

## URP 6223 Introduction to Urban Analytics

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

**Class Periods:** Thursday (R) | Period 3 – 5 (9:35 AM - 12:35 PM)

**Location:** ARCH 231F (Conference Room)

**Academic Term:** Fall 2024 (8/22/24 - 12/04/24)

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

**Office Hours:** 30 minutes following the in-class lectures in ARCH 0423; during and following lab classes (in ARCH 0423/Student hub); and by appointment via Canvas (Office: ARC 454).

**COURSE COMMUNICATION:** All communication with course faculty and TA will take place within **Canvas, through the Inbox**. All emails 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. It is recommended that you always send the message to both the instructor and the TA.

### 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.

### Course Description

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.

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<sup>1</sup> Learn More About Our *Urban Analytics* Work at the Research Laboratory of **Urban Agility and Resilience**: [Website](#) | [GoogleScholar](#) | [ResearchGate](#)

### 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**.

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 ([link](#)) 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: <https://dcp.ufl.edu/urp/urban-analytics/>

## 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: <https://www.codecademy.com/courses/introductionto-python-6WeG3/0/1>
- DataCamp: <https://www.datacamp.com/courses/intro-to-python-for-data-science>
- Khan Academy: <https://www.youtube.com/watch?v=husPzLE6sZc&list=PL36E7A2B75028A3D6>

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:

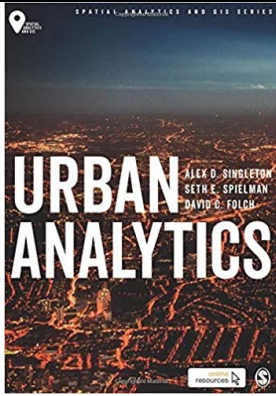
- Windows Vista or later
- Apple OS X 10.8 or later (Mountain Lion)

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

- [https://comptoolsres.github.io/py4e\\_1.html](https://comptoolsres.github.io/py4e_1.html)

- [https://practicumai.org/courses/Intro\\_Python/](https://practicumai.org/courses/Intro_Python/)

**Recommended Materials**

<b>Books/Materials</b>	
	<p>Urban Analytics (Spatial Analytics and GIS) First Edition            by Alex David Singleton (Author), Seth Spielman (Author), David Folch (Author)            ISBN-13: 978-1473958630            ISBN-10: 1473958636</p>
<p>UF AI Learning Resources</p>	<p><a href="https://practicumai.org/">https://practicumai.org/</a></p>

**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 Graduate Catalog and require appropriate documentation. Additional information can be found in Attendance Policies.

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 **Thursdays (by 11:59pm)** of the beginning week of the following module. For example, Module 1 assignments are due the Thursday 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**

<b>Components of the Grade Structure</b>	<b>Percentage of Final Grade</b>
Participation and Attendance <i>(class attendance, active engagement in discussions, and review of readings)</i>	20%
Discussions (4)	13%
Quizzes (2)	5%
Lab Assignments (6)	42%
Final Project	20%
<b>Total</b>	<b>100%</b>

**Grading Policy**

The following is given as an example only.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	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](#)

**Students Requiring Accommodations**

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the [Disability Resource Center](#). It is important for students to share

their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

**Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing [online evaluations](#). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students on the [Gator Evals page](#).

**University Honesty Policy**

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 Honor Code](#) specifies a number of behaviors that are in violation of this code and the possible sanctions. 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.

**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 [Notification to Students of FERPA Rights](#).

**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	Discussion/Quiz Readings
	<b>Module 1</b>	<b>Questioning the City through Urban Analytics</b>		
22-Aug	<b>Week #1</b>	<b>Course Overview, E-Portfolio Introduction, Syllabus</b> <ol style="list-style-type: none"> <li>1. Provide an overview of Urban Analytics and programs</li> <li>2. Introduce the textbook, structure, and integration of learning materials.</li> <li>3. Syllabus overview and our learner personas</li> <li>4. Skills for planning in the new era</li> </ol>	<b>Tutorials for setting up Python – Anaconda (Week 1)</b>	Readings
29-Aug 5-Sep	<b>Week #2-3</b>	<b>Urban Challenges, Data/IoT Opportunities, Smart and Resilient Initiatives, and Analytical Needs</b> <ol style="list-style-type: none"> <li>1. Urban Stressors (population growth, new challenges, disruptive technologies development): The majority of future population growth will be concentrated in urban areas. The planning and management of population change creates a range of challenges for cities.</li> <li>2. Data-rich cities and opportunities. New forms of technology are increasingly embedded into city systems and are providing a wealth of new data. Urban analytics represents a methodological toolkit for studying and managing data-rich cities.</li> </ol>	<u>Lab Session 1: Python Basics</u> Due: Week 4  Deliverables: Submit lab exercise code and report	Discussion: Trends in Urban Planning (Due: <u>Week 3</u> )  Readings
	<b>Module 2</b>	<b>Sensing the City</b>		
9/12	<b>Week #4</b>	<b>Urban Data, Computing and Visualization</b> <ol style="list-style-type: none"> <li>1. <b>Computing 101</b> <ul style="list-style-type: none"> <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>2. <b>Traditional data</b> <ul style="list-style-type: none"> <li>• There are many different types of data collected within urban contexts.</li> </ul> </li> </ol>	<u>Lab Session 2: Data Manipulation in Python (Week4 - Week 6)</u>	<b>Quiz 1 (Due Week 5)</b>  Readings

		<ul style="list-style-type: none"> <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> </ul> <p><b>3. New forms of data</b></p> <ul style="list-style-type: none"> <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>		
	<b>Module 3</b>	<b>Urban Data Infrastructure</b>		
9/19	<b>Week #5</b>	<p><b>1. Data and Computing Software (R studio, Python, SQL, etc)</b></p> <ul style="list-style-type: none"> <li>Some differentiating characteristics of software languages and their appropriate uses.</li> <li>How data are stored within a computing environment.</li> </ul>	Lab Session 2: Data Manipulation in Python (Due Week 6)	<b>Quiz 2</b> (Due Week 6)
	<b>Module 4</b>	<b>Visualizing the City</b>		
9/26	<b>Week #6</b>	<p><b>1. Urban Analytics, Visualization, and Mapping</b> (GIS, web mapping, urban visualization, and urban mapping)</p> <ul style="list-style-type: none"> <li>What is GIS?</li> <li>What is the need for generalization?</li> <li>How are geographic features represented in a GIS?</li> </ul>	Lab Session 3: Descriptive statistics and data visualization (Python) Week 6 -Due Week 7	
	<b>Module 5</b>	<b>Differences within Cities</b>		
10/3 10/10	<b>Week #7-8</b>	<p><b>1. Geodemographics</b></p> <ul style="list-style-type: none"> <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> <p><b>2. Urban Indicators</b></p>	Lab Session 4: Indices and Geovisualization –Social Vul. (ACS data) Week 7-Week 9 (Due)	<b>Discussion:</b> Creating an Urban Indicator (Due Week 9)

		<ul style="list-style-type: none"> <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>		
	<b>Module 6</b>	<b>Explanatory Urban Models (Explaining the City)</b>		
10/17 10/24	<b>Week #9-10</b>	<p>1. <b>Correlation urban model</b></p> <ul style="list-style-type: none"> <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> </ul> <p>2. <b>Regression tool</b> (complex relation within cities)</p> <ul style="list-style-type: none"> <li>• Regression is a flexible tool for helping to understand complex relationships within cities.</li> </ul> <p>3. <b>Basics of spatial statistical models for urban models</b></p> <ul style="list-style-type: none"> <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>	Lab Session 5: Exploring Data and Spatial Relationships Week 9-11 (Due)	Readings
	<b>Module 7</b>	<b>Urban Analytics Ethics</b>		
10/31	<b>Week #11</b>	<ul style="list-style-type: none"> <li>• Data Bias</li> <li>• Data Equity</li> <li>• Algorithm Fairness</li> <li>• Transparency</li> </ul>	Lab Session 6. Data Bias (finish the required readings before lab session) Week 11 - Week 12 (Due)	Readings <b>Discussion: AI ethics</b> (Due Week 12)
	<b>Module 8</b>	<b>Introducing Final Project</b>		
11/7 (ACSP)	<b>Week #12</b>	Exploratory Big Textual Data Analytics (Crowdsourcing Opinions/Situation Awareness)	The Final Project (Week 12 – Due Thursday Dec 4 <sup>th</sup> )	Readings
	<b>Module 9</b>	<b>The Future of Urban Analytics</b>		
11/14	<b>Week #13</b>	<ul style="list-style-type: none"> <li>• Key themes running through this course.</li> <li>• Where urban analytics is likely to develop in the future.</li> <li>• Future urban analytics and needs</li> </ul>	Final Project	
11/21	<b>Week #14</b>	Final Project Q&A Introducing optional learning sessions Introducing Advanced Urban Analytics and other advanced courses under the Certificate/Degree program	Final Project (Due Thursday Dec 4 <sup>th</sup> )	



**Campus Resources for Students:**

## Health and Wellness

**U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**Counseling and Wellness Center:** [counseling.ufl.edu/cwc](http://counseling.ufl.edu/cwc), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

**Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or [police.ufl.edu](http://police.ufl.edu).

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.

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

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

**Student Complaints Campus**

**On-Line Students Complaints**