ST537 Data Visualization: Draft Syllabus  
Sep 12th 2016

Course Name: Data Visualization  
Course Number: ST537  
Credits: 3 This course combines approximately 90 hours of instruction, online activities, and assignments for 3 credits.  
Term: Spring 2017  
Prerequisites: ST512 or ST517 or ST552 or at discretion of instructor (students should be familiar with linear regression and using R)  
Instructor: Charlotte Wickham charlotte.wickham@stat.oregonstate.edu  
Teaching Assistant: TBA

Course description

Perceptual principles for displaying data; critique and improvement of data visualizations; use of color in visualization; principles of tidy data; strategies for data exploration; select special topics.

Course content

This course will give you the tools to critique, create and improve visualizations of statistical data. Through readings and discussion of seminal work, you will learn the principles of graphical perception and the visual encoding of quantitative information and learn how to use these principles to evaluate an effective visualization. Through exposure to famous and infamous visualizations, you'll explore what makes graphical representations of data successful or unsuccessful, and gain an appreciation of the different goals of visualization.

A key part of the class will be critiquing other’s visualizations and, as your visualization creation skills develop, your own and your classmates’ visualizations.

Measurable Student Learning Outcomes

- Deconstruct a graphic into the data displayed and how it is mapped to visual properties.
- Describe the order of accuracy of perceptual tasks and how this affects the choices made in constructing a visualization.
- Critique a visualization based on its purpose and use or abuse of perceptual principles.
- Suggest improvements of a visualization to enhance its effectiveness.
- Use color in visualization appropriately for the variable it is encoding and with sensitivity to visually impaired viewers.
- Translate an image or description of a graphic to a specification of the graphic using ggplot2.
- Rapidly prototype visualizations using ggplot2 in R to answer a question about data.
- Develop a strategy for exploration of a dataset and document the results.
- Combine tools for data manipulation and visualization, to collect, tidy and manipulate data to create visualizations to answer your own questions of interest.
- Polish a visualization to publication-ready standards.

Tentative topic outline:

- Week 1: Introduction
the purpose of visualization
the guiding principles of visualization
the deadly sins of bad graphics
describing graphics

• Week 2: Deconstructing and constructing graphics
  • the grammar of graphics
  • constructing plots in ggplot2
  • replicating other peoples plots

• Assignment 1 - Construction

• Week 3: Perception
  • perception of continuous variables
  • perception of groups
  • making comparisons easy

• Week 4: Color and Scales
  • how we perceive color
  • the use of colour in graphics
  • scales in ggplot2

• Assignment 2 - Critique

• Week 5: Principles of Tidy data
  • data import
  • what makes data tidy?
  • reshaping data with tidyr

• Week 6: Data manipulation
  • summarizing data for more effective display
  • transforming data for more effective display
  • data manipulation with dplyr

• Assignment 3 - Exploration

• Week 8: Polishing
  • polishing a plot
  • practice brainstorming, critiquing and polishing

• Week 9: Interactive and dynamic visualization
  • using interaction or animation to improve understanding
  • interactive graphics with R

• Week 10: Special topics
  • displaying distributions and uncertainty
  • high dimensional data
  • spatial data/maps
  • networks/graphs

• Assignment 4 - Putting it all together
Evaluation of Student Performance

Assignments (100 points)

There will be four large graded assignments worth 20, 20, 30, and 30 points respectively. Roughly, they will be due at the end of weeks 2, 5, 7 and 10. The fourth assignment will require you to source your own data, so you may want to begin thinking about that.

Other activities (100 points)

Graded activities for the week will be posted at the start of the week. They could consist of discussion board posts, completing a lab activity, submitting R code, or submitting a written document. They may be individual or group submissions, and they may be graded or Complete/Incomplete. Read the instructions for each activity carefully.

Final grade

Your final score will be out of 200 points (allocated between assignments and other activities as above). Your numerical score will be converted to percentage, then to a letter grade based on the following table:

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<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>95 - 100</td>
<td>A</td>
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<tr>
<td>88 - 94.9</td>
<td>A-</td>
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<tr>
<td>80 - 87.9</td>
<td>B+</td>
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<td>75 - 79.9</td>
<td>B</td>
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<td>70 - 74.9</td>
<td>B-</td>
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<td>C+</td>
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<td>0 - 45</td>
<td>F</td>
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Learning Resources

All class materials will be posted online through canvas.

There is no assigned textbook for the class. Readings will be assigned from publicly available materials or materials available through the Oregon State University library.

Course Policies

Disability statement

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations.
While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

**Expectations for Student Conduct**

Student conduct is governed by the university’s policies, as explained in the Office of Student Conduct and Community Standards (http://oregonstate.edu/studentconduct/offenses-0).

**Academic integrity**

Students are expected to comply with all regulations pertaining to academic honesty. For further information, visit Student Conduct and Community Standards, or contact the office of Student Conduct and Mediation at 541-737-3656.

OAR 576-015-0020 (2) Academic or Scholarly Dishonesty:

a) Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student’s own efforts or the efforts of another.

b) It includes:

i) **CHEATING** - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.

ii) **FABRICATION** - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.

iii) **ASSISTING** - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone’s grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).

iv) **TAMPERING** - altering or interfering with evaluation instruments or documents.

v) **PLAGIARISM** - representing the words or ideas of another person or presenting someone else’s words, ideas, artistry or data as one’s own, or using one’s own previously submitted work. Plagiarism includes but is not limited to copying another person’s work (including unpublished material) without appropriate referencing, presenting someone else’s opinions and theories as one’s own, or working jointly on a project and then submitting it as one’s own.

c) Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University’s Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.