Using GitHub and RStudio to Facilitate Authentic Learning Experiences in a Regression Analysis Course

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JSM 2019

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Introduction

Assignments

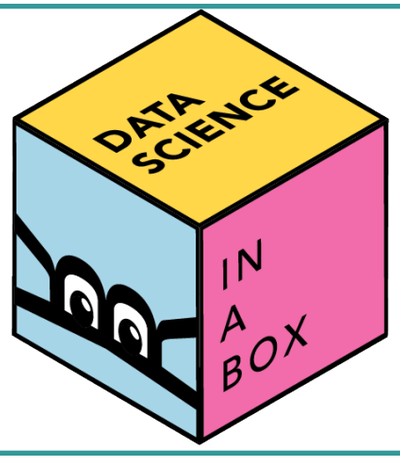
Challenges
+
Learning
Outcomes

Motivation

"To be prepared for statistics and data science careers, ***students need facility with professional statistical analysis software****, the ability to access and wrangle data in various ways, and the ability to perform algorithmic problem solving."*

2014 ASA Curriculum Guidelines for Undergraduate Programs in Statistical Science

Innovations in intro statistics and data science courses



Goal: Create learning experiences to continue cultivating these skills in intermediate courses

The Course

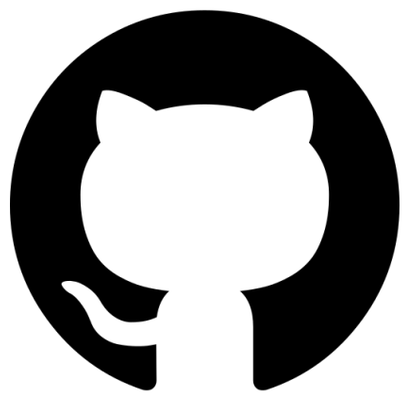
70 students who have taken introductory statistics or probability course

Applied course focusing on linear regression, analysis of variance and logistic regression

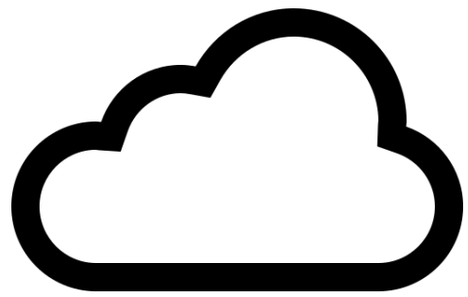
In-class activities + computing labs + homework assignments

Computing Tools

R + R Markdown for analysis and write up



Assign and submit assignments



RStudio Cloud

Run Git commands through Git pane

Platform for collaboration on group assignments

Packages installed + Git configured on Day 1

Çetinkaya-Rudel, M., & Rundel, C. (2017). Infrastructure and Tools for Teaching Computing Throughout the Statistical Curriculum. *The American Statistician,* 72, 58-65.

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Computing Assignments

The data for this part of the lab is the `Hitters` dataset in the `ISLR` package. Your goal is to fit a regression model that uses the performance statistics of baseball players to predictor their salary. There are 19 potential predictor variables, so you will use the `regsubsets` function to conduct forward selection to choose a final model.

Exercise 7. Read through the data dictionary for the `Hitters` dataset. You can access it by typing `?Hitters` in the console. What is the difference between the variables `HmRun` and `CHmRun`?

Exercise 8. Some observations have missing values for `Salary`. Filter the data, so only observations that have values for `Salary` are included. You will use this filtered data for the remainder of the lab.

Exercise 9. Fill in the code below to conduct forward selection and save the results in an object called `sel_summary` (selection summary).

```
regfit_forward <- regsubsets(_______, ________, method="forward", nvmax = 19)
sel_summary <- summary(_______)
```

The `nvmax` option indicates the maximum-sized variable subsets to consider in the model selection.

Homework Assignments

Part 2: Data Analysis

The *Data Analysis* section of homework contains open-ended data analysis questions. Your response should be neatly organized and read as a complete narrative. This means that in addition to addressing the question there should also be exploratory data analysis and an analysis of the model assumptions. In short, these questions should be treated as "mini-projects".

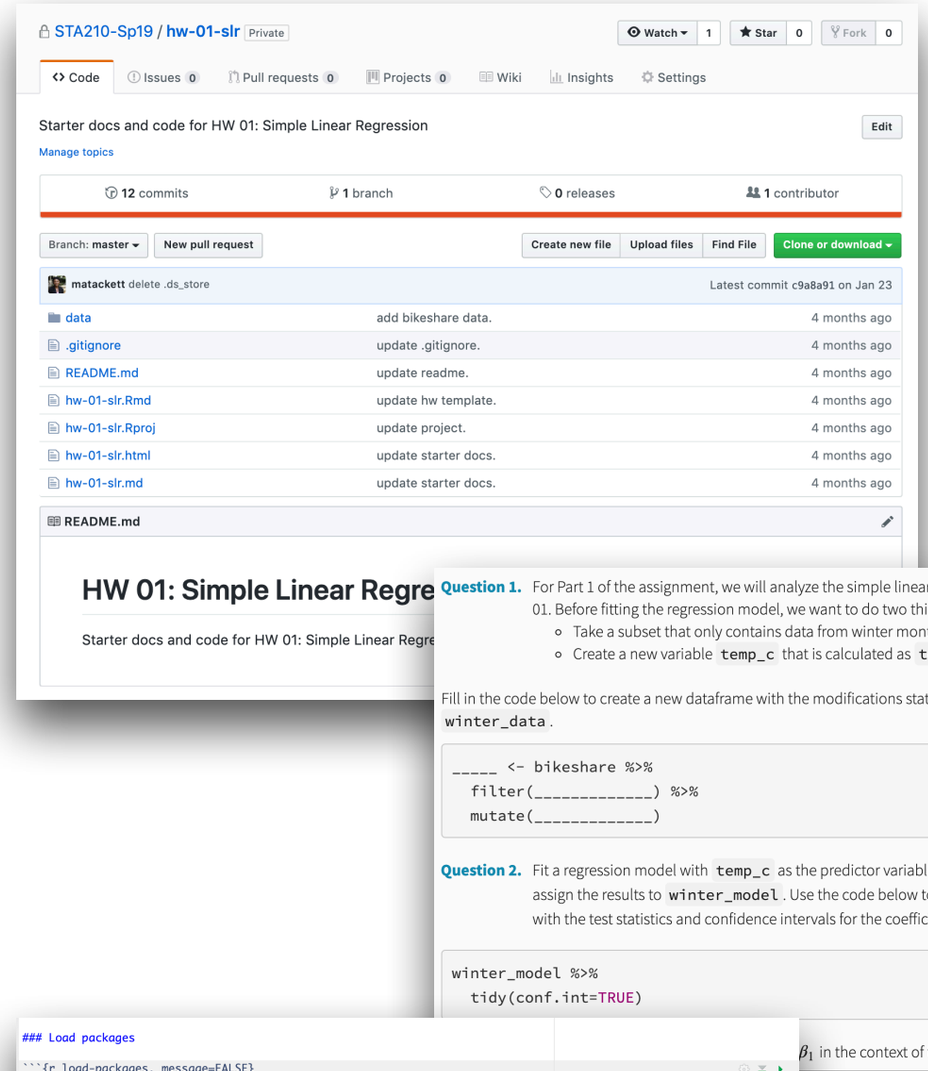
Question 8. For this portion, you will use the `housing` data you started analyzing in Lab 04. Use the code below to load the data and prepare the data.

```
houses <- read_csv("data/KingCountyHouses.csv")
houses <- houses %>%
  filter(bedrooms <= 5 ) %>%
  mutate(floorsCat = as.factor(floors),
         sqftCent = sqft - mean(sqft),
         bedroomsCent = bedrooms - mean(bedrooms),
         bathroomsCent = bathrooms-mean(bathrooms),
         logprice = log(price))
```

Fit a regression model with `logprice` as the response and `floorsCat`, `sqftCent`, `bedroomsCent`, `bathroomsCent`, and `waterfront` as predictor variables. In your analysis, include the following:

- Briefly explain why we should use the log-transformed version of `price` instead of the original version of the variable.
- Describe the relationship between a house's price and square footage (holding all else constant), including the appropriate confidence intervals.
- Describe how the expected price differs based on the number of floors in the house (holding all else constant). Include discussion about whether or not the differences are statistically significant.

Creating Assignments



1. Create starter repo in GitHub.
2. Make a copy of the starter repo for each student (or team) using **`ghclass`**.
3. Students clone repo into RStudio, write code and narrative in the R Markdown template, and knit to produce a Markdown document.
4. Write feedback to students as an "issue" in the GitHub repo and post grades in course management system.

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Challenges

Different computing backgrounds

- Begin semester with short in-class exercises to expose students to RStudio and GitHub early-on
- Have students work in groups that include diverse computing experiences

Learning curve for Git/GitHub

- Use Git through Git pane in RStudio
- Only focus on basic Git functions (push, pull, commit)

Handling large classes

- RStudio Cloud (or other server) to reduce computing differences
- **`ghclass`** package for easy course management

Learning Outcomes

Iterative Workflow

- Students "submit" work frequently by pushing it to GitHub
- Easier for students to incorporate feedback, make changes and include new ideas along the way

Professional Computing Skills

- R and GitHub are popular tools in industry
- Students gain computing skills that are applicable for internships, jobs, and higher-level classes

Professional Collaboration

- GitHub makes it easier to truly collaborate on group assignments
- Students gain skills for collaboration and sharing work in the workplace

Thank You!

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References

- Çetinkaya-Rudel, M., & Rundel, C. (2017). Infrastructure and Tools for Teaching Computing Throughout the Statistical Curriculum. *The American Statistician,* 72, 58-65.

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- Data Science in a Box. Retrieved from https://datasciencebox.org/