**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** |
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| * Computers for students with R Studio * Tree Based Methods Slides * Tree Based Methods Exercises R Markdown file | * Decision trees for regression and classification * Several methods for improving the prediction accuracy of trees |

| **Duration** | **Lesson Section** | **Learning Objectives** |
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| 40 mins | Go through the regression trees and classification trees sections. | * What is a tree? * Algorithm to build trees * Recursive binary splitting * Cost complexity pruning * Trees for classification * Trees for regression |
| 25 mins | Go through the “Fitting Classification Trees” and “Fitting Regression Trees” sections in the R Markdown file as a class. | * Fitting regression and classification trees with `tree()` * Plotting trees * Pruning trees with `cv.tree()` and `prune.misclass()` * Estimating test error rate |
| 15 mins | Go through the bagging and random forests sections. | * Bagging method for regression and classification trees * Out-of-bag error estimation * Random forests method for regression and classification trees |
| 10 mins | Go through the “Bagging and Random Forests” sections in the R Markdown file as a class. | * Fit bagged regression trees and random forests with `randomForest()` * Use `importance()` and `varImpPlot()` to measure relative importance of variables |
| 15 mins | Go through the boosting section. | * The boosting method for regression trees * Important parameters |
| 15 mins | Go through the “Boosting” section in the R Markdown file as a class. | * Fit boosted regression trees with `gbm()` * Look at the relative importance of variables |
| 15 mins | Go through the Bayesian Additive Regression Trees section. | * The BART method for regression trees |
| 8 mins | Go through the “Bayesian Additive Regression Trees” section in the R Markdown file as a class. | * Fit BART using `bart()` * Compare test errors between methods |