

# **URP 6223 Introduction to Urban Analytics**

Note: This syllabus is subject to change. Any changes will be communicated in advance.

\*Class is available online through e-learning @UF. Course website: https://elearning.ufl.edu/

Academic Term: Spring 2025 (Jan 15 – Apr 23)

Instructor: Dr. Yan Wang, Assistant Professor<sup>1</sup>, Department of Urban and Regional Planning (URP).

(Office: ARC 454) Office Hours: Zoom (Wednesdays 12pm-1pm) and by appointment via Canvas.

**COURSE COMMUNICATION:** All communication with course faculty will take place within **Canvas**, **through the Inbox**. All messages will be sent and received *within* Canvas. You should NOT be emailing the course instructor outside of the system. The instructor is also available for a Zoom meeting by appointment. Please contact the instructor through the Inbox to arrange a meeting.

#### **Course Description**

URP 6223 is designed to equip future urban planners, designers, and engineers with fundamental knowledge of urban analytics to address emerging urban challenges and analytical needs. This course integrates planning theories and urban science with various urban analytics tools, incorporating sustainability and resilience knowledge. Key topics include data, analytics methods, geo-visualization, and urban models aimed at achieving smart, resilient, and equitable cities. The course is taught through the lens of research and computational thinking, enabling students to understand and explore urban and regional challenges and develop data-driven solutions for better future cities.

The world is becoming more urbanized and massive data are continuously generated by sensor technologies and humans depicting the urban environment on an unprecedented scale. Urban data has become pervasive and computing ubiquitous, creating a great opportunity for reinvigorating, and revamping traditional urban planning. According to the National Science Foundation, "Knowledge of computer science and computer programming is becoming a necessary skill... in marketing, advertising, journalism, and the creative arts." Urban planning is no exception. Both the pervasiveness of ubiquitous sensor technology and the growth of information and communication technology produce large quantities of data and making sense of them requires computer and data science skills. Examples of technologies that have already been highly concentrated in the built environment include but are not limited to autonomous vehicles, embedded environmental sensors, distributed intelligence and control in infrastructure, the sharing economy, and social networks. The traditional data analysis methods in the urban planning field are insufficient to understand and take advantage of these vast amounts of new data, thus advanced data analysis skills are required for large datasets. Hence, there is a need for this course.

## A Brief Note about My Teaching Philosophy

Through a combination of lectures and hands-on lab sessions, I aim to illustrate how urban analytics concepts and skills can be applied to address challenges in the urban built environment. Assignments and projects are designed to challenge you to apply critical and socio-technical thinking skills to solve tangible analytical planning problems using real-world data and scenarios. The skills acquired through these assignments build upon one another, culminating in a comprehensive project that incorporates the constraints and complexities you might encounter as a professional in the planning field.

## Course Pre-Requisites / Co-Requisites

**No prerequisite** knowledge is required for this course. Specifically, students are not required to have prior programming experience, although it will be beneficial. **Python**, the primary language used in the course, is an accessible language, and the course will emphasize **learning by doing**.

<sup>&</sup>lt;sup>1</sup> Learn More About Our *Urban Analytics* Work at the Research Laboratory of **Urban Agility and Resilience**: <u>Website</u> <u>|GoogleScholar|ResearchGate</u>)



An undergraduate-level understanding of probability, statistics, and college-level mathematics is assumed. Prior or concurrent coursework in GIS, spatial statistics, and data analysis (such as URP 6270 and URP 6272) is *preferred but not required*, as this course will not cover the theoretical foundations of statistical analysis and planning information systems.

Students should have basic knowledge of how to install and debug programs on their computers. We will practice these skills throughout the lab sessions, so it's okay to take your time at first. I encourage beginners to walk through the Python and Anaconda installations covered in the Required Software section as soon as possible. This will help you become more familiar with your computer.

### Primary Audience for Course:

URP 6223 Introduction to Urban Analytics is the essential course for the *Urban Analytics* Certificate (<u>link</u>) and Degree Programs designed by the Department of Urban and Regional Planning at UF. URP 6223 is designed for the students who (plan to) take the Urban Analytics Certificate and Degree programs but is also open to other master and doctoral students across the UF campus.

Explore Our Programs: Master of Science in Urban Analytics and Graduate Certificate in Urban Analytics. For more information, visit: <u>https://dcp.ufl.edu/urp/urban-analytics/</u>

#### LOGISTICAL INFORMATION

Materials and Supply Fees

Not applicable

#### **Required Software**

## 1. Python

*Python Orientation Video:* As part of the pre-course training, you should complete one of the following introductory Python video courses available for free online. This will give you a head start on the course, making some concepts easier to review rather than diving in with no background knowledge. If you already have experience programming with Python, you can skip this requirement.

- CodeAcademy: <u>https://www.codecademy.com/learn/learn-python-3</u> (login required)
- DataCamp: <u>https://app.datacamp.com/learn/courses/intro-to-python-for-data-science</u>
- LinkedIn Learning: https://www.linkedin.com/learning/
- Khan Academy: <u>https://youtube.com/playlist?list=PLSQI0a2vh4HBnT6NBtgnGrB\_BRvGSdz-</u>

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You will need to have Python and several other libraries installed on your computer. While a shared server will be provided for some exercises (e.g., quizzes and tests), it is highly recommended that you set up your local computer to run all programs for testing, project work, and personal use. If you have not used Python before, I recommend following the Python 3.6.X installation instructions available here:

- MacOSX (https://www.python.org/downloads/mac-osx/)
- Windows (https://www.python.org/downloads/windows/)

If you have never used Python for data science before, I also ask that you install **Anaconda** (https://www.continuum.io/downloads) for managing packages and different Python versions

To properly install Python 3.6+, here are some outlines for each operating system:

- Windows Vista or later
- Mac OS X 10.8 or later (Mountain Lion)

#### 2. Additional software learning resources include:

- <u>https://comptoolsres.github.io/py4e\_1.html</u>
- <u>https://practicumai.org/courses/Intro\_Python/</u>



## Recommended Materials

Books/Materials	
	Urban Analytics (Spatial Analytics and GIS) First Edition
	by Alex David Singleton (Author), Seth Spielman (Author), David Folch (Author)
	ISBN-13: 978-1473958630
URBAN SETK E SPIELMAN DAVIDGE FOLGE	ISBN-10: 1473958636
ANALYTICS	
UF AI Learning Resources	https://practicumai.org/

## Attendance Policy, Class Expectations, and Make-Up Policy

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the *first class* meeting. In general, *acceptable reasons* for absence from or failure to participate in class include illness, serious family emergencies, special curricular requirements (e.g., judging trips, field trips, and professional conferences), military obligation, severe weather conditions, religious holidays, and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) must be excused. Other reasons also may be approved. Excused absences must be consistent with university policies in the <u>Graduate Catalog</u> and require appropriate documentation. Additional information can be found in <u>Attendance Policies</u>.

Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence.

Students cannot participate in classes unless they are registered officially or approved to audit with evidence of having paid audit fees. The Office of the University Registrar provides official class rolls to instructors.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

## **QUIZ & EXAM POLICIES**

Quizzes and Exams will be given to test students' knowledge of course materials.

## HOMEWORK ASSIGNMENT POLICY

Homework assignments, discussions, and exercises are mostly due on **Wednesdays (by 11:59pm)** of the beginning week of the following module. For example, Module 1 assignments are due the Wednesday when Module 2 starts. Please refer to the course schedule in Canvas.

## MAKE-UP POLICY

Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence, if the absence is due to the one of accepted reasons listed in the Attendance Policy.



If you are unable to turn in an assignment on time, please contact me before the due date to discuss your options. A grade reduction of **5% per day** will occur unless there is an acceptable excuse for the late submittal.

Computer problems that arise during submission will not be accepted as an excuse for late work. In the event that you have technical difficulties with e-Learning, please contact the UF Help Desk. If technical difficulties cause you to miss a due date, you MUST report the problem to Help Desk. Include the ticket number and an explanation of the issue based on consult with Help Desk in an e-mail to the instructor to explain the late assignment/exam. The course faculty reserves the right to accept or decline tickets from the UF Help Desk based on individual circumstances.

#### **Evaluation of Grades**

Components of the Grade Structure	Percentage of Final Grade
Discussions (4)	15%
Quizzes (2)	5%
Lab Assignments (6)	55%
Final Presentation (problem/theory focused)	5%
Final Project (lab focused)	20%
Total	100%

#### **Grading Policy**

Percent	Grade	Grade Points
90.0 - 100.0	Α	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	В	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	С	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

UF Graduate Catalog

Grades and Grading Policies

#### SPECIAL ACCOMMODATIONS

Students requesting disability-related academic accommodations must first register with the <u>Disability</u> <u>Resource Center (Links to an external site.)</u>.

The Disability Resource Center will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

#### UNIVERSITY POLICIES

University policies on such matters as add/drop, incomplete, academic probation, termination of enrollment, reinstatement, and other expectations or procedures can be found in the <u>graduate student</u> handbook (Links to an external site.) and on the <u>Dean of Students website (Links to an external site.</u>).

#### UNIVERSITY POLICY ON ACADEMIC MISCONDUCT

Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the <u>UF Student Honor Code (Links to an external site.)</u>.



## STUDENT HONOR CODE

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. *See the UF Conduct Code website for more information*. If you have any questions or concerns, please consult with the instructor or TA in this class.

#### **NETIQUETTE: COMMUNICATION COURTESY**

All members of the class are expected to follow rules of common courtesy in all messages, threaded discussions and chats. Course communication should be civilized and respectful to everyone. The means of communication provided to you through e-Learning (e-mail, discussion posts, course questions, and chats) are at your full disposal to use in a respectful manner. Abuse of this system and its tools through disruptive conduct, harassment, or overall disruption of course activity will not be tolerated. Conduct that is deemed to be in violation with University rules and regulations or the Code of Student Conduct will result in a report to the Dean of Students.

Refer to the following link for more information: <u>https://teach.ufl.edu/wp-content/uploads/2020/04/NetiguetteGuideforOnlineCourses.docx</u>

#### 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 at <a href="https://gatorevals.aa.ufl.edu/students/">https://gatorevals.aa.ufl.edu/students/</a>. 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 <a href="https://gatorevals.aa.ufl.edu/public-results/">https://gatorevals.aa.ufl.edu/public-results</a> are available to students at <a href="https://gatorevals.aa.ufl.edu/public-results/">https://gatorevals.aa.ufl.edu/public-results/</a>.

#### Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

#### Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the <u>Notification to Students of FERPA Rights</u>.

#### ChatGPT or other GenAI platforms:

ChatGPT is currently being assessed for regulatory concerns related to privacy and confidentiality of data within the United States and internationally. Please be advised that data may be retained by ChatGPT and provided as responses to other users. Individuals have limited control over their data and parent company, OpenAI, offers no process to amend or delete data that has been submitted. Therefore, putting data into ChatGPT or similar services is equivalent to disclosing the data to the public. Any data classified as sensitive or restricted should not be used. Please be cognizant of our data stewardship responsibilities and the importance of safeguarding information. When using ChatGPT, please review responses for factual accuracy, as ChatGPT has been known to assert incorrect facts. **Students are personally responsible for submitted assignment content and guiz answers, and any violations of plagiarism or dishonesty will be handled in accordance with UF's policies.** 



## Course Themes, Learning Objectives, and Schedule

**Disclaimer:** This syllabus represents our current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

Date	#Module	Lectures Topics and Learning Objectives	Practical Labs (Technical objectivies)	Discussion/Quiz Readings
Weds	Module 1	Questioning the City through Urban Analytics		
15-Jan	Week #1	<ol> <li>Course Overview, E-Portfolio Introduction, Syllabus</li> <li>An overview of Urban Analytics and programs</li> <li>Introduce the textbook, structure, and integration of learning materials.</li> <li>Syllabus overview</li> <li>Skills for planning in the new era</li> </ol>	Course Qulatrics Survey Tutorials for setting up Python – Anaconda (Due: <u>Week 2</u> ) Anaconda, Python 3 and Jupyter Notebook installation.	Readings
22-Jan 29-Jan	Week #2-3	<ul> <li>Urban Challenges, Data/IoT Opportunities, Smart and Resilient Initiatives, and Analytical Needs <ol> <li>Key urban stressors (population growth, new challenges, disruptive technologies etc).</li> </ol> </li> <li>Data-rich cities and opportunities. Urban analytics represents a methodological toolkit for studying and managing data-rich cities.</li> </ul>	Lab Session 1: Python Basics         (Due: Week 4)         • Basic syntax, variables, and data types         • Control structures (loops, conditionals)         • Functions and modules         Deliverables: Submit lab exercise code and outcomes as a PDF.	Discussion: Trends in Urban Planning (Due: <u>Week 3</u> ) Readings
	Module 2	Sensing the City		
5-Feb	Week #4	<ul> <li>Urban Data, Computing and Visualization <ol> <li>Traditional data</li> <li>different types of data collected within urban contexts.</li> <li>Data are generated organically, as a byproduct of our daily lives, or through -purposeful data collection processes.</li> <li>Data can record activity, attributes, and dynamics over a range of spatio-temporal scales.</li> <li>The different types of traditional data collected about cities.</li> </ol> </li> <li>New forms of data <ul> <li>Sensors and social media complement traditional sources and are generating an increasing amount of new data about urban areas.</li> <li>Example methods used within urban areas to "sense" the city.</li> </ul> </li> </ul>	<ul> <li>Lab Session 2: Data Manipulation in Python (Due: <u>Week 6</u>)</li> <li>Major packages: Pandas, Numpy, Geopandas</li> <li>Tabular data read and storage: Array, DataFrame</li> <li>Spatial data read and storage</li> <li>Data manipulation with Pandas and Numpy</li> <li>Save data</li> <li>Deliverables: Submit lab exercise code and outcomes as a PDF.</li> </ul>	Readings
	Module 3	Urban Data Infrastructure		



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12-Feb	Week #5	<ol> <li>Computing 101         <ul> <li>The essential components of a computer, and those locations where computation can occur.</li> <li>The environmental consequences of computing.</li> </ul> </li> <li>Data and Computing Software (R studio, Python, SQL, etc)         <ul> <li>Some differentiating characteristics of software languages and their appropriate uses.</li> <li>How data are stored within a computing environment.</li> </ul> </li> </ol>	Contunue Lab Session 2: Data Manipulation in Python (Due: <u>Week 6</u> )	Quiz 1 (Due Week 5) Quiz 2 (Due <u>Week</u> <u>6</u> )
	Module 4	Visualizing the City		
19-Feb	Week #6	<ol> <li>Urban Analytics, Visualization, and Mapping (GIS, web mapping, urban visualization, and urban mapping)</li> <li>What is GIS?</li> <li>What is the need for generalization?</li> <li>How are geographic features represented in a GIS?</li> </ol>	<ul> <li>Lab Session 3: Descriptive statistics and data visualization (Python) (Due: Week 7)</li> <li>Major packages: Seaborn, Geopandas, folium</li> <li>Summary descriptive statistics (tabular and spatial)</li> <li>Data visualization (tabular and spatial)</li> <li>Interactive map</li> </ul> Deliverables: Submit lab exercise code and outcomes as a PDF.	
	Module 5	Differences within Cities		
26-Feb 5-Mar	Week #7-8	<ol> <li>Geodemographics         <ul> <li>There are two main approaches to urban analytics: the variable and contextual paradigms.</li> <li>What are Geodemographic classifications?</li> <li>Geodemographics has a long history of use within cities.</li> <li>How can Geodemographics be used to summarize population and built environment characteristics?</li> </ul> </li> <li>Urban Indicators         <ul> <li>Composite indicators have a history of use within cities.</li> <li>There are differences between univariate and multivariate indices and their application.</li> </ul> </li> </ol>	Lab Session 4: Indices and Geovisualization – Social Vul. (Due: <u>Week 9</u> ) Major packages: matplotlib, Geopandas, datetime Composite indicators Plotting with Matplotlib Interactive visualizations Deliverables: Submit lab exercise code and outcomes as a PDF.	<b>Discussion:</b> Creating an Urban Indicator (Due <u>Week 9</u> )
	Module 6	Explanatory Urban Models (Explaining the City)		
12-Mar 26-Mar	Week #9-10	1. Correlation urban model	Lab Session 5: Exploring Data and Spatial Relationships	Readings



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		<ul> <li>Models can be descriptive, predictive, or explanatory.</li> <li>Exploratory data analysis can help uncover meaningful patterns in data, which can in turn help guide model development.</li> <li>Regression tool (complex relation within cities)</li> <li>Regression is a flexible tool for helping to understand complex relationships within cities.</li> <li>Basics of spatial statistical models for urban models</li> <li>Urban data are spatial data, and these can be statistically problematic when used in a model, but there are techniques to explicitly account for spatial patterns.</li> </ul>	<ul> <li>(Due: <u>Week 11</u>)</li> <li>Major packages: matplotlib, scipy.stats, datetime</li> <li>Exploratory data analysis (plot, rank and correlation)</li> <li>Regression analysis</li> <li>Spatial lag regression</li> <li>Deliverables: Submit lab exercise code and outcomes as a PDF.</li> </ul>	
	Module 7	Urban Analytics Ethics		
2-Apr	Week #11	Ethical considerations in Urban Analytics • Al   Data Bias   Data Equity   Algorithm Fairness   Transparency   Privacy	<ul> <li>*Please finish the required readings before lab session</li> <li>Lab Session 6: Data Bias</li> <li>(Due: Week 12)</li> <li>Major packages: matplotlib, geopandas, datetime</li> <li>Examine and quantify the spatial and sociodemographic bias</li> <li>Understand the social inequities and biased data representation</li> <li>Deliverables: Submit lab exercise code and outcomes as a PDF.</li> </ul>	Readings Discussion: Al ethics (Due <u>Week</u> <u>12</u> )
	Module 8	Capstone Project		
9-Apr	Week #12-14	Exploratory Big Textual Data Analytics	<ul> <li>The Final Project: Social Media Analysis</li> <li>(Due <u>Wed: April 23</u>)</li> <li>Major packages: nltk, wordcloud, transformers, genism, shap</li> <li>Social media data preprocessing</li> <li>Sentiment analysis</li> <li>Topic modeling</li> <li>Explorative analysis and visualization</li> <li>Deliverables: Submit the lab exercise code (Jupyter Notebook), a report (Word document), and a map (HTML file).</li> </ul>	
	Module 9	Final Presentation		
23-Apr	Week #14	<ul><li>Key themes running through this course.</li><li>Future urban analytics and needs</li></ul>	Final Project Due Final Presentation	Readings



#### Campus Resources for Students:

#### Health and Wellness

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

*Counseling and Wellness Center*. <u>Visit the Counseling and Wellness Center website</u> 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: <u>Visit UF Police Department website</u> 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; <u>Visit the UF Health</u> <u>Emergency Room and Trauma Center website.</u>

*GatorWell Health Promotion Services:* For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the <u>GatorWell website</u> or call 352-2734450.

#### Academic Resources

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

<u>Career Connections Center</u>: Reitz Union Suite 1300, 352-3921601. Career assistance and counseling services.

<u>Library Support</u>: Various ways to receive assistance with respect to using the libraries or finding resources. Call 866-281-6309 or email <u>ask@ufl.libanswers.com</u> for more information.

<u>Teaching Center</u>: 1317 Turlington Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

<u>Writing Studio:</u> Daytime (9:30am-3:30pm): 2215 Turlington Hall, 352-846-1138 | Evening (5:00pm-7:00pm): 1545 W University Avenue (Library West, Rm. 339). Help brainstorming, formatting, and writing papers.

Academic Complaints: Office of the Ombuds; Visit the Complaint Portal webpage for more information.

Enrollment Management Complaints (Registrar, Financial Aid, Admissions): <u>View the Student Complaint</u> <u>Procedure webpage for more information.</u>