YData: An Introduction to Data Science

Lecture 01: Introduction

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Spring 2020

Credit: data8.org

YData: Instructor

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Course website

Schedule and files:
http://ydata123.org/sp20/

Course info, grades, etc:
https://canvas.yale.edu

This week I will send out a link to a **survey** to collect data that may be used as examples in class.
The responses will likely be made publicly available so that we can work with the data during class. None of the questions are required so feel free to skip any questions you do not want to answer.
Please only submit your responses once.

YData website: http://ydata123.org
YData Piazza site: https://piazza.com/yale/spring2020/sds123

What is Data Science?

Drawing useful conclusions from data using computation

- **Exploration**
  - Identifying patterns in information
  - Uses visualizations
- **Inference**
  - Quantifying whether those patterns are reliable
  - Uses randomization
- **Prediction**
  - Making informed guesses
  - Uses machine learning

YData Seminar Courses

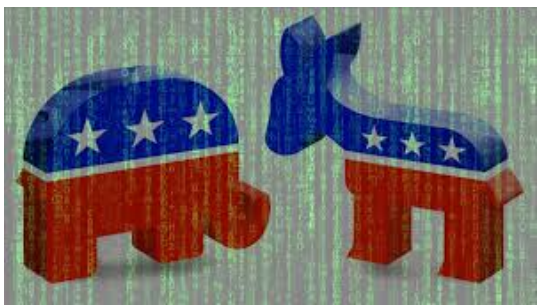
- Data science is driven by applications
- Every data-driven subject brings new challenges
- YData seminars are small, independent courses taught by Yale faculty who are excited to share their expertise
- We encourage you to consider enrolling in one of the three YData seminars offered this semester

Currently available YData Seminar Courses

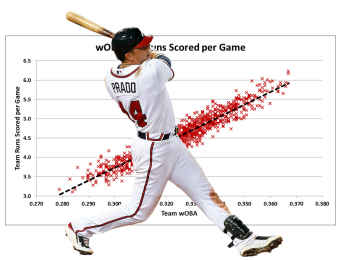
Text Data Science: An Introduction (S&DS 171)

Derek Feng: Text – from scientific journals, the internet, digitized books, social interactions from Twitter and other social media platforms – are becoming increasingly important sources of data. Text Data Science is an introduction to the computational methods for handling such datasets, with a focus on simple but surprisingly powerful techniques that do not require linguistic analyses.

Data Science for Political Campaigns (S&DS 172)



Joshua Kalla: Political campaigns have become increasingly data driven. Data science is used to inform where campaigns compete, which messages they use, how they deliver them, and among which voters. In this course, we will explore how data science is being used to design winning campaigns. Students will gain an understanding of what data is available to campaigns, how campaigns use this data to identify supporters, and the use of experiments in campaigns.



Analysis of Baseball Data (S&DS 173)

Ethan Meyers: Baseball is a game that contains a high degree of randomness, and because professional baseball has been played since the 19th century, a large amount of data has been collected about players' performance. In this class we use baseball data to understand key concepts in data science including data visualization, data wrangling, and statistical inference. To understand these concepts, we analyze data include season-level statistics going back to the 1870s, play-by-play statistics going back to the 1930s and pitch trajectory data going back to 2006.

Course Structure

- Three lectures per week
- Weekly homework assignments
  (lowest homework grade will be dropped at end of semester)

  First homework due by 11:59 PM on Thursday, January 23
- Weekly practice exercises (ungraded)
- Three projects
- Drop-in office hours (see Canvas)
- Midterm during lecture hour on Wednesday, March 4, 2020
- **Final exam scheduled on Friday, May 1 (2 PM)**

Details can be found at https://canvas.yale.edu

Course grade

Your overall course score will be determined as a weighted average of weekly homework (25% of final grade), projects (25%), midterm exam (20%), and final exam (30%)

A letter grade will be assigned based on:

A: 93 - 100	**A-:** 90 - 93	**B+:** 87 - 90	**B:** 83 - 87	**B-:** 80 - 83
C+: 77 - 80	**C:** 73 - 77	**C-:** 70 - 73	**D:** 60 - 70	**F:** Below 60

Honors: 90-100 **High Pass:** 80-90 **Pass:** 70-80 **Fail:** Below 70

If adjustments are made to this grading scale, it will only be in a direction that will result in a higher letter grade.

Course Textbook

Computational and Inferential Thinking:
The Foundations of Data Science

By Ani Adhikari and John DeNero (**?**)

Freely available at https://www.inferentialthinking.com

Getting Help

- Ask a friend
- Ask on Piazza
  Participation on Piazza through asking and answering questions is *strongly* encouraged
- Come to office hours (see Canvas for days and times)

Collaboration

Asking questions is encouraged

- Discuss questions with each other (except on exams)
- Submit homework individually, but discuss with others (don't share written solutions or code)
- Submit projects individually or with one partner (only undergraduates may work with a partner)

The limits of collaboration

- Don't share solutions with each other (except project partners)
- Copying or other dishonesty will result in failing the course

Data science can be used for answering many different sorts of questions.

For example, do left-handers die younger than right-handers?

Do left-handers die younger than right-handers?

Psychological Bulletin
1991, Vol. 109, No. 1, 90-106

0033-2909/91/$3.00

Left-Handedness: A Marker for Decreased Survival Fitness

Stanley Coren
University of British Columbia
Vancouver, British Columbia, Canada

Diane F. Halpern
California State University, San Bernardino

Life span studies have shown that the population percentage of left-handers diminishes steadily, so that they are drastically underrepresented in the oldest age groups. Data are reviewed that indicate that this population trend is due to the reduced longevity of left-handers. Some of the elevated risk for sinistrals is apparently due to environmental factors that elevate their accident susceptibility. Further evidence suggests that left-handedness may be a marker for birth stress related neuropathy, developmental delays and irregularities, and deficiencies in the immune system due to the intrauterine hormonal environment. Some statistical and physiological factors that may cause left-handedness to be selectively associated with earlier mortality are also presented.

***According to a study from 1991, the answer is "Yes"**

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- Average age of death for left-handers: 66

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***According to a study from 1991, the answer is "Yes"**

- Average age of death for left-handers: 66
- Average age of death for right-handers: 75

*Example found in "Seeing Through Statistics" by J. Utts

Think - Pair - Share

Think - Pair - Share

Think - Pair - Share 1

The results of the study addressing the question "Do left-handers die younger than right-handers?" suggest

A Yes, left-handed people do die younger than right-handed people. Period.

B Yes, the study suggests that left-handed people do die younger than right-handed people, but the study should be repeated in exactly the same manner to see if the same results appear.

C No, there is no evidence whatsoever that left-handed people die younger than right-handed people.

D I need to know more information about how the study was performed before I can decide.

Do left-handers die younger than right-handers?

- Left-handers: 66 vs. Right-handers: 75
- Flaws in the study?

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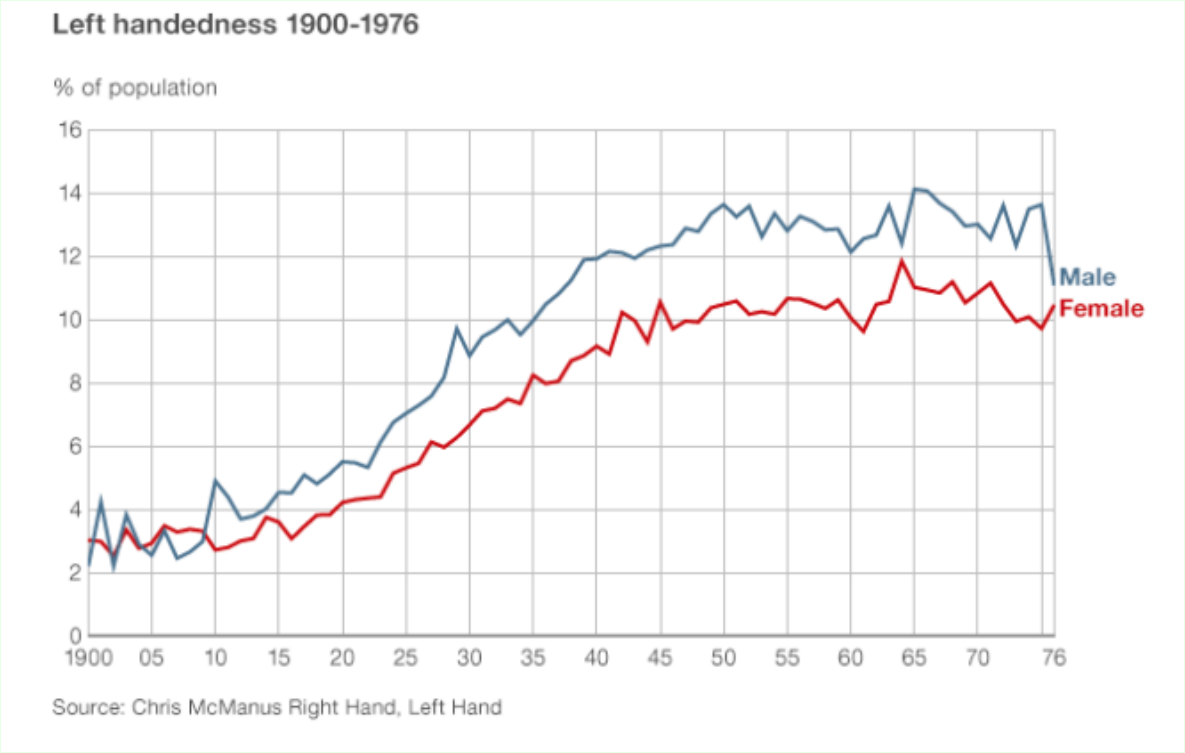

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- Ideas for improvement?

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- Ideas for improvement?
- A prospective study - follow group of current left and right handers until death

Do left-handers die younger than right-handers?

Where the data come from matters.

Example

(DEMO)

References

Adhikari, A. and DeNero, J. (2018), "Computational and Inferential Thinking," Gitbook.