# Syllabus
# URP 6931 Introduction to Urban Analytics
# 2023 Spring

## Instructor

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Email: shenhaowang@ufl.edu
Tuesday afternoon: 1:55pm – 4:55pm
Location: M.E. Rinker Hall 0210 (First class on January 10 is online: https://mit.zoom.us/j/7548601834)
Office hour: Wednesday 2-3pm (Starting on January 18)

## Course description

This course introduces the primary modeling paradigms to analyze cities with an emphasis on analytical perspectives and urban applications. The course consists of four study modules with the first three introducing regression, network science, and machine learning and the module four discussing their integration. The regression module introduces linear and logistic regression from the statistics tradition, applied to the analysis of urban economy and mobility. The network module introduces the spatial networks, spatial regression, power-law scaling, and urban network dynamics. The machine learning module introduces supervised and unsupervised learning, and deep learning with applications to mobility networks and urban imagery. The course discusses the similarities and differences of the three analytical paradigms and introduces how to integrate them in the fourth study module. The course will also provide broad urban analytical perspectives by touching upon optimization, causal inference, generative models, and social justice in cities. Students will learn Python packages, such as Pandas, GeoPandas, and Scikit-learn to analyze urban mobility, economic development, resilience, and housing. This course focuses on intuition and application of the analytical tools to urban topics, rather than theory or math foundations. It provides future urban planners, designers, and engineers the critical analytical capacity to understand cities and address upcoming urban challenges.

### Course prerequisites
No strict prerequisite course is needed. However, the students are highly recommended to be familiar with python, probability and statistics, and linear algebra, since the course will use the math notations to demonstrate the analytical methods. Since this course is offered for the first time, please contact the instructor to discuss the specific qualification questions.

### Textbook
No textbook is required. The three textbooks are used as references:
- James Stock and Mark Watson (2011), Introduction to Econometrics, 3rd Edition.
- M. Newman (2018). Networks. Oxford University Press, second edition.
- Bishop, C. M. (2006). Pattern recognition and machine learning.

### Coding
This course uses Python as the main programing language. Students are expected to use their own laptop in the lab sessions, so you need to install Python and other libraries on your computer. The Python 3.6.X version is recommended (Mac, Windows). Google Colab will be used in the lab sessions. I will present the

demo for the Python coding modules including [Numpy](#), [Pandas](#), [Matplotlib](#), [Statsmodels](#), [GeoPandas](#), [Scikit-Learn](#), and [PyTorch](#).

## Course schedule (tentative)

| Week | Dates | | Guest lectures | Lab sessions | Work sessions | Psets | Project |
|------|-------|--|----------------|--------------|---------------|-------|---------|
| 1 | Jan 10 | class overview | | | | | |
| 2 | Jan 17 | review: statistics and python | | Y | | | |
| **Module 1: Urban statistical analysis** | | | | | | | |
| 3 | Jan 24 | univariate linear regression | | Y | | | |
| 4 | Jan 31 | multivariate linear regression | | Y | | | idea guideline out |
| 5 | Feb 7 | logistic regression | | Y | | hw 1 out | |
| NA | Feb 14 | NA | | | | | idea due |
| **Module 2: Urban network analysis** | | | | | | | |
| 6 | Feb 21 | network representation with nodes and edges | | Y | | hw1 due | |
| 7 | Feb 28 | spatial autocorrelation and regression | | Y | | hw 2 out | |
| **Module 3: Machine learning in cities** | | | | | | | |
| 8 | Mar 7 | supervised learning: classifications and regression revisited | | Y | | | proposal guideline out |
| NA | Mar 14 | no class (spring break) | | | | | |
| 9 | Mar 21 | supervised learning: regularization. | | Y | Y | hw 3 out, hw2 due | |
| 10 | Mar 28 | mid-term presentation and review session | | | | | mid-term presentation; proposal due on Mar 31 |
| 11 | Apr 4 | supervised learning: diverse classifiers. | Y | Y | | | final report guideline out |
| 12 | Apr 11 | unsupervised learning or fairness with an analytical perspective | Y | Y | | hw 3 due | |
| **Module 4** | | | | | | | |
| 13 | Apr 18 | work session and guest lecture | Y | | Y | | |
| 14 | Apr 25 | final presentation & review session & course evaluation | | | | | final presentation; report due on Apr 28 |

Note: This schedule is subject to changes.


## Course communication
The instructor can be reached through Canvas inbox or by email. Expect a message in 48 hours, excluding holidays and weekends. General questions can be posted to the Canvas class website discussion board.

# Grading

Your grade consists of the follow three components.

| Components | Total points | Percentage of final grade |
|---|---|---|
| Course participation | 100 | 10% |
| Problem sets (3) | 100 each | 45% |
| Project | 100 | 45% |

**Course participation (10 pts)**
Attendance and participation in the class activities are required. Attendance and participation grade will be computed in proportion to the number of presences. Students are also highly encouraged to get engaged in the class discussions. The university policy can be found here.

**Problem sets (45 pts)**
Problem sets are designed to help you learn how to apply the material presented in lectures and lab sessions. Students are allowed to work in groups, as long as each group is comprised of no more than three people and as long as each member submits their own written answers.
1. Pset 1 (15 pts) – Regression
2. Pset 2 (15 pts) – Network analysis
3. Pset 3 (15 pts) – Machine learning

**Project: three stages (45 pts)**
1. Idea (5 pt). Limit to 1 page.
2. Proposal (10 pt). Limit to 3 pages.
3. Final paper (30 pt). Limit to 8 pages.

**Grading scale**
The following table is used as **an example only**. Since the course is offered for the first time, the instructor may need to normalize the grades at the end of the semester.

| | Percent Grade | 4.0 Scale | | Percent Grade | 4.0 Scale |
|---|---|---|---|---|---|
| A+ | 97-100 | 4.0 | C+ | 77-79 | 2.33 |
| A | 93-96 | 4.0 | C | 73-76 | 2.0 |
| A- | 90-92 | 3.67 | C- | 70-72 | 1.67 |
| B+ | 87-89 | 3.33 | D+ | 67-69 | 1.33 |
| B | 83-86 | 3.0 | D | 65-66 | 1.0 |
| B- | 80-82 | 2.67 | E/F | Below 65 | 0.0 |

The grading follows the university policy here.

**Late Submission**
It is important to meet the deadlines. All work must be completed and submitted by the designated date and time in Canvas. However, life is sometimes uncertain. Therefore, you are allowed to submit your assignments late, but with **25% grade marked down every 24 hours**. For example, if an assignment is submitted 1 hour after the deadline, its full grade will automatically drop to 75 points. You will lose all the points if the assignment is submitted **72 hours (3 days)** after the deadline. This policy applies to both Psets and the milestones of the project.

# Other UF policies and resources

## Accommodating Students with Disabilities
Students requesting accommodation for disabilities must first register with the Dean of Students Office (https://disability.ufl.edu/). The Dean of Students Office will provide documentation to the student who

must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

## Academic integrity and UF honor code

Academic honesty and integrity are fundamental values of the University community. 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." Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## Course evaluation

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 here. 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 this link. Summaries of course evaluation results are available here.

## Other academic resources

- For On-Campus URP Students: Graduate Coordinator contact information: Laura Dedenbach, laurajd@ufl.edu, 352-294-1493.
- Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services career.ufl.edu/.
- Library Support: various ways to receive assistance with respect to using the libraries or finding resources. cms.uflib.ufl.edu/ask
- Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring. teachingcenter.ufl.edu/
- Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. writing.ufl.edu/writing-studio/
- For issues with technical difficulties for E-learning in Canvas, please contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu
- Student Complaints: sccr.dso.ufl.edu/policies/student-honor- code- student-conduct-code/

## Health and wellness

- U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit umatter.ufl.edu/ to refer or report a concern and a team member will reach out to the student in distress.
- Counseling and Wellness Center: Visit counseling.ufl.edu/ 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 shcc.ufl.edu/.
- University Police Department: Visit police.ufl.edu/ 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; ufhealth.org/emergency-room-trauma-center