ZOO 800

Homework Week 13

Submission instructions

Submit a single URL to a public GitHub repository on Canvas. Please make sure it works – i.e., that you can clone the repo as a project yourself. Be sure to indicate in the submission who is in your group. Submit a single URL for each group, but if you're not the one submitting the URL, submit a comment mentioning the name of the person submitting for your group.

Problem

To understand how maximum likelihood estimation of model parameters works, it helps to start with a simple problem and approach it using alternative methods. In this case, we start with a simple linear regression: one continuous explanatory variable and one continuous response variable with normally distributed error. We estimate the parameters of the linear regression model in three ways: using the analytical solution, ordinary least squares, and maximum likelihood. The latter two we approach using a grid search and a more efficient optimization using the optim() function.

The data for all three come from randomly generated from a classmate's Week 11 assignment. The "ecological" scenario (we're really stretching the ecology here) is:

Uther Pendragon is having some trouble with dragons in his medieval kingdom. They keep setting fire to the kingdom. He wants to hire a private contractor named Merlin (occupation: Wizard) to relocate the dragons, but private contractors are really expensive and Merlin can only capture half the dragons. The dragons are also all different sizes. To minimize the area burned by dragons, should Merlin focus on relocating small dragons, large dragons, or doesn't it matter. The data on dragon size and the area they burned should help answer this question.

Objective 1

    A.   Estimate the parameters of the linear regression of area burned on dragon size using the analytical solution to the linear regression (equation in lecture).

Objective 2

    A.   Estimate the parameters of the linear regression of area burned on dragon size using ordinary least squares based on:
        a.   A grid search (estimate the slope and intercept to the nearest 0.1)
        b.   Optimization using the optim() function
        c.   Verify that the optimization routine converged and is not sensitive to starting values

Objective 3

A. Estimate the parameters of the linear regression of area burned on dragon size using ordinary least squares based on:
   a. A grid search (estimate the slope and intercept to the nearest 0.1)
   b. Optimization using the optim() function
   c. Verify that the optimization routine converged and is not sensitive to starting values

Objective 4

A. Compare the slope and intercept estimates from the three approaches. Are they the same? (They should be very close)