Lesson 5 Overview

**Learning Objectives**

This lesson covers linear model selection and regularization. By the end of the lesson, we will have explored how to:

* Identify reasons to perform predictor selection and issues with collinear predictors.
* Understand situations in which penalized regression is better option for regression.
* State basic form of penalized regression model.
* State basic form of constrained regression model.
* State the constrained formulations for the Ridge Regression (RR), LASSO, and Elastic Net model fit goal functions.
* Understand basic behavior of penalized regression as shrinking coefficients toward origin.
* Visualize constraints as restrictions in the coefficient space.
* Understand pathway model fit of penalized regression.
* Explain Elastic Net as a “compromise” between RR and LASSO.
* Compare and contrast penalized regression methods.
* Fit penalized regression models using glmnet function in R.
* Understand need for validation methods.
* Apply cross-validation to penalized regression models using cv.glmnet function in R, for the purpose of model selection.
* Apply bootstrapping to estimate error of coefficients.

**Learning Resources**

**Watch**

* [Predictor Selection and Penalties: Background for Penalized RegressionLinks to an external site.](https://media.uwex.edu/content/ds/ds740_r21/ds740_lesson5_presentation1/)  
  Download [Lesson5presentation1SE.R](https://uweau.instructure.com/courses/566248/files/55290556?wrap=1)[Download Lesson5presentation1SE.R](https://uweau.instructure.com/courses/566248/files/55290556/download?download_frd=1)to be used in the demonstration.
* [Ridge Regression, LASSO, and Elastic Net with AssessmentLinks to an external site.](https://media.uwex.edu/content/ds/ds740_r21/ds740_lesson5_presentation2/)  
  Download [bodyfat.csv](https://uweau.instructure.com/courses/566248/files/55290723?wrap=1)[Download bodyfat.csv](https://uweau.instructure.com/courses/566248/files/55290723/download?download_frd=1), [Lesson5presentation2fit.R](https://uweau.instructure.com/courses/566248/files/55290677?wrap=1)[Download Lesson5presentation2fit.R](https://uweau.instructure.com/courses/566248/files/55290677/download?download_frd=1), and [Lesson5presentation2select.R](https://uweau.instructure.com/courses/566248/files/55290591?wrap=1)[Download Lesson5presentation2select.R](https://uweau.instructure.com/courses/566248/files/55290591/download?download_frd=1)to be used in the demonstration.

**Read**

* *Introduction to Statistical Learning*: Sections 6.2, 6.4, 6.5.2
* [*Elements of Statistical Learning*: pp. 69–73](https://uweau.instructure.com/courses/566248/files/55290633?wrap=1)