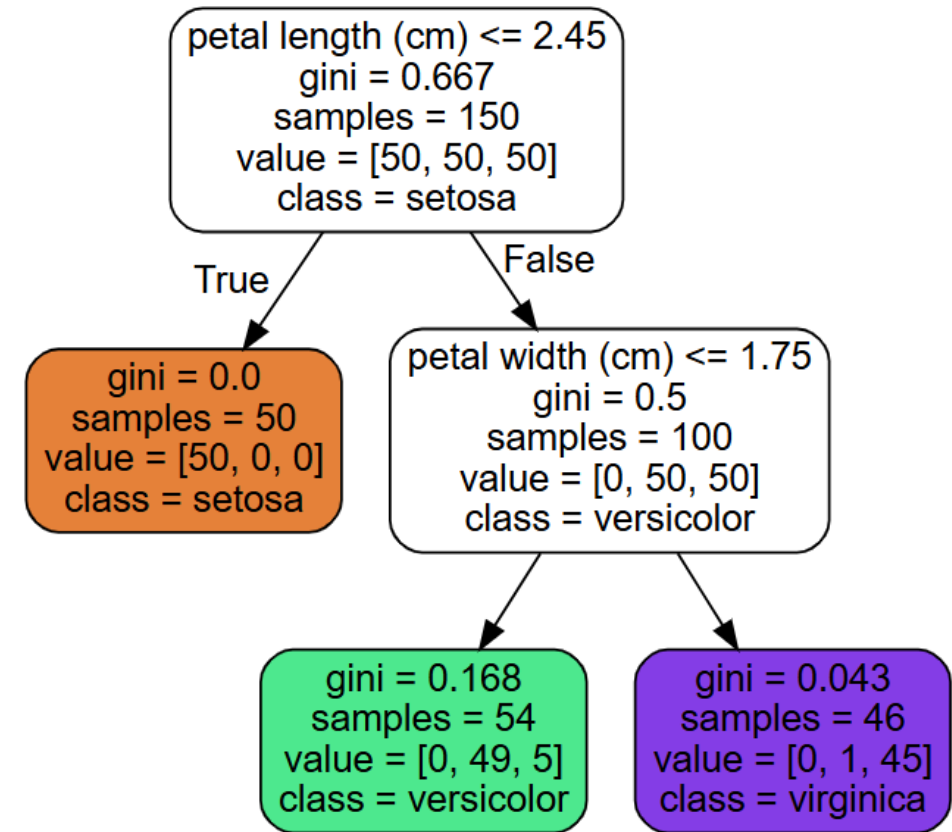


| Root Node

- The topmost node of the tree. It contains the first yes/no question.
- At the root, the data is split based on the feature that provides the highest information gain or the best separation according to a chosen criterion (e.g., Gini impurity, entropy for classification trees).
- In a decision tree predicting whether to play tennis based on weather conditions, the root node might split the data based on the feature "Outlook" (e.g., Sunny, Overcast, Rain).

| Root Node

- **Root node** (depth 0, at the top): this node asks whether the flower's petal length is smaller than 2.45 cm. If it is, then you move down to the root's left **child node** (depth 1, left).

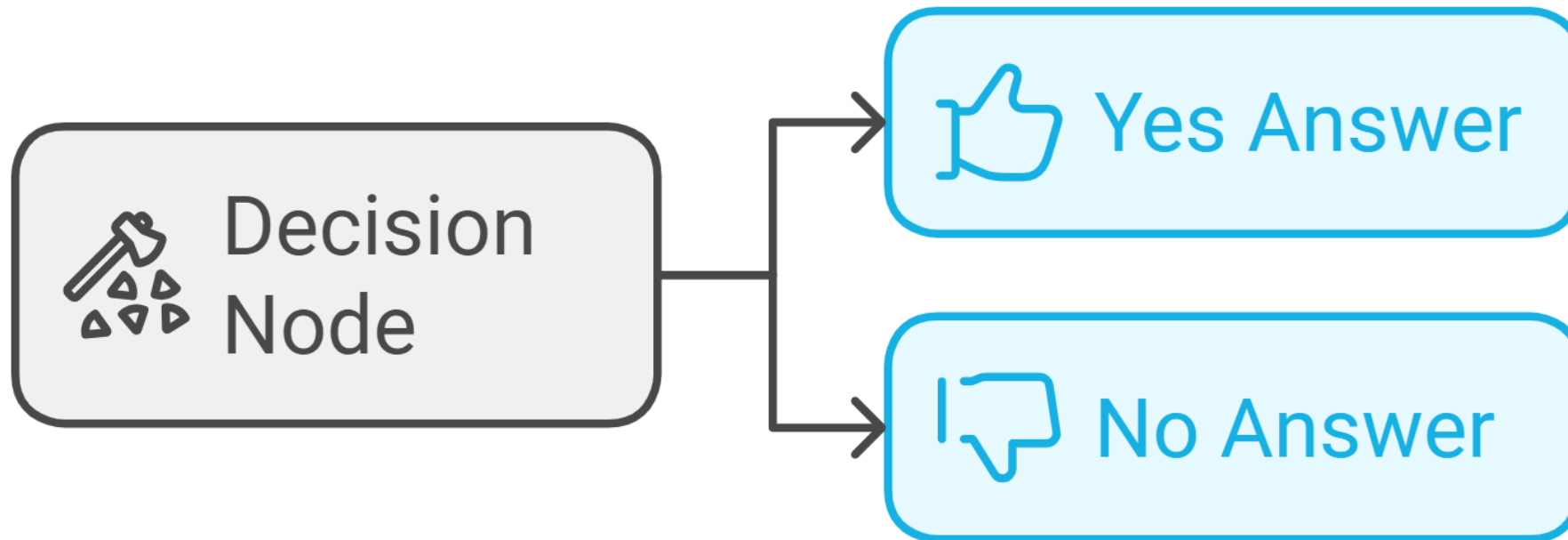


| Node

- A node is a point within the tree where the data is split based on a particular feature
- Each yes/no question in our model is represented by a node, or decision stump, with two branches emanating from it (one for the 'yes' answer, and one from the 'no' answer).
- There are two main types of nodes:
 - Decision Nodes
 - Leaf Nodes: final output or decision of the tree, where no further splits are made.

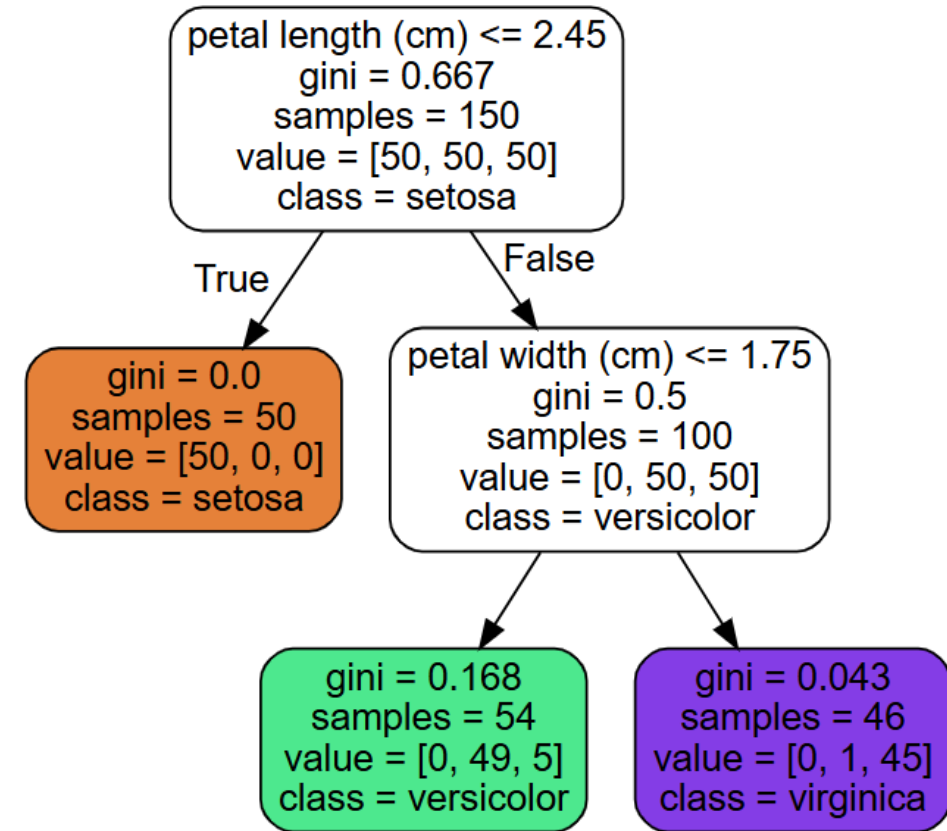
| Decision Nodes

- These nodes represent the decision points where the data is split based on a feature.



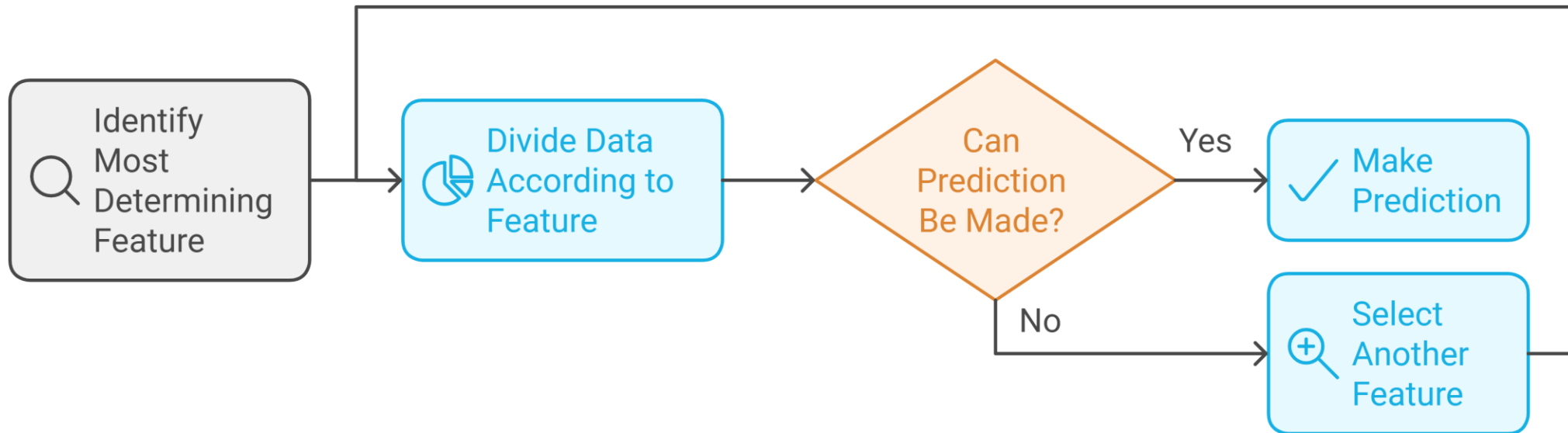
| Leaf Node

- **Leaf node:** it does not have any child nodes, so it does not ask any questions



| Algorithm

- Among all the features in the data, picks the one that best divides the labels



| Example

- You want to decide if you should **wear a jacket** today

Is it raining?



Raining

Wear a jacket

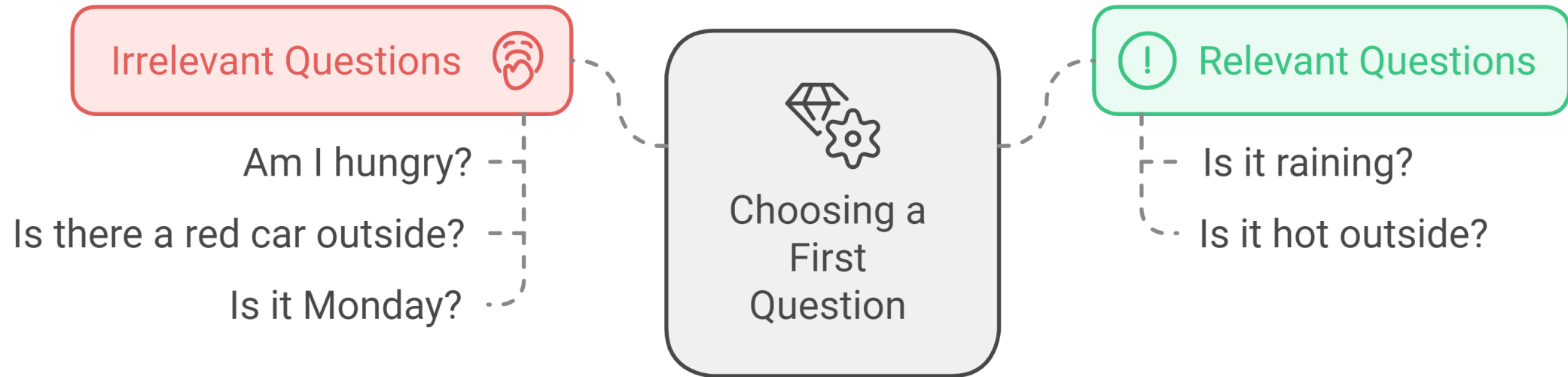


Not raining

Check temperature

| Example

- Pick a good first question for the root of our tree



| Example

- Decision Criteria – Later based on Data

