UP 317 Introduction to Urban Data Science

Instructor: Dr. Fang Fang (fangf@illinois.edu)

Lectures: Tuesday 11:00-12:20, Temple Hoyne Buell Hall 227

Labs: Thursday 11:00-12:20, Temple Hoyne Buell Hall 227

Office Hours:
Wed 10:00 am – 12:00 pm TBH 232, or by appointment

TA: Anshita Kandhari (ak59@illinois.edu) Office hour: Wed 3:00 pm to 5:00 pm TBH 224

Course Overview:
Data science is a multi-disciplinary field that involves scientific methods, processes, algorithms, and systems to extract and further understand knowledge or insights from all kinds of data. Especially for planners or social scientists, they use a wide range of data from different sectors such as transportation, housing, physical environment to understand the complex urban issues. This is the entry-level data science course for undergraduate students in urban planning. You will learn a set of fundamental concepts, skills, and tools in R for effective data analysis. We will start with basic data import, data cleansing/transformation, and will introduce data visualization later for communication purposes especially for planners. This course builds a common foundation for quantitative analysis among undergraduate and graduate students for a wide application in one or more domain-specific courses in their capstone/thesis/dissertation work in the future. No previous coding experiences are required.

This syllabus is subject to change by the instructor.

Course Outcomes:

1. Understand the basic concepts and workflows in data science
2. Collect, import, tidy, export, and manipulate data effectively and efficiently.
3. Analyze and interpret data using R in the urban planning discipline
4. Apply the fundamental and basic quantitative techniques in social research.
5. Produce and interpret professional plots, graphics, and maps using R in the urban planning discipline.
6. Interpret and summary results professionally for communication

Course Structure/Philosophy/Attendance

- I firmly believe that students learn via engagement and by doing. As a result, this will not be a pure lecture-based course. It is important to engage yourself during this class. I will do my best to help you learn; however, it is imperative that you take ownership of your education. Come see me if you need help.
- This is a 16-week / full semester course. We have one lecture and one lab each week. You
Each student is expected to devote 1-2 hours per week learning the lecture contents, and 1-2 hours for lab exercise per week.

Engagement: The engagement is demonstrated in various ways for lectures and labs: e.g. in-class discussion, in-class exercise, in-class group work, in-class presentation, reading discussion, short essay summary etc. The in-class activities for online lectures will be posted via these platforms but not limited to: 1) shared google documents/sheets 2) Google Jamboard; 3) Padlet online. Bonus credits will be allotted for some of the in-class exercise: either essay questions for reading discussions, or mini project, etc.

Students are also expected to complete the assigned readings prior to class and to come to lectures prepared for thoughtful participation and discussion.

All the assignments, exams, and labs are mandatory.

Lab sessions are delivered every Thursday 11:00-12:20pm in TBH 227

On campus instruction under COVID: For in person meetings, in order to implement COVID-19-related guidelines and policies affecting university operations, students will be asked to show their Building Access Status in the Safer Illinois app or the Boarding Pass. Students can enter the classroom only with a granted building access status. All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and expected in this class. Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols. Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work. Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

Required Textbook

- R for Data Science import, tidy, transform, visualize and model data. By Hadley Wickham & Garrett Grolemund

Software

Students can install RStudio and R on their personal computers for free through [https://rstudio.com/products/rstudio/download/](https://rstudio.com/products/rstudio/download/)

Lab Assignments and Late Work Policy:

In addition to the exams, you will be asked to complete 11 lab assignments. Assignments must be turned in via Canvas site submission. You will receive a zero on the assignment if it is not submitted.
Note the lowest grade among the 11 assignments will be dropped. Unless otherwise stated, the lab assignments are due on 11 AM of the Thursday that one week after they are assigned (e.g. a lab assigned on Sep 3rd will due on 11 AM of Sep. 10th). You should submit your assignment to Canvas website. An assignment, including lab assignments, mid-term exam, project proposal, and final project, submitted 24 hours or less after the due date will only be eligible for 80% of the maximum number of points allotted. Assignments submitted more than 24 hours but less than 48 hours after the due date will only be eligible for 60% of the maximum number of points allotted, and so on. Assignments submitted more than 120 hours (or 5 days) after the due date will NOT be accepted and you will receive a zero on that assignment. If you experience extenuating circumstances (e.g., you are hospitalized) that prohibit you from submitting your assignments on time, please let me know. I will evaluate these instances on a case-by-case basis. You are responsible to confirm each submission in Canvas. For any technical issues in Canvas /Netid, you need to contact me in advance or email your assignment to me ASAP by the deadline. Otherwise, the late work policy will be strictly enforced.

Error/warning messages are very common in R, and these are NOT the valid excuses for late assignment submission. It is your responsibility to utilize resources (textbook, office hours, ask the instructor for help, online resources, etc.) to debug your code.

Exams:
The exam will take place in Canvas with one-week period (~90min). The exam will be a combination of multiple-choice, true-and-false, and short answer questions. Instead of regurgitating facts, my tests are designed so that you think about the key concepts of the topics we have covered. The exam cannot be re-taken. Consistent with UIUC guidelines, if you cannot take a regularly scheduled exam because of authorized University activities, you will have the opportunity to take a make-up exam at an alternate time. Make-up exams for absence due to any other reason will be at the discretion of the instructor. You must notify me beforehand if you need to miss an exam. I will not let you make up an exam without prior notification.

Final project
All the student needs to finish a final project. The details will be posted on Canvas later this semester.

The final project can be finished as a group. You should email the instructor about your group info by 11:59 PM, Oct 9th.

A project proposal is due by 11:59PM, Oct 21th. A poster is required as delivery by 11:59 PM, Dec 5th.

Grade Point Distribution:

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Assignments*10</td>
<td>50 Points Each</td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>200 Points</td>
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<tr>
<td>Final project</td>
<td>200 Points</td>
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<tr>
<td>Participation and in-class activity</td>
<td>100 Points</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1000 Points</strong></td>
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Grade Scale:

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<tr>
<th>Letter grade</th>
<th>Percentage</th>
<th>Points</th>
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Academic Integrity

We will follow Articles 1-401 through 1-406 of the Student Code. The provisions of the Student Code are applicable to this course. This rule defines infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. You are responsible for following these guidelines. If you have any questions about whether something would be an infraction, consult with the instructor before proceeding.

Special Accommodations

We will accommodate students with documented disabilities. Please be familiar with the services and resources provided by Disability Resources and Educational Services (DRES) and visit (http://disability.illinois.edu/disability-resource-guide) for more information. Please inform the instructor of any requests at the beginning of the semester.

Feedback Response Time

I generally reply to email and discussion posts within 48 hours, except during holidays. I often reply much more quickly, but you should not count on a same-day reply. Please plan accordingly so that you don’t miss deadlines! I generally return assignments within one week of when a discussion or assignment closes. If you would like to get help on an assignment ahead of the deadline, please email me! I’m happy to give preliminary feedback or answer questions.

Emergency Response Recommendations

Emergency response recommendations can be found at the following website: http://police.illinois.edu/emergency-preparedness/. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/.
Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Sexual Misconduct Policy and Reporting

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University’s Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

Tips for Succeeding in this Course

1. Get help early on if you are having difficulties. Come to my office if you need to. If my office hours don’t work for you, we can work something out.
2. Get to know others in the class. Help each other out.
3. If I give bonus opportunities, take advantage of them.
4. If I give study guides, take advantage of them.
5. If a book is required, get the book and use it.
6. Your goal should not be to pass; shoot for an A.
7. If I give a writing assignment it will have a rubric attached. Use this rubric because this is what I’m looking for.
8. If I give a writing assignment, don’t hesitate to get help.
9. Be open-minded. I understand that this class may not be within your subject of interest, but that doesn’t mean you can’t take interest. It’s easier to learn something you have an interest in.
Reading list:
1. **Aug. 29:**

2. **Sep. 5:**

3. **Sep. 12:**

4. **Sep. 19:**

5. **Sep. 26:**

6. **Oct. 3:**

7. **Oct. 17:**

8. **Oct. 24:**

9. **Oct. 31:**

10. **Nov. 7:**

11. **Nov. 14:**
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>22-Aug</td>
<td>Intro to Data Science R setup</td>
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<tr>
<td>2</td>
<td>29-Aug</td>
<td>Introduction to R Assignment 1 Basics and data type</td>
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<td>3</td>
<td>5-Sep</td>
<td>Basic control structures Assignment 2 Loops and functions</td>
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<td>4</td>
<td>12-Sep</td>
<td>Data import Assignment 3 Get your data ready</td>
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<td>5</td>
<td>19-Sep</td>
<td>Tidy messy data Assignment 4 Evaluate air quality in Sydney</td>
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<td>6</td>
<td>26-Sep</td>
<td>Data Manipulation Assignment 5 Analysis population based on American Community Survey</td>
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<td>7</td>
<td>3-Oct</td>
<td>Relational data Assignment 6 Education level and housing/income analysis</td>
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<td>8</td>
<td>10-Oct</td>
<td>Review &amp; Midterm exam</td>
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<td>9</td>
<td>17-Oct</td>
<td>Data summaries Assignment 7 Summary Statistics</td>
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<td>10</td>
<td>24-Oct</td>
<td>Basic Graphics design Assignment 8 Visualize demographic information in midwest counties</td>
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<tr>
<td>11</td>
<td>31-Oct</td>
<td>Data visualization Assignment 9 Visualize air quality in Sydney</td>
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<td>12</td>
<td>7-Nov</td>
<td>Data visualization for spatial data Assignment 10 Draw maps using R</td>
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<td>13</td>
<td>14-Nov</td>
<td>Working with time series data Assignment 11 Understand flights in NYC,2013</td>
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<td>14</td>
<td>21-Nov</td>
<td>Fall break</td>
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<tr>
<td>15</td>
<td>28-Nov</td>
<td>Group work</td>
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<tr>
<td>16</td>
<td>5-Dec</td>
<td>Final exam week</td>
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