Section 6.6: Beyond Linearity

Duration: 2.5 hours

Concepts:

- Polynomial Regression
- Step Functions
- Regression Splines
- Smoothing Splines
- Local Regression
- Generalised Additive Models

Textbook section: An Introduction to Statistical Learning, Chapter 7

Materials and Resources	Learning Goals
● Computers for students with R Studio ● Slides ● Exercises R Markdown file	● Fit the different models to data ● Use anovas to pick the best model complexity

Duration	Lesson Section	Learning Objectives
10 mins	Go through the polynomial regression section of the slides.	● Polynomial regression
20 mins	Go through the polynomial regression section in the R Markdown file as a class.	● Use `lm()` to fit a polynomial regression ● Plot fit with confidence intervals ● Use `anova()` to compare polynomial regression of increasing degrees
8 mins	Go through the step function section.	● Step function
15 mins	Go through the step function section in the R Markdown file as a class.	● Use `lm()` and `cut()` to fit a step function ● Make predictions
15 mins	Go through the regression splines section.	● Regression splines ● Degrees of freedom ● Location and number of knots ● Constraints of regression splines
15 mins	Go through the regression splines section in the R Markdown file as a class.	● Use `bs()` to fit a piecewise polynomial regression ● Use `ns()` to fit a natural spline ● Plot results with confidence intervals
15 mins	Go through the local regression section.	● Local regression
15 mins	Go through the local regression section in the R Markdown file as a class.	● Use `loess()` to perform local regression ● Plot the results with confidence intervals

10 mins	Go through the generalised additive models section.	• GAMs • Pros and cons of GAMs
20 mins	Go through the generalised additive models section in the R Markdown file as a class.	• Fit a GAM to data • Use `plot.Gam()` to summarise it • Use an anova to choose best GAM