Statistics 536 - Modern Regression Methods

**Course Information**
Winter 2017
12:00-1:00PM 299 TMCB
mheaton.byu.edu/Teaching

**Instructor Information**
Matthew J. Heaton, Ph.D.
mheaton@stat.byu.edu
801-422-7249
Office Hours: Whenever

**Course Purpose:** To develop and present necessary statistical tools to promote statistical learning from complex datasets.

**Description:** Multiple linear regression, nonlinear regression, local regression, missing data strategies, penalized regression, generalized additive models, logistic regression, discriminant analysis, tree-structured regression, support vector machines.

**Prerequisites:** STAT 535, STAT 624

**Learning Outcomes:** By the end of this course students should be able to:

1. Appropriately explore data to determine an appropriate statistical model.
2. Posit & explain an appropriate statistical model that answers questions related to a dataset.
3. Fit the posited statistical model to the data using statistical software.
4. Appropriately present model results and conclusions from the statistical analysis.
5. Be comfortable submitting a written or oral report of a statistical analysis.

**Learning Methods:** The following learning methods will be applied in this class.

1. Case Studies (40% of final grade): This course is built around case studies. Case studies are real-life data sets from various clients which require statistical expertise to analyze. New methods and models will be presented and taught in the context of case studies.
   
   (a) Two due dates are associated with each case study: (i) exploratory data analysis (EDA) and (ii) final report.

   (b) The EDA is a preliminary analysis of major components in the data. Instructions for completing an EDA, as well as a grading rubric, is provided on the course webpage. If working in pairs (see below) submit one EDA with both names attached.
(c) Students may choose to submit the final report in written or oral form.

- Written reports must be no more than 5 single-spaced pages of text and done in \LaTeX. Do not include code in your report.
- Each written report must include a 1 paragraph abstract (this is part of the portfolio requirement for the MS degree).
- At least 1 but no more than 3 case studies can be submitted as a 20 minute oral presentation to the professor. Oral presentations must be approved by the professor before the due date. For oral reports, a copy of the slides must be submitted on the due date. The professor reserves the right to deny permission to submit an oral report. Do not include code in the oral report.
- For both oral and written reports, the target audience are students who will take this class in the future. Therefore, a proper report will describe less familiar terms but still use common statistical jargon.

(d) Except for the midterm and final case study, students can work with 1 other partner on a case study (two people total). If you choose to work with a partner, I reserve the right to deduce points if the work was not distributed evenly (see the grading rubric). If you choose to work with a partner on a case study, you may NOT work with that student on a case study again.

(e) A grading rubric for case study reports is available on the course webpage. The same rubric will be used for oral and written reports.

(f) No credit will be given for late reports unless the instructor has given prior consent.

2. Midterm Case Study (30% of final grade): The midterm case study will be a written report of a case study. The grading rubric will be the same as that used for the case studies. Students may not collaborate on the midterm case study.

3. Final Case Study (30% of final grade): The final case study will be an oral presentation of no more than 30 minutes given during finals week to the professor. Students may not collaborate on the final case study. Failure to complete the final case study will result in an incomplete for the course.

**Course Materials:** The required course textbook will be

- An Introduction to Statistical Learning with Applications in R by G. James, D. Witten, T. Hastie and R. Tibshirani (2013).

Other course materials (which can be borrowed from the professor) include:

Coding: This class will primarily use R and the book gives nice tutorials on how to use R for the analyses we will be doing. However, python also provides nice toolkits to do many of the things that we will be doing in this class so you can use python if you want. I know just the basics of python (I’m currently learning it) so I won’t be able to help that much if you choose to use python. I am currently working on similar tutorials in python to what your book has for R but I’m not done yet but you can certainly take on python if you wish.

Course Policies and Expectations:

1. Please put all notes, computers, etc. away during class. I want you paying attention to me rather than scrupulously writing notes. All lecture notes will be made available on the course webpage (so you shouldn’t have to worry about notes).

2. Please silence all cell phones before class begins. If your phone goes off during class, you buy the whole class donuts or bagels. If we go the whole semester without a cell phone going off, I buy donuts or bagels (or whatever, within reason, the students choose).

3. Students are expected to participate in class by asking questions, answering questions, and providing useful discussion with other students.

4. Students will be graded based on the following scale (inclusive on the left):

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>94%-100%</td>
<td>A</td>
</tr>
<tr>
<td>90%-94%</td>
<td>A-</td>
</tr>
<tr>
<td>87%-90%</td>
<td>B+</td>
</tr>
<tr>
<td>83%-86%</td>
<td>B</td>
</tr>
<tr>
<td>80%-82%</td>
<td>B-</td>
</tr>
<tr>
<td>77%-79%</td>
<td>C+</td>
</tr>
<tr>
<td>73%-76%</td>
<td>C</td>
</tr>
<tr>
<td>70%-72%</td>
<td>C-</td>
</tr>
<tr>
<td>67%-69%</td>
<td>D+</td>
</tr>
<tr>
<td>63%-66%</td>
<td>D</td>
</tr>
<tr>
<td>60%-62%</td>
<td>D-</td>
</tr>
<tr>
<td>&lt;60%</td>
<td>F</td>
</tr>
</tbody>
</table>

5. Honor Code: In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university’s expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

6. Preventing & Responding to Sexual Misconduct. In accordance with Title IX of the Education Amendments of 1972, Brigham Young University prohibits unlawful sex
discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment?including sexual violence?committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university. University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or (801) 422-8692. Reports may also be submitted through EthicsPoint at https://titleix.byu.edu/report or 1-888-238-1062 (24-hours a day).

BYU offers confidential resources for those affected by Sexual Misconduct, including the university’s Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university’s Sexual Misconduct Policy, reporting requirements, and resources can be found at http://titleix.byu.edu or by contacting the university’s Title IX Coordinator.

7. Student Disability: Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.