Decision Trees

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Trees

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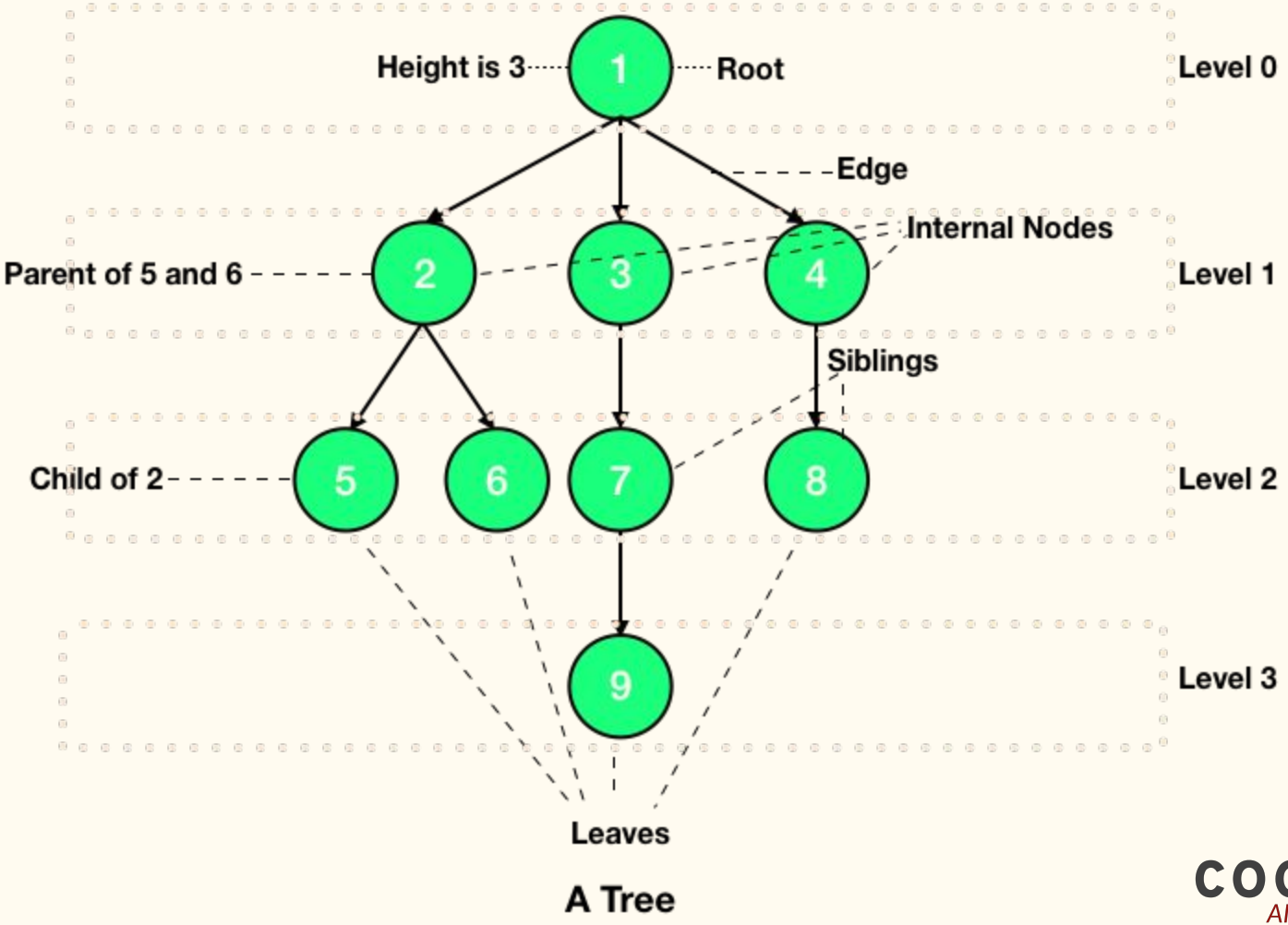

A Tree

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- Can be used for classification (most common use) or regression problems
- Is human interpretable
- Pick an attribute, do a simple test
- Conditioned on a choice, pick another attribute, do another test
- In the leaves, assign a class with majority vote
- Do other branches as well

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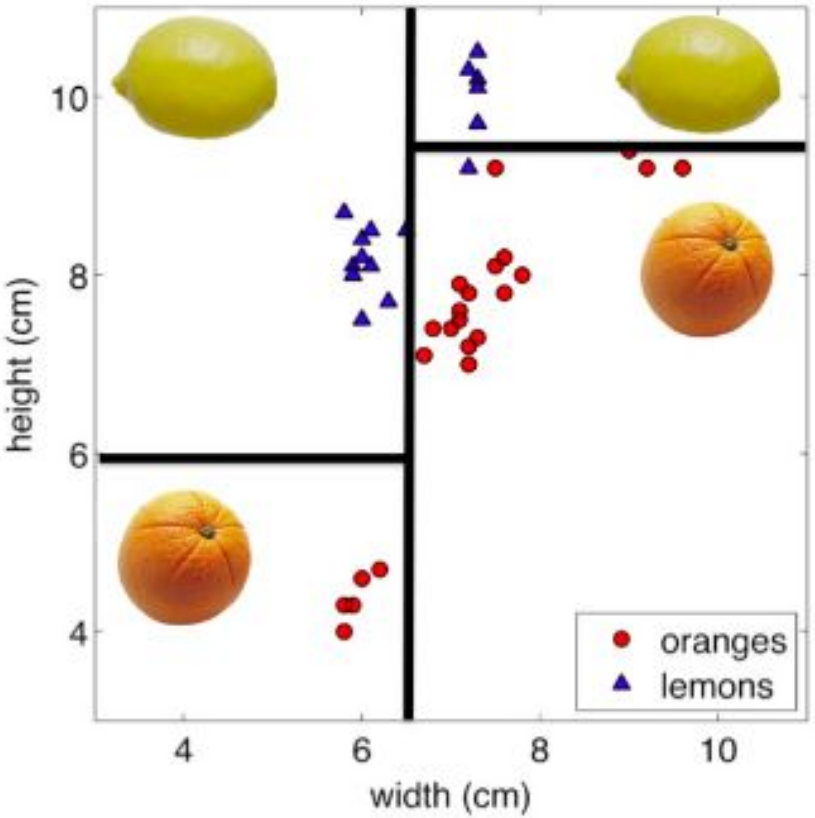
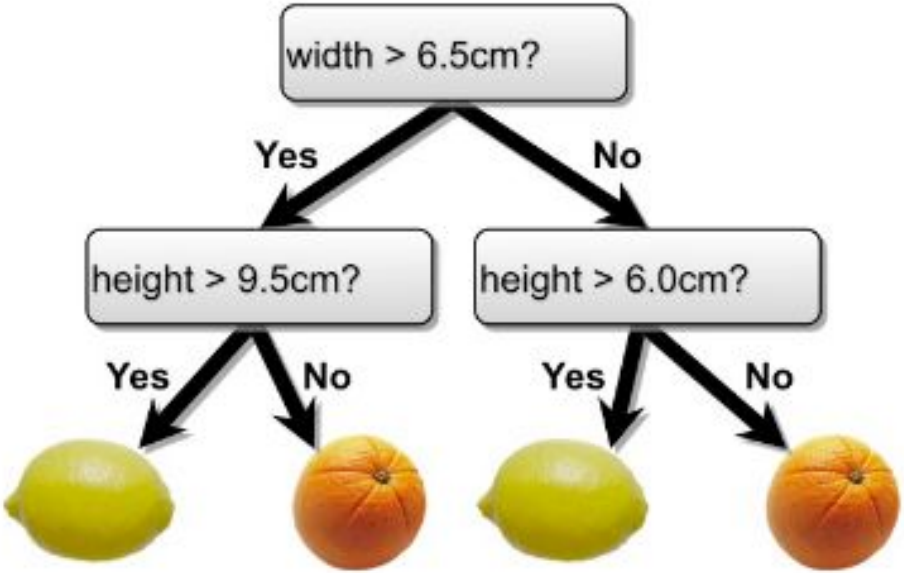
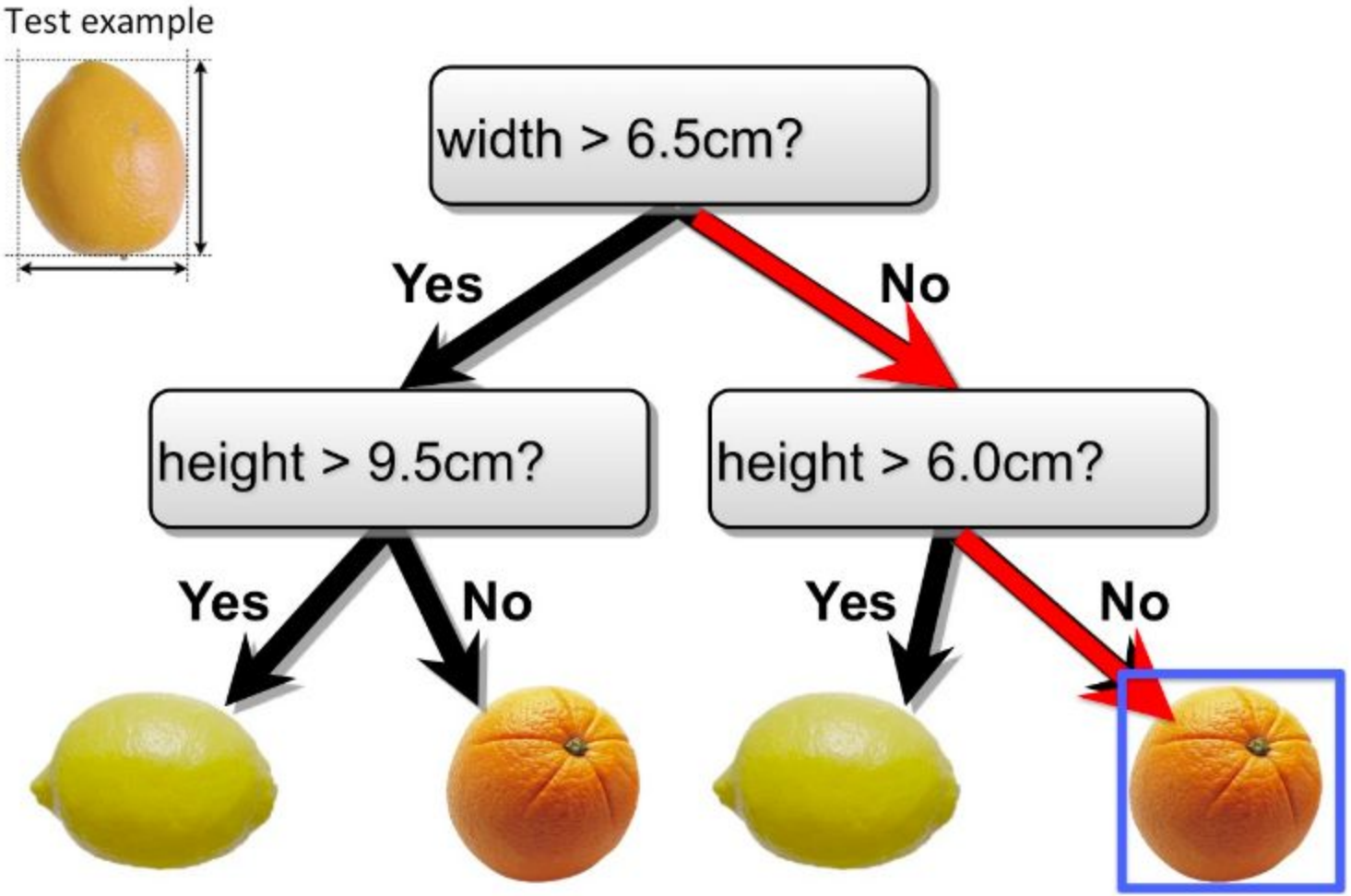

10
8
6
4
height (cm)
4
6
8
10
width (cm)
oranges
lemons


width > 6.5cm?
Yes
No
height > 9.5cm?
height > 6.0cm?
Yes
No
Yes
No


Test example
width > 6.5cm?
Yes
No
height > 9.5cm?
height > 6.0cm?
Yes
No
Yes
No

- Classification tree:
  - Discrete output
  - leaf value ym typically set to the most common value in $\{t_{(m_1)}, \ldots, t_{(m_k)}\}$
- Regression tree:
  - Continuous output
  - leaf value ym typically set to the mean of values in $\{t_{(m_1)}, \ldots, t_{(m_k)}\}$

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Function Approximation

- Problem:
  - Set of possible instances X
  - Set of possible labels Y
  - Unknown target function $f : X -> Y$
- Input: Training examples of unknown target function

$$\{\langle \boldsymbol{x}_i, y_i \rangle\}_{i=1}^{n} = \{\langle \boldsymbol{x}_1, y_1 \rangle, \ldots, \langle \boldsymbol{x}_n, y_n \rangle\}$$

- Output: The best approximation of f

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Iris Dataset

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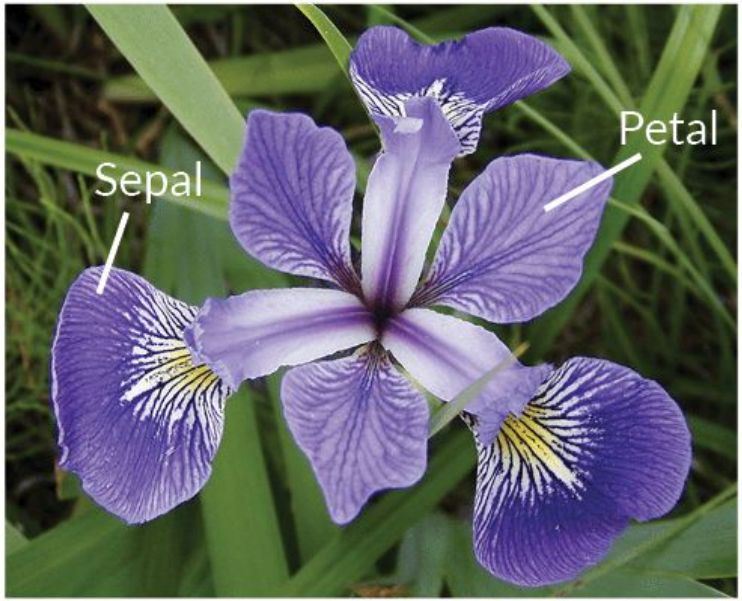

Iris Versicolor

Iris Setosa

Iris Virginica

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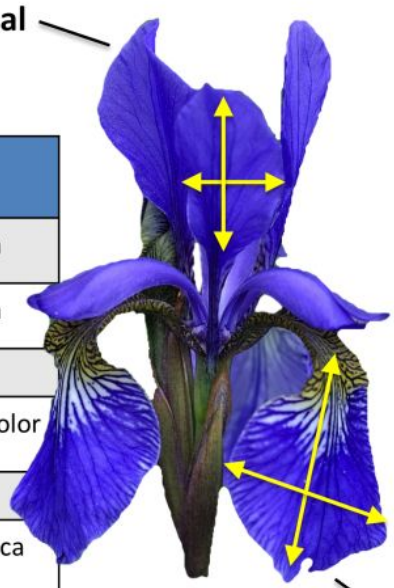
Samples
(instances, observations)

	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
...					
50	6.4	3.5	4.5	1.2	Versicolor
...					
150	5.9	3.0	5.0	1.8	Virginica



Features
(attributes, measurements, dimensions)

Class labels
(targets)

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