703: Data Science

Course Description

Data Science for Psychologists (DSP) introduces on the principles of data science, including data wrangling, modeling, visualization, and communication. In this class, we link those principles to psychological methods and open science practices by emphasizing exploratory analyses and description, rather than confirmatory analyses and prediction. We'll work our way thru Wickham and Grolemund's R for Data Science text (http://r4ds.had.co.nz/) and develop expertise in tidyverse (https://www.tidyverse.org/). This class emphasizes replication and reproducibility. DSP is a practical skilled-based class and should be useful to students aiming for academia as well as those interested in industry. Applications of these methods can be applied to a full range of psychological areas, including perception (e.g, eye-tracking data), neuroscience (e.g., visualizing neural networks), and individual differences (e.g., valence analysis).

Broad goals for the course:

- 1. Reproducibility;
- 2. Replication;
- 3. Robust Methods;
- 4. Really Nice Visualization; and
- 5. R

Required Materials

Wickham and Grolemund's R for Data Science text (http://r4ds.had.co.nz/)

Course Assignments

You will be formally evaluated in three different ways.

Presentation

You will give one presentation. This presentation will be approximately 10-minutes. This presentation is chance to practice a formal presentation in a relatively pressure-free setting).

Labs

There is (at least) one lab available per module.

Portfolio

The major semester projects (described on the data science website) is a set of EDA Projects, which you will summarize in an EDA Portfolio to be handed in on the last day of class.

Engagement

This experiential course requires active engagement. There will be few lectures and we will not be building toward an exam. Instead, we will work together to build our facilities for thinking critically about data. You should come to every class having read all of the required reading, watched the required videos, browsed the suggested resources, and so forth. You should enter the classroom prepared to discuss these materials with colleagues and complete both individual and group in-class assignments.

Grading Policy

In this course, you will determine the grade you receive by fulfilling a contract you will submit for my approval on 01/21.

Your written contract will detail:

- The requirements you will meet in order to receive the grade for which you've contracted,

- the penalties you will incur for not meeting those requirements,
- a calendar you will follow for meeting the requirements you have outlined.

Many aspects of this calendar will be determined by windows outlined on the course schedule, but your contract will take ownership of these deadlines while committing to specific due dates for the course's more flexible assignments.

Contract Details

To fulfill any grade contract a student must do the following, which should nonetheless be specified in the contract submitted for approval. When writing self-assessments students must describe how they have met these requirements in addition to the grade-specific requirements:

- Come to class prepared to discuss any assigned readings, videos, or other media. Participate actively in class activities and discussions, making observations and asking questions that help the class think together.
- Meet with me in person—during office hours or another scheduled time—at least once around midterm—roughly between weeks 5-8 to ensure you are on-track to meet your contract requirements, discuss any questions or concerns you have about the course or your progress, and decide on any necessary contract amendments.
- Revise contractual assignments as necessary until both you and I consider them "Satisfactory."
- Complete a final self-assessment demonstrating that your work has met the agreed requirements, submitting it to me by 5pm on the last day of class.

The professor reserves the right to award a grade of D or F to anyone who fails to meet a contractual obligation in a systematic way. A "D" grade denotes some minimal fulfilling of the contract. An "F" is absence of enough satisfactory work, as contracted, to warrant passing of the course. Both a "D" and "F" denote a breakdown of the contractual relationship implied by signing any of the contracts described above.

What About Exceptional (or Mediocre) Work?

I also reserve the right to reward exceptional work throughout the semester using the full range of Wake Forest's grading scale. If you contract for a "B," for instance, and submit particularly strong pieces to fulfill that contract, I may elect to raise your contracted grade to a "B+."

Likewise, if you consistently submit mediocre work in fulfillment of your contract, I reserve the right to adjust your grade one half-step down (e.g. from "A" to "A-") or even, in extreme cases, a full step.

Contract Adjustments

Periodically during the semester I will ask you to evaluate your work thus far and compare it against what you agreed in your grade contract. In these moments you can also take the opportunity to request an adjustment to your contract in either direction. If you find that you will be unable to meet the obligations of your contract, you may request to move to the next lowest grade and its requirements. Contrariwise, if you find that you've been performing above the obligations of your contract, you may request to fulfill the requirements for the next higher grade. Important Note: In order to effectively evaluate your own progress, you must keep track of your work, including days missed, and so forth.

Contract Grades

"A" Contract

To contract for an "A" in this course, you agree to:

- Earn "Satisfactory" on 11 self-paced lab assignments on a schedule you will specify in your contract.
- Produce at least 10 "Satisfactory" portfolio pieces over the course of the semester.
- Complete two "Satisfactory" Unessays on a schedule you will specify in your contract and present the strongest as an asynchronous presentation.

"B" Contract

To contract for a "B" in this course, you agree to:

- Earn "Satisfactory" on 8 self-paced lab assignments on a schedule you will specify in your contract.
- Produce at least 6 "Satisfactory" portfolio pieces over the course of the semester.
- Complete one "Satisfactory" Unessay on a schedule you will specify in your contract and present it during the last week of class

"P" Contract

To contract for a "P" or Pass in this course, you agree to:

- Earn "Satisfactory" on 8 self-paced lab assignments on a schedule you will specify in your contract.
- Produce at least 4 "Satisfactory" portfolio pieces over the course of the semester.
- Complete one "Satisfactory" Unessay on a schedule you will specify in your contract and present it during the last week of class

Tentative Module Release Schedule

Note that I'll be using your contracts to guide my tinkering.

Search:

module	start	topic	week
1	01/10	What is Data Science and Meet the Toolkit	Week 01, 01/10 - 01/14
2	01/17	Data and Visualization	Week 02, 01/17 - 01/21
3	01/24	Welcome to the Tidyverse	Week 03, 01/24 - 01/28
4	01/31	Data types and Data Transformations	Week 04, 01/31 - 02/04
5	02/07	Effective data visualization	Week 05, 02/07 - 02/11
6	02/14	Scientific Communication and confounding	Week 06, 02/14 - 02/18
7	02/21	Functions and Automation	Week 07, 02/21 - 02/25
8	02/28	Webscraping	Week 08, 02/28 - 03/04
9	03/07	Spring Break	Week 09, 03/07 - 03/11
10	03/14	Ethics	Week 10, 03/14 - 03/18
11	03/21	Tidy Models	Week 11, 03/21 - 03/25
12	03/28	Overfitting and Cross validation	Week 12, 03/28 - 04/01
13	04/04	Quantifying uncertainty	Week 13, 04/04 - 04/08
14	04/11	Rshiny	Week 14, 04/11 - 04/15
15	04/18	Machine Learning	Week 15, 04/18 - 04/22