Selected Topics in Computer Science
Data Science for Smart Cities
CIS 5930/4930, Fall 2022
Department of Computer Science, Florida State University

Class time and location
Tuesday and Thursday, 3:05 – 4:20pm, In person
- In person (EOAS 1050)
- Remote via zoom at
  (meeting id:)

Instructor

- Instructor: Guang Wang
- Email: gwang9@fsu.edu (most effective way to contact me)
- Home page: http://www.guangwang.me/
- Office Hours: Friday 3:00pm to 4:00pm, or by appointments

Class Home Page
Will provide later
This web site contains the up-to-date information related to this class such as news, announcements, assignments, lecture notes, and useful links to resources that are helpful. Besides the web pages, Canvas will be used to communicate changes and updates and post grades for this class; in particular, I will send emails using email addresses in the Canvas system and please make sure that your email address on record is current.

Rationale
We are witnessing a rapid development of smart cities in the past decades. In general, a smart city is a city that utilizes different technologies (e.g., sensing, communication, and control) to provide city services and solve practical urban problems. The main goals of a smart city are to improve infrastructure utilization efficiency, reduce air pollution, improve social and economic quality, maximize social inclusion, and finally improve the quality of life of humans. Smart cities cover many domains like smart transportation, smart grid, smart healthcare, smart manufacture, smart agriculture, smart government, logistics, and mobility, etc. All these domains are highly related to our daily life. With the advance of ubiquitous and communication technologies, massive data are collected from these domains in real time, which provide us a great opportunity to understand urban phenomenon and solve real-world problems with data science techniques. This class is to cover the fundamental principles and algorithms in data science and their applications on smart city services. The instructor will introduce scientific techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS data, billing data, Wi-Fi data, and mobile phone data). The course will focus both on the methods and their applications to different smart city problems. Students will be able to develop new applications and improved algorithms that could have significant impacts, and therefore be competitive for many of jobs created by data science and machine learning techniques like Combinatorial Optimization, Graph Neural Network, Reinforcement Learning, Federated Learning, Transfer learning, etc.

Course Description

Empowered by rich data collected from various urban infrastructures in our cities, combined with the Artificial Intelligence techniques, our cities are becoming smarter and smarter. In this course, we discuss how data science is used to innovate our cities. We cover topics such as urban sensing, data-driven modeling, simulation, and decision making for smart city services, data visualization, and novel smart city services to facilitate our daily life. Students are expected to (i) read and present research papers drawn from top conferences and journals, (ii) participate in discussions of the papers, (iii) make up teams to present proposals, and (iv) design, implement and present their ideas for the final class project.

Prerequisites

Senior or graduate standing in science or engineering, or permission of the instructor. Some familiarity with basic concepts in linear algebra and probability theory. Some basic knowledge of algorithm designs and some experience with Python programming or another language that supports the machine learning framework you plan to use.

Course Objectives

By the end of this course, you will be able to

(1) learn the basic principle underlying data science for smart cities
(2) understand the state-of-the-art research in this area
(3) demonstrate ideas for smart cities
(4) implement ideas based on real-world data using tools including but not limited to data analytics, machine learning, statistics, data visualization, etc.

Textbook and Course Materials

No books are required. All the materials will be online.

Student Responsibilities

In case that it is necessary to skip a class, a student is required to notify the instructor beforehand; the absence is excused if it is allowed by the University Attendance Policy (see below). The penalty for each unexcused absence is 10% reduction of attendance points (see the Grading Policy below); a student will receive 0 for attendance points if he or she has ten or more unexcused absences through the semester. In both excused and unexcused cases, the students are responsible for making up missed materials. Participation in in-class discussions and activities is also required. All submitted assignments and projects must be done by the author(s). It is a violation of the Academic Honor Code (see below) to submit other's work and the instructor of this course takes the violations very seriously.

University Attendance Policy - Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Assignments and Projects

There will be no exams. There are three types of assignments and projects. (i) Each student needs to submit reading summaries of 8 papers from the assigned paper list. (ii) Every student will present about two papers from the assigned reading list based on the number of registered students. (iii) There will be a team-based project related to smart cities. Students can form their groups with 2-3 team members. The project should have suitable scope for one semester. The instructor will provide some datasets, and students can also find other data sources. The project should be able to be evaluated.

Grading Policy

Grades will be determined as follows:

10% for class participation
20% for reading summary
20% for topic presentations
50% for class projects (10% for Proposal Presentation, 20% for Final Reports, 20% for Presentations)

Grades will be computed using the weighted average as specified above and the following scale will be used (S is the weighted average on a 100-point scale):

Score	Grade	Score	Grade
$90 < S$	A	$70 < S < 75$	B-
$85 < S < 90$	A-	$65 < S < 70$	C
$80 < S < 85$	B+	$60 < S < 65$	D
$75 < S < 80$	B	$0 < S < 60$	F

Late Penalties

Assignments are due at the beginning of the class on the due date. Assignments turned in late, but before the beginning of the next scheduled class will be penalized by 10%. Assignments that are more than one class period late will **NOT** be accepted.

Submission and Return Policy

All tests/assignments/projects/homework will be returned as soon as possible after grading but no later than two weeks from the due date.

Tentative Schedule

Week	Date	Readings and Assignments
1	08/23/21	Course Introduction and Motivation
	08/25/21	
2	08/30/21	Urban Infrastructure Allocation
	09/01/21	

3	09/06/21 09/08/21	Data Management and Processing
4	09/13/21 09/15/21	Data-Driven Modeling: Sensing
5	09/20/21 09/22/21	Data-Driven Modeling: Measurement
6	09/27/21 09/29/21	Data-Driven Modeling: Prediction
7	10/04/21 10/06/21	Data-Driven Modeling: Decision Making
8	10/11/21 10/13/21	Data Visualization
9	10/18/21 10/20/21	Proposal Presentation
10	10/25/21 10/27/21	Urban Phenomena
11	11/01/21 11/03/21	Novel Urban Applications
12	11/08/21 11/10/21	Challenges in Smart Cities: Privacy and Security

13	11/15/21	Challenges in Smart Cities: Fairness and Equity
	11/17/21	
14	11/22/21	Human-in-the-loop and Behavior
	11/24/21	Thanksgiving Break (no classes held)
15	11/29/21	Project Presentation
	12/01/21	

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://fda.fsu.edu/academic-resources/academic-integrity-and-grievances/academic-honorpolicy.)

Examples of violations of the Academic Honor Policy are given in its document (found at http://fda.fsu.edu/content/download/21140/136629/AHPFinal2014.pdf). For this course, assignments/projects/exams are to be done individually, unless specified otherwise. It is a violation of the Academic Honor Policy to take credit for the work done by other people. It is also a violation to assist another person in violating the Academic Honor Policy. Concrete examples of violations include:

- Discuss the solution for a homework question
- Copy programs (done by another student) for a programming assignment
- Use and submit existing programs and reports on the world wide web for a written assignment
- Submit programs/reports/assignments done by a third party, including hired and contracted

The judgment of an alleged violation of the Academic Honor Policy will be done in accordance with the specified procedures. If the student is found to be responsible for the violation, the sanctions specified in the University Academic Honor Policy will be applied, including a zero for the particular assignment /exam and a reduction of one letter grade in the final grade for each occurrence. In addition, administrative actions will be taken in accordance with the University Academic Honor Policy.

Americans With Disabilities Act

Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center; and (2) bring a letter to the instructor indicating the need for accommodation and what type. Please note that instructors are not allowed to provide classroom accommodation to a student until appropriate verification from the Student Disability

Resource Center has been provided. This syllabus and other class materials are available in alternative format upon request.
For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdrc@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/

Additional Information

Free Tutoring from FSU - On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options at http://ace.fsu.edu/tutoring or contact tutor@fsu.edu. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Syllabus Change Policy: Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.