THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

Stat 3302 (Spring 2024): Statistical Modeling for Discovery II

Course information

Lectures Mon, Wed, Fri, 12.40–1.35pm in Pomerene Hall 250.

Holidays: Martin Luther King Jr. Day is Mon 15 Jan; Spring break is Mon 11—Fri 15 Mar.

In person lectures won't be recorded.

Instructor

Name:	Sally Paganin
E-mail:	paganin.1@osu.edu
Office:	229 Cockins Hall
Office hours:	Wed, 3:00 — 4:00 pm, or by appointment

TA

Biqing Yang

yang.5733@buckeyemail.osu.edu

Course Description

This course continues to investigate statistical models for data analysis and discovery in big-data settings. The regression methods developed in Stat 3301 are extended to data settings with binary and multi-category outcomes. An introduction to some of the most commonly used statistical methods for exploring and analyzing multivariate data is provided. Interpretation and communication of the results of analyses is emphasized. Upon successful completion of the course, students will be able to

1. Build, fit and interpret statistical models for binary outcomes
2. Understand the difference between nominal and ordinal outcomes and build regression models that are appropriate for each
3. Recognize the types of questions that can be answered by regression models for multi-category data and structure models to answer those questions
4. Comprehend the statistical principles that underlie basic methods of multivariate data analysis

Prerequisites: Stat 3301 (Statistical Modeling for Discovery I); (Math 2568) Linear Algebra.

Textbooks

An online version of the books is avaliable via OSU Univeristy Libraries.

A. J. Dobson and A. Barnett (2018), An Introduction to Generalized Linear Models, Fourth Edition, Chapman & Hall/CRC Texts in Statistical Science.
https://library.ohio-state.edu/record=b8615141~S7

A. C. Rencher and W. F. Christensen (2012), Methods of Multivariate Analysis, Third Edition, Wiley.
https://library.ohio-state.edu/record=b7149844~S7.

I will highlight other useful references as the course progresses.

Required equipment

- Computer: current Mac (macOS) or PC (Windows or Linux) with high-speed internet connection, capable of running R and RStudio (described below)

Required software

- This class requires you to use the statistical software called R (The R Project for Statistical Computing; http://www.r-project.org/ . This software is available as free Software.

    - You can download R for Windows, Mac, and Linux, from the CRAN archive at https://cran.r-project.org.

    - An in-depth introduction to R is availableat http://cran.r-project.org/doc/manuals/R-intro.pdf

- An easy-to-use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from https://posit.co/downloads/. Note that RStudio requires R to be installed.

Assignment, grading and attendence

Assigment information

Homeworks	20% .... Almost biweekly
Midterm 1	20%.............. Fri 16 Feb 2024 (in class)
Midterm 2	20%.............. Fri 22 Mar 2024 (in class)
Project	10%.............. Fri 19 Apr 2024
Final Exam	30%.............. Tue Apr 30,12:00pm-1:45pm

Homeworks will be assigned on an approximately biweekly basis on Carmen and will be due at the **beginning** of class on the day it is due.

Your answers must be submitted on Carmen as a **single PDF** produced from an R Markdown file template provided with the assignment. Homework problems that that do not require R may be handwritten (electronically, or on paper and scanned) but they must be combined together with the rest

of your submission into a single PDF. You can use Adobe Acrobat (see https://it.osu.edu/adobe) to combine PDF files.

You are encouraged to work together on the homework, but **do not copy any part of a homework**; your submitted answers (code, prose, solutions) must be your own work. For example, I encourage you to discuss strategies for solving problems, but the actual solution that you write must be your own. Keep in mind the university policies on plagiarism. Do not copy or plagiarise anything from others or that you may find on the Internet.

Exams. There will be **two midterms** and **one final exam**. All exams will be closed book/closed notes. You will not need a calculator. Computers, smartphones, and similar devices are not allowed to be used. If there is an an exceptional circumstance, e.g. medical or family emergency, then please contact me as soon as possible before the exam date to make potential arrangements.

Project. There will be a project that you will complete in groups of 4 students. The group leader and members will be assigned automatically. The project will consist of finding a dataset, formulating questions that can be answered with the data, and performing an appropriate analysis to answer the questions posed.

Proposals for the project will be due just before spring break. The complete project will be due before the final exam. Further details, including deadlines, will be given as the semester progresses and announced on Carmen. There are limited options to change your group, under some circumstances if you want to. Email me so we can discuss and find a way. Late assignments

Late Assignments

Generally, late assignments will not be accepted. However, if there are extenuating circumstances beyond your control, please contact the course instructor immediately.

Grading scale

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\begin{array}{ll}
93 — 100 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{A} \\
90 — 92.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{A-} \\
87 — 89.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{B+} \\
83 — 86.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{B} \\
80 — 82.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{B-} \\
77 — 79.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{C+} \\
73 — 76.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{C} \\
70 — 72.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{C-} \\
67 — 69.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{D+} \\
60 — 66.9 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{D} \\
\text{Below } 60 & \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{E}
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Class Attendance Policy

You are expected to attend all lectures.

Academic policies

Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's Code of Student Conduct ((studentconduct.osu.edu) and this syllabus may constitute "Academic Misconduct."

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct.

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)

- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)

- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at `equity.osu.edu`

2. Call 614-247-5838 or TTY 614-688-8605

3. Or email equity@osu.edu

Religious accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can

reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Accessibility Accommodations for Students with Disabilities

Requesting Accommodations

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations.

Disability Services Contact Information

- Phone: 614-292-3307

- Website: slds.osu.edu

- Email: slds@osu.edu

- In person: Baker Hall 098, 113 W. 12th Avenue

Accessibility of Course Technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations as early as possible.

- CarmenCanvas accessibility (go.osu.edu/canvas-accessibility)

- Streaming audio and video

- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)

Course schedule (tentative)

Week	Dates	Topics
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1	01/08—01/12	Introduction and Motivation, Review of Binomial Model
	01/15	**No class** (Martin Luther King, Jr. Day)
2	01/17—01/19	Simple Logistic Regression: Model Formulation
3	01/22—01/26	Estimation of Parameters, Categorical Logistic Regression
4	01/29—02/02	Model Evaluation and Diagnostics in Logistic Regression
5	02/05—02/09	Model Building in Logistic Regression
6	02/12—02/14	Binomial Regression
	02/16	**Midterm Exam 1**
7	02/19—02/23	Poisson Regression
8	02/26—03/01	Models for Ordinal and Multicategory Data
9	03/04—03/08	Introduction to Multivariate Data
	03/11—03/15	**No class (Spring break)**
10	03/18—03/22	Multivariate Numerical Summaries
	03/22	**Midterm Exam 2**
11	03/25—03/29	The Multivariate Normal Distribution
12	04/01—04/05	More on the Multivariate Normal Distribution
13	04/08—04/12	Principal Components Analysis
14	04/15—04/19	Linear Discriminant Analysis
	04/19	**Project due**
15	04/22	Catch-Up, Review, and Further Direction
	04/30	**Final Exam** 12:00pm — 1:45pm