Tree-based methods

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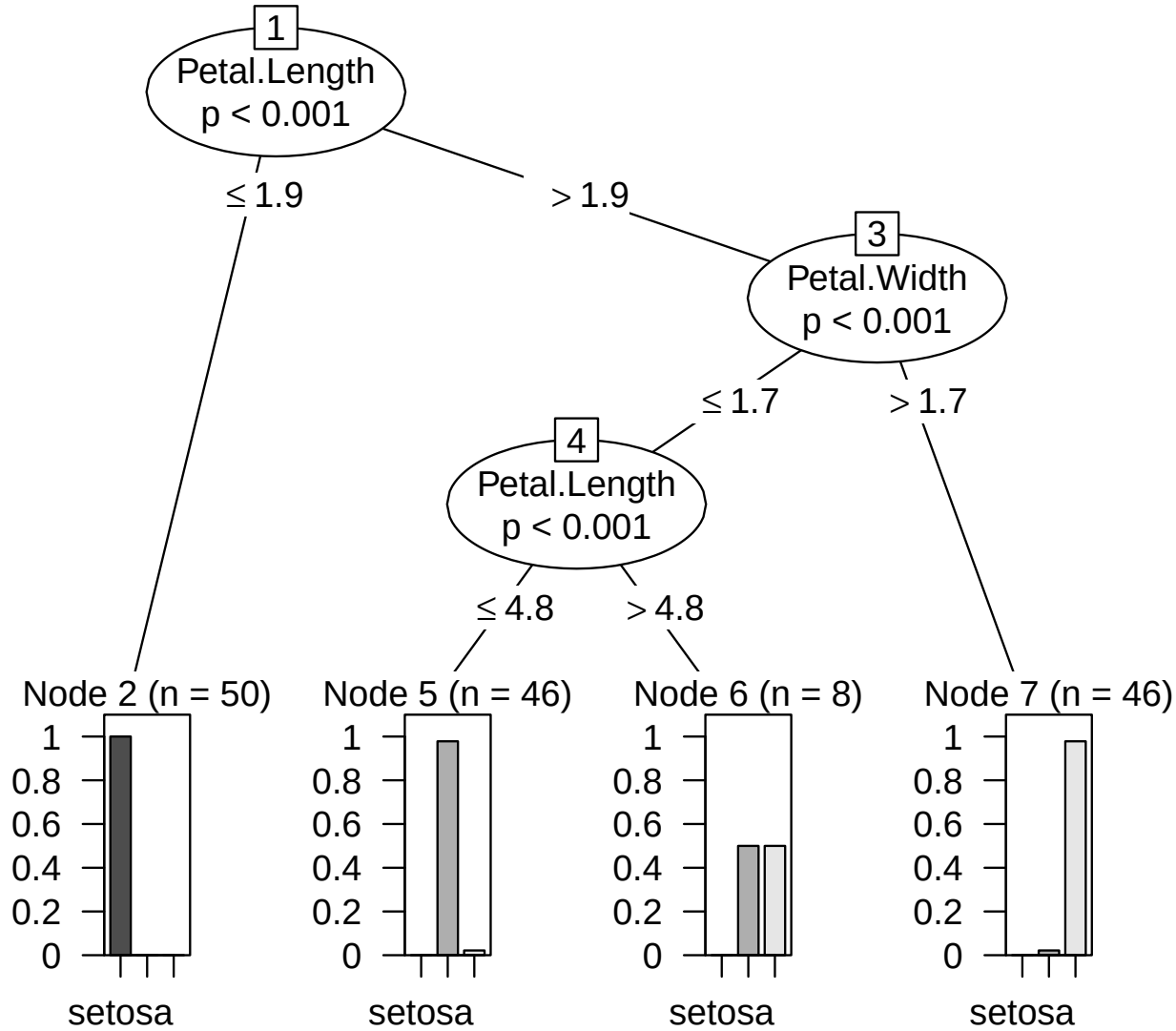
Tree-based methods

Tree-based methods centers around decision or regression trees.
Flexible and popular method for prediction.
Can be applied successfully to most prediction problems.

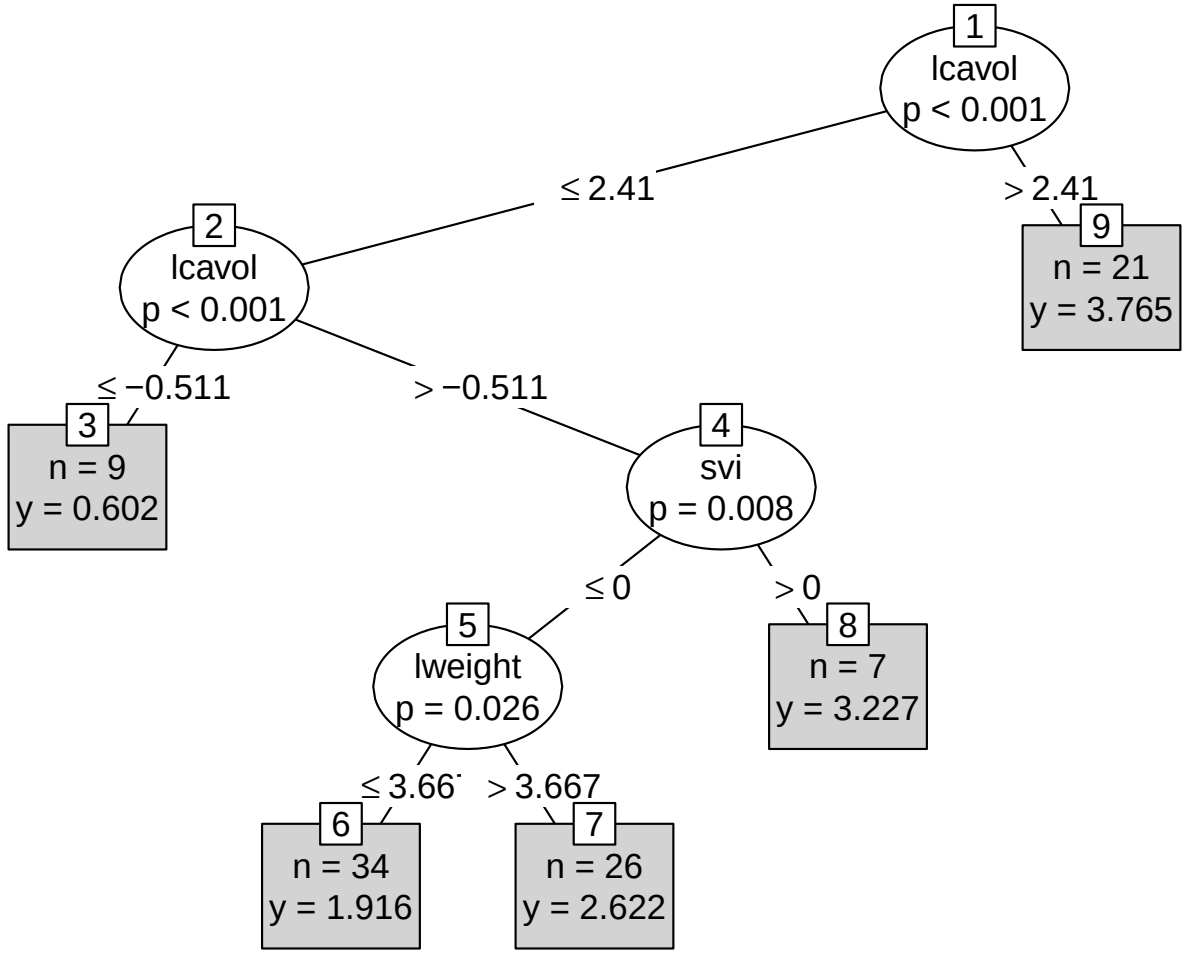
What is a decision tree?

A decision tree consists of nodes, that create a dichotomy on a given variable.



Regression trees

We can apply the same concept to create a regression tree to predict a continuous quantity.



Each leaf node gives the average value in that node.

Trees

- Nested sequence of dichotomies
- Constant among leaf nodes
- Can be viewed as a piecewise constant regression
- Adapted to categorical and ordinal data

Fitting a tree

At each node, the algorithm decides:

1. Pick variable to split on
2. Decide split location
3. Decide whether to stop or continue

Fitting a tree

How to pick varibable and spit location?

Greedy algorithm

At each stage, pick the split that lowers disparity the most.
Does not necessarily pick optimal splits overall.

Fitting a tree

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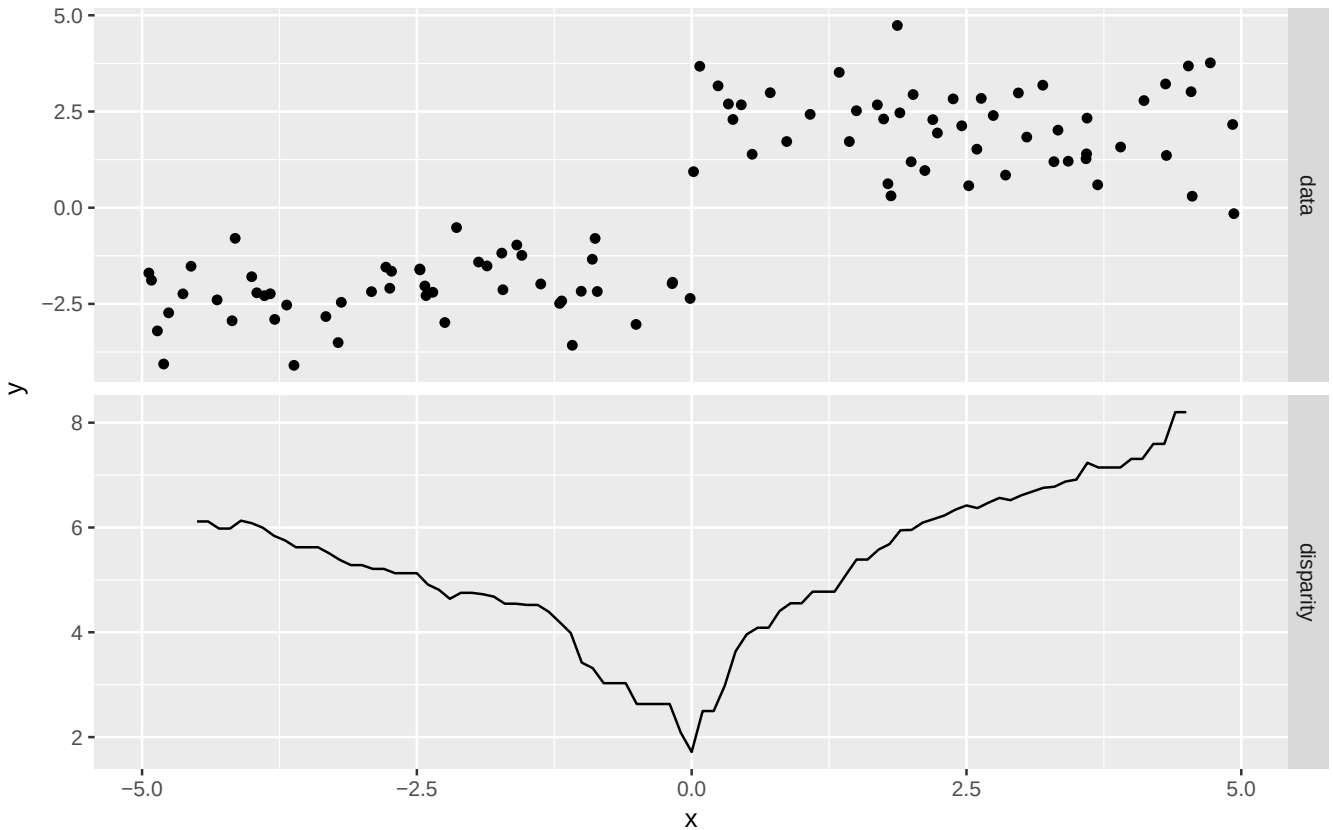

Random forests

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Random forest

- Combine multiple trees together (usually 100s).
- Each tree trained on a slightly randomised dataset
- Trees vote on prediction

Ensemble methods

General idea to combine weaker models into a stronger one.

Bagging

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Boosting

1. Train model 1, then evaluate its performance.
2. Train model 2 to do well where model 1 does not.
3. Train model 3 to do well where model 1 and 2 do not.

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Pure prediction

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As ensemble methods fairly universal, usually not mentionned.