SDS 383D: Statistical Modeling II
MW 1:00PM — 2:30PM, Room: UTC 4.120

Instructor: Dr. Antonio Linero, WEL 5.244

Office Hours: 3:00pm — 4:00PM on Monday and 12:00 — 1:00PM on Wednesday.

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Prerequisites: This course primarily concerns probabilistic modeling using generalized linear models and hierarchical Bayesian modeling, although there will be other topics covered. This course is intended for graduate students in the Statistics and Data Sciences Department or any students from other departments who are interested in developing/using probabilistic models. In terms of substantive prerequisites, I assume that you are comfortable with the following topics:

- linear algebra;
- how to program in a language like `R` or `Python`;
- multivariate calculus;
- probability (although measure theory isn't necessary);
- basic inferential statistics at the level of Casella & Berger;
- linear regression.

If you have any doubt about your preparation for this course, or have any questions about whether this course is right for you, feel free to chat with me.

Course Website: Course website is available at `www.github.com/theodds/StatModelingNotes`.

Course Structure: Each week, I will give you a set of exercises and light notes. These will contain results for you to prove, problems to solve, and datasets to analyze. In class you will present your solutions and we will discuss the material. This will be supplemented by more traditional lectures where necessary. Exercises should be completed *before they are discussed in class.*

You should expect to spend a substantial amount of time — typically 5 to 10 hours a week — outside class working on the exercises. I encourage you to work on your own to obtain maximum benefit.

Textbook: Relevant readings will be given throughout the course; *Bayesian Data Analysis*, 3rd by Gelman, Carlin, Stern, Dunson, Vehtari, and Rubin is a recommended text for this course, but is not required.

Software: The examples in this course will use the `R` programming language, available at `www.`

r-project.org. See also www.rstudio.com for a nice development environment. You will be asked to submit R-code as part of your homework solutions.

Course Objectives: The purpose of this course is to give students the mathematical tools and intuition required to develop and deploy sophisticated probabilistic models. Major topics will include:

- classical Frequentist and Bayesian approaches to inference;
- fundamentals of generalized linear models;
- multivariate distributions, such as the multivariate Gaussian and Dirichlet;
- nonparametric regression techniques (smoothing, additive models, and Gaussian processes);
- hierarchical linear/generalized linear models.

Grading: Your grade will be based on completion of the homework (25%), class participation (25%), a take-home final exam (25%), and a class project (25%).

Homework: Homework will be collected at the beginning of each month. Exercise solutions should be typeset using LaTeX and code should be documented. In class you will present your work. I highly encourage you to write your solutions as `.Rmd` files, perhaps using the published notes as a template where you can add your solution.

Course Project: For the project part of the course, you may pick a topic of interest that showcases the topics discussed in class, after discussing it with me in advance. This might be analyzing a dataset associated with your own research, or developing and implementing a new model or inference technique and comparing it with existing methods. You may work in a group of three or fewer.

You should prepare a report up to 8 pages in length using the NeurIPS style files and guidelines, available on the course website. Reports are due on the final day of class.

Students with Disabilities: Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, `http://www.utexas.edu/diversity/ddce/ssd/`.

Religious Holy Days: By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Scholastic Honesty: We expect students to behave with integrity. Students found cheating on exams or homework will receive a score of zero for that exam or assignment, and may be subject to

additional disciplinary action. For more information on the University of Texas scholastic dishonesty policy, see the 2006-2007 General Information Catalog, Appendix C.

Campus Safety: Please note the following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, `http://www.utexas.edu/safety`:

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.
- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation should inform the instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors.
- Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Behavior Concerns Advice Line (BCAL): 512-232-5050
- Further information regarding emergency evacuation routes and emergency procedures can be found at: `http://www.utexas.edu/emergency`.