> **Syllabus**
> STA7322: Advanced Regression, Fall 2022
> Department of Statistics, University of Florida

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Course objective. The course STA7322 covers a variety of advanced methods used in modern regression analyses. The major topics covered in the course will be (in no particular order) semiparametric regression techniques (e.g., local linear regression, splines), regularized/shrinkage estimators (e.g., ridge regression and lasso), advanced statistical machine learning methods (e.g., tree-based methods, support vector machines, neural networks), deep learning, and more. The course culminates in a final project, which could include novel methodological research, an in-depth numerical or theoretical examination of a method covered in class, a novel data analysis project, or similar.

Lectures. Course lectures will take place in different locations on Tuesdays and Thursdays. Specifically,

- 12:50 PM–2:45 PM on Tuesday in TUR B310

- 12:50 PM–1:40 PM on Thursday in FLI 0210

A link to the lecture meeting and recordings can be found on the [course webpage].

COVID-19 policies. In response to COVID-19, the following recommendations are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available and have been demonstrated to be safe and effective against the COVID-19 virus. Visit one.uf for screening / testing and vaccination opportunities.

- If you are sick, stay home. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 to be evaluated.

- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

Office hours and appointments. In-person office hours (with the option to Zoom during this time) will be held immediately after lecture on Thursday from 1:50 PM - 2:50 PM in 202 Griffin Floyd; the link to virtual office hours will also be active during this time. Zoom

office hours will take place at a time TBA on the [course webpage]. Appointments (virtual or in-person) can be requested at alternative times by email.

Prerequisites. A well prepared student should have taken advanced courses in generalized linear models, matrix algebra, theoretical statistics, and should be comfortable with the R programming language.

Course webpage. Course materials (e.g., homework assignments and due dates) will be posted to the course webpage [link]. A link to this page will be available on the course eLearning site, where students' grades will be posted. Please check this site regularly for updates and announcements. Course documents and important information, including homework exercises and solutions, will be posted here.

Schedule. Table 1 provides a tentative schedule of topics we will cover throughout the semester.

Week	Topic
1	OLS, ridge regression
2	Lasso (computing)
3	Lasso (theory)
4	Inference for high-dimensional linear models
5	Piecewise polynomials and splines
6	Kernels, nearest-neighbors regression
7	Discriminant analysis
8	Support vector machines
9	Generalized additive models
10	Tree-based methods, random forests
11	Boosting
12	Ensemble learning
13	Neural networks, deep learning
14	Deep learning
15	Project presentations

Table 1: Tentative schedule of topics covered in this course.

Textbooks and other resources. There will be no single textbook used for the course. However, lectures will often follow chapters from the following books:

- Hastie, Tibshirani, and Friedman, *Elements of Statistical Learning* [link]

- Ruppert, Wand, and Carroll, *Semiparametric Regression* [UF library]

- Wood, *Generalized Additive Models* [UF library]

- Hastie, Tibshirani, and Wainwright, *Statistical Learning with Sparsity* [link]

- Fan, Li, Zhang, and Zou, *Statistical Foundations of Data Science.* Physical copy available at Marston library.

- Goodfellow, Bengio, Courville, and Bach, *Deep Learning.* Physical copy available at Marston library.

We will also cover material from recent articles which do not appear in textbooks: these will be cataloged on the aforementioned course page. Note that exams and homework will be based on material presented in lectures.

Assignments. The course will consist of (at most) six homework assignments and a project. The due dates are (tentatively):

- Homework 1: Friday, Week 3, 5:00pm (on eLearning)

- Homework 2: Friday, Week 5, 5:00pm (on eLearning)

- Homework 3: Friday, Week 7, 5:00pm (on eLearning)

- Homework 4: Friday, Week 9, 5:00pm (on eLearning)

- Homework 5: Friday, Week 11, 5:00pm (on eLearning)

- Homework 6: Friday, Week 13, 5:00pm (on eLearning)

- Presentation of projects: Thursday, December 2nd and Tuesday, December 6th

- Submit project: Tuesday, December 13th (on eLearning)

Some important notes about homework and exams:

- Homework assignments will often require a combination of programming (in R), statistical theory, and data analysis. Ideally, these will be completed and submitted as a Jupyter Notebook or Rmarkdown (.rmd) document.

- Homework assignments will be posted on the course webpage at least two weeks before their due date.

- *It is highly encouraged to work on these with classmates, although all submitted work should be yours alone.*

Course project. The course project will be completed in lieu of a final exam. *Ideally, this project will complement your current research, or allow you to learn more about a topic from the course (or course-adjacent) which particularly interests you.* Projects can be methodological, numerical, or applied, e.g., you could apply a method from the course to a new dataset; you could perform extensive simulation studies comparing methods from the course, etc.

The project will consist of four checkpoints:

- *Project proposal.* ~ Week 6–7

  You will writeup a 1-2 page project proposal laying out *specifically* what you will do. These will be discussed in a one-on-one meeting with the instructor, who will approve the project or suggest changes. If you are having difficulty thinking of a project, speak with the instructor prior to this deadline.

- *Check-in.* ~ Week 10

  You will writeup a 2-3 paragraph project progress statement laying out what specific progress has been made thus far. At this stage, you may also propose amendments to the original project proposal.

- *Presentation.* ~ Week 14

  You will prepare and deliver a 15 minute presentation describing your project, the progress you've made, and directions for future research.

- *Submission.* ~ Week 15

  You will submit a pdf writeup of your project. This should be a latex document in the style of a journal article. There is no page minimum or maximum per-se, but the project should be self-contained, have an introduction, methods, results section(s), along with a bibliography and any accompanying code.

Grades. Course grades will be based on six homework scores (70%) and the course project (30%). Grade cutoffs are provided in Table 2.

Grades	Percentage cutoff
A	100 - 90
A-	90 - 87
B+	87 - 84
B	84 - 80
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D-	60 - 55
F	55 - 0

Table 2: Grade cutoffs.

Incomplete policy. The grade of "Incomplete" can be assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospitalization, a student is prevented from completing the work of the course on time. In particular, an "Incomplete" will be given if the student presents evidence from a certified professional that the

student is unable to complete the course. In addition, the student must have a passing grade at the time of the incomplete request in order to receive the "Incomplete". An "Incomplete" requires a written agreement between instructor and student found here `https://clas.ufl.edu/files/2019/02/CLASIncompleteGradeContract.pdf`.

Students with disabilities. Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center (352-392-8565, `www.dso.ufl.edu/drc/`). Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities are encouraged to follow this procedure as early as possible in the semester.

Online course evaluation process. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at `https://gatorevals.aa.ufl.edu/students/`. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via `https://ufl.bluera.com/ufl/`. Summaries of course evaluation results are available to students at `https://gatorevals.aa.ufl.edu/public-results/`.

Academic dishonesty. UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. The Conduct Code can be found here: `https://sccr.dso.ufl.edu/process/student-conduct-code/`. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Virtual class consent. Our class sessions may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate verbally are agreeing to have their voices recorded.

If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared.

In class recording. Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student.

Health and wellness resources.

- U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.

- Counseling and Wellness Center: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.

- Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.

- University Police Department: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).

- UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

Academic resources.

- E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.

- Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

- Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.

- Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352-392-6420. General study skills and tutoring.

- Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

- Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

- On-Line Students Complaints: View the Distance Learning Student Complaint Process.