Class Syllabus

GISC 4381/6321: Spatial Data Science

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Course Description

Data science has emerged as one of the key drivers of societal transformation. Many data have intrinsic spatial properties (e.g., locations, geometry, and boundary) and subsequent relationships and interactions in space and time. Such spatial data are critical to find solutions or develop applications for emergency management, environmental sustainability, public health, smart city, public safety, business logistics, driverless cars, ecological conservation, and many other problem domains. This course aims to help students develop knowledge and skills to ask spatial questions, find, process and analyze spatial data, solve spatial problems, and communicate their findings. Specifically, the course will introduce spatial data analytics and machine learning methods. Central to the course is learning how to think through spatial problems and formulate solutions in spatial data science frameworks. How can we leverage spatial properties of data to advance our understanding of the roles, functions, and processes of location, space, and place on the society, environment, and their interactions? How does spatiality provide efficient frameworks to organize information, conceptualize real-world problems, and innovate solutions? Technically, we will explore machine learning with ArcGIS and proceed with open-source Python libraries (e.g., pandas, geopandas, scipy, stats, scikitlearn, and if time permits, keras and tensorflow) with cloud technologies, for example, AWS, Microsoft Azure, and Google Cloud Platform.

Student Learning Objectives/Outcomes

1. Knowledge: define spatial data science and its relations to spatial data science
2. Skills: fundamental tools and methods to process and analyze spatial data
3. Application: understand application principles to develop spatial data workflows to solve real-world problems through hands-on project packages

Course schedule: Subject to modifications (We may go quicker or slower depending on your learning progress).

Date	Topic	
Aug 26	Introduction to Spatial Data Science for problem solving	
Sept 02	Get to know data and think about how the data can be useful with ArcGIS pro	
Sept 09	Get to know data and think about how the data can be useful with Python	Package 1 due 9/15 midnight

All package due dates are tentative.
The actual due dates depend on when we have finished the packages in class. If we finish a package in class today, the package report is due by midnight next Wednesday.

Sept 16	Questions that find and extract objects of interest	
Sept 23	Questions that aim to summarize observations	
Sept 30	Questions that seek patterns and organizations	Package 2 due 10/6 midnight
Oct 07	Questions that look for relationships	
Oct 14	Questions that use relationships	
Oct 21	Questions that inquire associations	
Oct 28	Questions that seek explanations	Package 3 due 11/3 midnight
Nov 04	Questions that project what is likely …	
Nov 11	Questions that address what can be …	
Nov 18	Questions that ask what if …	
Nov 25	Thanksgiving break, no class	Package 4 due 12/01 midnight
Dec 02	Research project presentations (graduate students only; undergraduate students need to attend the presentations)	
Dec 09	Final Exam	

Grading Policy

No Curved
93-100 points = A; 90-92 points = A-
87-89 points = B+; 83-86 points = B; 80-82 points = B-
77-79 points = C+; 73-76 points = C; 70-72 points = C-
67-69 points = D+; 63-66 points = D; 60-62 points = D-
59 and below = F

Assignments include homework and classwork given in each class.
A package is an ensemble of exercises and questions for each topical section of the class. We have five packages in the class. Each package has a maximum of 100 points.

For undergraduate credits:

- All assignments count 20%
- All packages together count 50%
- Final exam counts 30%
- Graduate plus questions: bonus 10% for undergraduates only

Late submissions: A penalty of 10% deduction for a delay of every two hours on all assignments.

Course & Instructor Policies

Class attendance is expected. No make-up exams or assignments except for medical reasons, family emergencies or official university responsibilities. Class materials will be distributed on our class elearning website. All assignments should be submitted to the class elearning site. There will be no paper handouts and submissions in the class.

Sept 09	Get to know data and think about how the data can be useful with Python	Package 1 due 9/15 midnight
Sept 16	Questions that find and extract objects of interest	
Sept 23	Questions that aim to summarize observations	
Sept 30	Questions that seek patterns and organizations	Package 2 due 10/6 midnight
Oct 07	Questions that look for relationships	
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