

## Section 6.7: Tree Based Methods

**Duration:** 2.5 hours

**Concepts:**

- Regression trees
- Classification trees
- Bagging
- Random forests
- Boosting
- Bayesian additive regression trees

**Textbook section:** An Introduction to Statistical Learning, Chapter 8

Materials and Resources	Learning Goals
<ul style="list-style-type: none"><li>• Computers for students with R Studio</li><li>• Tree Based Methods Slides</li><li>• Tree Based Methods Exercises R Markdown file</li></ul>	<ul style="list-style-type: none"><li>• Decision trees for regression and classification</li><li>• Several methods for improving the prediction accuracy of trees</li></ul>

Duration	Lesson Section	Learning Objectives
40 mins	Go through the regression trees and classification trees sections.	<ul style="list-style-type: none"><li>• What is a tree?</li><li>• Algorithm to build trees</li><li>• Recursive binary splitting</li><li>• Cost complexity pruning</li><li>• Trees for classification</li><li>• Trees for regression</li></ul>
25 mins	Go through the “Fitting Classification Trees” and “Fitting Regression Trees” sections in the R Markdown file as a class.	<ul style="list-style-type: none"><li>• Fitting regression and classification trees with <code>tree()</code></li><li>• Plotting trees</li><li>• Pruning trees with <code>cv.tree()</code> and <code>prune.misclass()</code></li><li>• Estimating test error rate</li></ul>
15 mins	Go through the bagging and random forests sections.	<ul style="list-style-type: none"><li>• Bagging method for regression and classification trees</li><li>• Out-of-bag error estimation</li><li>• Random forests method for regression and classification trees</li></ul>
10 mins	Go through the “Bagging and Random Forests” sections in the R Markdown file as a class.	<ul style="list-style-type: none"><li>• Fit bagged regression trees and random forests with <code>randomForest()</code></li><li>• Use <code>importance()</code> and <code>varImpPlot()</code> to measure relative importance of variables</li></ul>
15 mins	Go through the boosting section.	<ul style="list-style-type: none"><li>• The boosting method for regression trees</li><li>• Important parameters</li></ul>

15 mins	Go through the “Boosting” section in the R Markdown file as a class.	<ul style="list-style-type: none"> <li>• Fit boosted regression trees with <code>`gbm()`</code></li> <li>• Look at the relative importance of variables</li> </ul>
15 mins	Go through the Bayesian Additive Regression Trees section.	<ul style="list-style-type: none"> <li>• The BART method for regression trees</li> </ul>
8 mins	Go through the “Bayesian Additive Regression Trees” section in the R Markdown file as a class.	<ul style="list-style-type: none"> <li>• Fit BART using <code>`bart()`</code></li> <li>• Compare test errors between methods</li> </ul>