

# AEDE 6130 Syllabus

Applied Quantitative Methods III (Spring 2024)

## Course Information

- **Course times and location:**
  - **Lectures:** Tuesdays and Thursdays, 2:20 – 3:40pm (Kottman Hall 460)
  - **Labs:** Thursdays, 3:50 – 5:30pm (Ag. Admin 005)
- **Credit hours:** 4
- **Mode of delivery:** In Person

## Instructor

- **Name:** Karan Shakya
- **Email:** shakya.11@osu.edu
- **Office location:** Ag. Admin 342
- **Office hours:** Tuesdays 4:00 – 5:00pm [Zoom link available:  
<https://osu.zoom.us/j/98234805194?pwd=QWFGLzRqMnIxZ0xicXZTNjVSSEs0UT09>]
- **Preferred means of communication:**
  - Preferred method of communication for questions is **email**. For a quicker response, please use “6130 - ...” as the subject of your email.
  - Any class-wide communications will be sent through the ‘Announcements’ tool in CarmenCanvas.

## Teaching Assistant

- **Name:** Kunxin Zhu
- **Email:** zhu.2906@osu.edu
- **Office location:** Ag. Admin 327
- **Office hours:** Mondays 4:00-5:00 pm [Zoom link available:  
<https://osu.zoom.us/j/91530898344?pwd=OUVuTWZmeDdwNXoyakk5bVJ0U0tlUT09>]

## Course Prerequisites

AEDE 6130; or permission of instructor



THE OHIO STATE UNIVERSITY

College of Food, Agricultural, and Environmental Sciences  
Agricultural, Environmental, and Development Economics

## Course Description

The increasing availability of large-scale datasets and rapid improvement in computing power and software provide an opportunity to develop more reliable quantitative models of economic behavior and policy analysis. This course builds upon the applied econometric content in AEDE 6110 by introducing complementary practical methods of data analytics. Topics include data exploration and visualization, model selection and regularization for high dimensional data, supervised and unsupervised machine learning methods. Lectures and labs will feature discussion of technical concepts and computer applications using real and simulated datasets.

This course relies on two live lectures a week. All assignments and exams must be completed by the due date shown on the syllabus to receive the opportunity for credit, except in the case of documented emergencies, illness, or time zone differences.

## Course Learning Goals and Outcomes

The course goals are the following:

- To introduce econometrics models relevant to big data.
- To develop the skill necessary to select and estimate data-relevant, question-relevant models

### Course Learning Outcomes

As a result of taking this course, successful students will be able to:

1. Understand the basic theory of the quantitative methods of big data
2. Apply data exploration and visualization methods
  - a. Be able to detect patterns of relationships in large-scale agricultural, environmental and development economics datasets
  - b. Be able to aid in the formulation of empirical models of economic behavior
3. Implement model selection and machine learning methods in data-rich environments to understand and predict economic behavior or evaluate policy
4. Acquire practical knowledge of data analytics software
  - a. Be familiar with the language used in professional settings around relevant software options
  - b. Be able to create and assess models in the software package used in this course

**How Students Meet the Outcomes:** Students meet the learning outcomes by completing all assigned course readings; actively listening to and engaging with all lectures and labs; completing all assigned individual and groups work; and completing both of the course exams.

# Course Materials and Technologies

## Required Textbook

- [An Introduction to Statistical Learning with Applications in R \(2<sup>nd</sup> Edition\)](#), by Gareth James, Daniela Witten, Trevor Hastie, Rob Tibshirani (*freely available online*)

## Required Software

- [R](#) and [R Studio](#) (*freely available online*)

## Optional Resources

- [Computer Age Statistical Inference: Algorithms, Evidence, and Data Science](#), by Bradley Efron and Trevor Hastie. Cambridge University Press, 2016.
- Textbook lectures (high on math) by an American University professor here: <http://fs2.american.edu/alberto/www/analytics/ISLRLectures.html>

## CarmenCanvas Access

You will need to use [BuckeyePass](https://buckeyepass.osu.edu) (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](https://go.osu.edu/add-device) (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes, good for 365 days, that can each be used once.
- [Install the Duo Mobile application](https://go.osu.edu/install-duo) (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at [614-688-4357 \(HELP\)](tel:614-688-4357) and IT support staff will work out a solution with you.



# Evaluation

Assignment Category	Points
Problem Sets (5 @ 5 points)	25
Lab Practice Sets	5
In-class Midterm	20
Group Projects (2 @ 10 points)	20
Take-home Final	30
<b>Total</b>	<b>100</b>

## Descriptions of Major Course Assignments

**Problem Sets:** There will be 5 equally weighted homework assignments. These assignments may involve theoretical derivations but will mostly focus on computer applications requiring the use of R (through R Studio). Students are welcome to work together on these assignments, but each student must turn in their own, independently written up assignment. All group members should be identified at the top of the submitted document, so that we can effectively address gaps in understanding with all group members. Assignments will be available in Carmen and are due at 11:59pm via the Carmen dropbox. Use of R-Markdown is recommended but not required.

**Lab Practice Sets:** After each lab there will be a short practice set. These will involve applying R codes and functions discussed in the week's lectures and labs. Students will submit the R script file in Carmen. More details will be provided in lab.

**Group Projects:** Toward the end of the course, students will work in groups to analyze a real-world dataset using both supervised and then unsupervised machine learning techniques. Final presentations will be given by the group at the end of each "Economic Applications" section. All group members will receive the same grade unless it is clear that specific members have not contributed as much as others.

**Midterm:** A closed-book midterm will occur in person during lecture, and will require students to synthesize and apply concepts covered in lecture and practiced via problem sets to the problems posed in the exam. It will be theory-based, i.e., not applied in data. One "cheat sheet" of paper will be allowed per student, but no other notes or materials may be used during the closed-book midterm.

**Final:** The open-book final will focus on analyzing a real dataset and answering questions about the relationships in that dataset. So, it will be about applying theory in data, rather than the details of theory itself. Students will have 48 hours to finish the exam and will submit their exam through Carmen by the deadline. (This deadline is set by the university according to class timing.) Any resource may be consulted during the open-book final except another student or person. If we suspect that two or more students have "collaborated" on the final exam, we will turn all those involved over to the university authorities that formally investigate cheating cases. The penalty for cheating ranges from course failure to expulsion from the program.

**Late/Makeup Policy:** Late work will not be accepted except in documented emergencies (illness, family emergency, etc.), or unless you have requested and been granted an extension in advance. Students who will or have missed assignments should contact their instructor to discuss these. Acceptable forms of documentation include, but are not limited to, a doctor's note, a funeral pamphlet, etc.

## Course Schedule

\*Course Schedule is subject to change. Students will be informed of any change in advance.

Week	Date	Topic, Assignment, Deadlines, Events
1	Jan 9, 11	Introduction to Big Data and Machine Learning <ul style="list-style-type: none"> <li>Read: Chapter 1, Chapter 2</li> <li>Lab: R Review</li> </ul>
2	Jan 16, 18	Review of Linear Regression <ul style="list-style-type: none"> <li>Read: Chapter 3</li> <li>Lab: Linear Regression</li> <li>Assigned: Problem Set 1</li> </ul>
3	Jan 23, 25	Classification: Logistic Regression, LDA, QDA, KNN <ul style="list-style-type: none"> <li>Read: Chapter 4</li> <li>Lab: Classification</li> <li>Due: Problem Set 1</li> <li>Assigned: Problem Set 2</li> </ul>
4	Jan 30, Feb 1	Using Resampling: Cross Validation and Bootstrapping <ul style="list-style-type: none"> <li>Read: Chapter 5</li> <li>Lab: Cross Validation and Bootstrapping</li> <li>Due: Problem Set 2</li> </ul>
5	Feb 6, 8	Selection and Regularization: Subset and Shrinkage <ul style="list-style-type: none"> <li>Read: Chapter 6 (6.1, 6.2)</li> <li>Lab: Sub-set and Shrinkage</li> <li>Assigned: Problem Set 3</li> </ul>
6	Feb 13, 15	Selection and Regularization: Dimension Reduction <ul style="list-style-type: none"> <li>Read: Chapter 6 (6.3, 6.4)</li> <li>Lab: PCA and PLS</li> <li>Due: Problem Set 3</li> </ul>
7	Feb 20, 22	Midterm and Review <ul style="list-style-type: none"> <li>Feb 20: Midterm Review Session</li> <li><b><u>Feb 22: MIDTERM EXAM</u></b></li> </ul>



8	Feb 27, 29	Decision Trees <ul style="list-style-type: none"> <li>• Read: Chapter 8</li> <li>• <a href="#">Lab: Decision Trees</a></li> <li>• <i>Assigned: Problem Set 4</i></li> </ul>
9	Mar 5, 7	Economic Applications of Supervised Learning <ul style="list-style-type: none"> <li>• Mar 5: Supervised Learning Project Description</li> <li>• Mar 7: Group work in location of choosing</li> <li>• <b>Due: Problem Set 4</b></li> </ul>
10	Mar 18, 21	Economic Applications of Supervised Learning <ul style="list-style-type: none"> <li>• Mar 18: Group work in class</li> <li>• <b>Mar 21: Presentations</b></li> </ul>
11	Mar 26, 28	Unsupervised Learning: Principal Component Analysis <ul style="list-style-type: none"> <li>• Read: Chapter 12 (12.1, 12.2, 12.3)</li> <li>• Lab: Principal Component and Factor Analysis</li> <li>• <i>Assigned: Problem Set 5</i></li> </ul>
12	Apr 2, 4	Unsupervised Learning: Clustering <ul style="list-style-type: none"> <li>• Read: Chapter 12 (12.4)</li> <li>• <a href="#">Lab: Clustering</a></li> </ul>
13	Apr 9, 11	Economic Application of Unsupervised Learning <ul style="list-style-type: none"> <li>• Apr 9: Unsupervised Learning Project Description</li> <li>• Apr 11: Group work in class</li> <li>• <b>Due: Problem Set 5</b></li> </ul>
14	Apr 16, 18	Presentations and Final Revisions <ul style="list-style-type: none"> <li>• <b>Apr 16: Presentations</b></li> <li>• Apr 18: Final Review</li> <li>• <a href="#">Lab: Final Review in R</a></li> </ul>
	<b><u>Final Exam</u></b>	<ul style="list-style-type: none"> <li>• <b>Assigned: Apr 22 (Monday): 8:00am</b></li> <li>• <b>Due: Apr 24 (Wednesday): 8:00am</b></li> </ul>



# Additional Information

Lauren's Promise (and my promise to you):

I will listen and believe you if someone is threatening you.

Lauren McClusky, a 21-year-old honors student athlete, was murdered on October 22, 2018 by a man she briefly dated on the University of Utah campus. We must all take actions to ensure this never happens again.

If you are in immediate danger call 911. Do not hesitate.

If you experiencing sexual assault, domestic violence, or stalking please seek help from the police whether or not you are in immediate danger.

- Campus police: (614) 292-2121 (for things that happen on campus)
- Columbus Police: (614) 645-4545 (for things that happen off campus)

You can also seek help specific to sexual or domestic violence from (24/7):

- Sexual Assault Response Network of Central Ohio (SARNCO) Rape Helpline: 614-267-7020
- Rape, Abuse and Incest National Network Sexual Assault Hotline: 800-656-4673
- Lutheran Social Services Choices Domestic Violence Hotline: 614-224-4663
- LGBT National Health Center Hotline: 888-843-4564

Medical providers can conduct forensic evaluations within 120 hours of an assault

- Wexner Medical Center: 614-293-8333
- Wilce Student Health Center: 614-292-4321

Confidential support services:

- Sexual Assault Response Network of Central Ohio (SARNCO), on campus: 614-688-2518
- Counseling and Consultation Services: After-hours helpline: 614-292-5766, choose option 2
- Stress, Trauma and Resilience (STAR) Trauma Recovery Center: 614-293-7827

## COURSE POLICIES

Faculty feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call 614-688-HELP at any time if you have a technical problem.)

- Grading and feedback: For problem sets, you can generally expect feedback within 7 days.
- E-mail: I will reply to e-mails within 24 hours on school days.

## Attendance Policy

Attendance in lectures and labs is not a graded component of the course. However, it is a critical part of your success. The following is a summary of everyone's expected participation:

- Lectures: Attend both lectures each week
- Laboratory: Attend the lab each week
- Office hours: Optional



Office hours are optional but encouraged. If you are feeling lost, struggling with problem sets, or just otherwise want to speak through the material, we are here to do so! We are also willing to meet outside of regular office hours, by appointment, if that works best for you.

### Exams

You must complete the exams yourself, without any external help or communication.

### Written assignments

You may work in groups on your problem sets, but you must write up your ultimate problem set solution yourself. If you worked with anyone, you should identify those people by name at the top of the paper. (This helps us to efficiently address gaps in understanding with all group members.)

## UNIVERSITY POLICIES

For current versions: <https://ugeducation.osu.edu/faculty-and-staff-resources>

**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 at Student Life <http://studentconduct.osu.edu>.

### 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, 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 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. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic





misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

Ask me if you have questions about this policy or what constitutes academic misconduct in this course.

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

- The Committee on Academic Misconduct web pages (COAM Home)
- Ten Suggestions for Preserving Academic Integrity (Ten Suggestions)
- Eight Cardinal Rules of Academic Integrity ([www.northwestern.edu/uacc/8cards.htm](http://www.northwestern.edu/uacc/8cards.htm))

### **Copyright disclaimer**

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course. Intellectual Property (covered by copyright) includes Course materials (Text, Audio, Video, Multimedia, Sims, Apps, etc.), and Student Generated materials.

### **Safe and Healthy Buckeyes**

Health and safety requirements: All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses.”

### **Disability Accommodations**

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. 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. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

### **Counseling and Consultation Services/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 Counseling and Consultation Services (CCS) by visiting [ccs.osu.edu](http://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 through the 24/7 National Suicide Prevention Hotline at 1-(800)-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

David Wirt, [wirt.9@osu.edu](mailto:wirt.9@osu.edu), is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Creating an environment free from harassment, discrimination, and sexual misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

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](http://equity.osu.edu),
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email [equity@osu.edu](mailto:equity@osu.edu)

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

This course adheres to The Principles of Community adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at <https://go.osu.edu/principlesofcommunity>. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (<https://equityandinclusion.cfaes.ohio-state.edu/>). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at <https://studentlife.osu.edu/bias/report-a-bias-incident.aspx>.

**Lyft Ride Smart (previously Safe Ride Program)**

Lyft Ride Smart at Ohio State offers eligible students discounted rides, inside the university-designated service area, from 9 p.m. to 3 a.m. Each month, 10,000 discounted rides will be made available on a first-come, first-served basis with the average cost expected to be \$2 or less. Prices may be impacted by distance, traffic, time of day, special events and prime time surcharges. To qualify for program discounts, users must select "shared ride" when booking in the Lyft app. When using ride sharing, remember to visually confirm vehicle info/descriptions in the company app and ask the driver to say who they are picking up.