

## **GEOG683/683L: Advanced GIS**

### **Spring 2023, Units: 3 (683), 1-2 (683L)**

#### **Instructor**

Atsushi Nara, Ph.D.

Email: [anara@sdsu.edu](mailto:anara@sdsu.edu)

Office: 311C Storm Hall

Office hours: Wed. 09:30-10:30  
or by appointment

#### **Course Schedule**

M 17:00-18:40 (SH331, Lecture)

W 17:00-19:40 (SH331, Lab)

#### **Course Description**

This graduate-level course is aimed at students who have a foundation in basic GIS techniques and applications, and are interested in expanding their knowledge into the area of scripting and modeling in the context of GIS. The course objective is to introduce scripting techniques mainly using Python for the development of various GIS analysis tools and models.

#### **Students' Responsibilities**

Students are required to attend and actively participate in the class sessions (lecture + lab), read the assigned course materials, and complete on time the lab assignments. As part of the lecture series, students are also required to develop, justify, implement, and present a course project of their own choice. The course project (final project), should reflect an application of methods and techniques presented in the course to student's own area of interest and, ideally, be relevant to student's thesis research.

Examples elaborating upon the material presented during lectures will be further examined during the lab sessions. The lab exercises provide the stepping stones to mastering concepts and techniques that are discussed in the lecture. Given that the content and the sequence of lectures and labs are heavily intertwined, attending both GEOG683 and GEOG683L is required. The course was designed based on the assumption that students complete the assignments in the lab or outside the lab contact hours – if necessary.

Attendance will be checked periodically and will constitute part of your grade for GEOG683. The instructors expect that in the case of a planned absence (e.g., medical appointment, study-related field trip) students excuse themselves well in advance of the class session.

#### **Final Project**

The main deliverable for the course is the final project. Students are encouraged to select project topics that reflect their respective areas of interest/research. The project must be completed individually. Students must also present a project proposal. The proposal should include 1) an introduction containing a general description of the project as well as the purpose of the project, 2) methods that will be used to complete the project, and 3) expected results. The due date for the proposal is **April 5, 2023**.

In the last meeting of the course (i.e., May 3, 2023), students will give a 15-minute presentation to the whole class about their project. The presentation should be prepared in PowerPoint and focus on the project objective, methods, results, and lessons learned.

The final project paper, due on May 5, 2023, should elaborate on and go beyond the proposal. The paper should not exceed 7 pages of single-spaced text and should clearly explain the motivation for the project, project objective(s), methods used, results, and lessons learned. The paper should also discuss limitations, challenges, and problems that were encountered during the completion of the project. Figures, tables, illustrations, and some scripting examples are encouraged to be included in the report, but they are limited to 3 pages in total.

### **Student Learning Outcomes**

By the end of this course, students will be able to:

- Define and describe the fundamental programming concepts, methods, and approaches in spatial analysis and modeling
- Design and implement Python scripts for advanced spatial analysis and modeling
- Apply and utilize external resources including GIS-Python libraries and online helps
- Understand and implement geospatial web-based applications

### **Prerequisites**

GEOG 484 and CS 108.

Prior programming experience is required. Students would benefit from taking GEOG 582 (Python programming) and GEOG 580 (Spatial database) or similar courses.

### **Course Materials and Textbooks**

All course materials including lecture slides, assignment documents, and lab materials are available via **Canvas**. There is one required textbook, which is available as a *free e-book* in the SDSU library. The link is available on Canvas.

Xiao, N. (2016). *GIS algorithms: theory and applications for geographic information science & technology*.

Textbook Github Repository: <https://github.com/gisalgs>

Book Author's Github Repository: <https://github.com/ncxiao>

Cell phones: **Please remember to bring your cell phone to class** in order to access any classroom computers and campus applications. This requirement is part of the expanded Duo security expansion intended to reduce the risk of technology and data compromises.

## **Grading**

### ***GEOG 683***

The final grade for GEOG 683 will be based on the quality of the final course project. The grade will be determined as follows:

- 25% for the originality and relevance of the project
- 45% for the demonstrated mastery of method(s)
- 15% for the overall quality (style) of the project paper
- 10% for the quality of the project presentation, and
- 5% for attendance.

### ***GEOG 683L***

All labs need to be completed individually. There will be a total of 8 lab assignments. In addition to programming codes, each lab assignment requires write-ups describing problems encountered and insights gained. The form of delivery will be specified by the lab instructor for each lab. In general, students will be given one week to complete the assignment. Each lab assignment accounts for **12.5% (8 x 12.5 = 100%)** of the final GEOG 683L grade.

Assessments received after the due date or after the extended submission date will be penalized at **20% per day** for a maximum penalty period of five consecutive days unless a valid excuse is presented to Prof. Nara prior to the due date (medical, family emergency, university-related field trip).

## **Class Participation**

Class participation is based on each student's contribution to class throughout the semester. Students are expected to attend and actively participate in lectures, labs, and project presentations.

## Course Schedule & Topics

<i>Week</i>	<i>Date</i>	<i>Lecture &amp; Lab Topics</i>	<i>Assignment</i>
1			
	01/18	Course Introduction (No Lab)	
2	01/23	Geometric Algorithms I: Basic Geometric Operations	A1 dist.
	01/25		
3	01/30	Geometric Algorithms II: Polygon Overlay	A2 dist.
	02/01		<b>A1 due.</b>
4	02/06	Spatial Index I	A3 dist.
	02/08		<b>A2 due.</b>
5	02/13	Spatial Index II	A4 dist.
	02/15		<b>A3 due.</b>
6	02/20	Spatial Analysis & Modeling I	A5 dist.
	02/22	Topics: Spatial Autocorrelation	<b>A4 due.</b>
7	02/27	Spatial Analysis & Modeling II	A6 dist.
	03/01	Topics: Network Analysis	<b>A5 due.</b>
8	03/06	Spatial Analysis & Modeling III	A7 dist.
	03/08	Topics: Agent-Based Modeling (TBD)	<b>A6 due.</b>
9	03/13	Spatial Analysis & Modeling IV	
	03/15	Topics: Machine Learning & Object Detection (TBD)	<b>A7 due.</b>
10	03/20	Geospatial Web Application Development I	A8 dist.
	03/22	AAG Week; Work on A8 (no lab)	
11	03/27	<b>Spring Break (no class)</b>	
	03/29		
12	04/03	Geospatial Web Application Development II	
	04/05		<b>FP Proposal Due</b>
13	04/10	Geospatial Web Application Development III	
	04/12		
14	04/17	Final Project Prep.	<b>A8 due.</b>
	04/19		
15	04/24	Final Project Prep.	
	04/26		
16	05/01	Final Project Prep.	
	05/03	Final Project Presentation	<b>Final Project Due</b> Friday 05/05 @ 23:59:59

\*The course topics and schedule may change due to various circumstances. You are responsible for any announcement made during class, even if you were absent.

## **Course Policies**

**Turnitin & MOSS:** Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. You may submit your papers in such a way that no identifying information about you is included. Another option is that you may request, in writing, that your papers not be submitted to Turnitin.com. However, if you choose this option, you will be required to provide documentation to substantiate that the papers are your original work and do not include any plagiarized material.

The same principle will apply to programming assignments, which may be subject to submission to the MOSS (Measure Of Software Similarity) program for the purpose of software plagiarism detection.

**Copyright Policy:** SDSU respects the intellectual property of others and asks faculty & students to do the same. It is best to assume that any material (e.g., graphic, programming code, text, video, or sound) on the Web is copyrighted unless specific permission is given to copy it under a [Creative Commons License](#). More information about the use of copy written material in education as part of the [TEACH Act](#) and [Copyright Fair Use Guidelines](#). Whenever possible, you should attribute the original author of any work used under these provisions.

**Course Materials:** All lecture slides, lab exercises, and assignments created by the course instructor available via Canvas are copyrighted. *These course materials are for the student's academic use only and should not be distributed in any manner to any other individual.*

## **Audio/Video Recordings**

Students may not record (audio or video) in this class except in accordance with ADA accommodations. Any recordings made in connection with a disability accommodation are for the student's personal academic use only and may not be distributed in any manner to any other individual.

## **Academic Honesty**

The University adheres to a strict [policy prohibiting cheating and plagiarism](#). Examples of academic dishonesty include but are not limited to:

- Copying, in part or in whole, from another's test or other examination;
- Obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- Collaborating with another or others in coursework without the permission of the instructor;
- Falsifying records, laboratory work, or other course data;
- Submitting work previously presented in another course, if contrary to the policies of the course;
- Altering or interfering with grading procedures;
- Assisting another student in any of the above;
- Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- Copying and pasting work from an online or offline source directly and calling it one's own;

- Using information found from an online or offline source without giving the author credit;
- Replacing words or phrases from another source and inserting one's own words or phrases.

Unauthorized recording or dissemination of virtual course instruction or materials by students, especially with the intent to disrupt normal university operations or facilitate academic dishonesty, is a violation of the Student Conduct Code. This includes posting of exam problems or questions to on-line platforms. Violators may be subject to discipline.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

### **Classroom Conduct Standards**

SDSU students are expected to abide by the terms of the [Student Conduct Code](#) in classrooms and other instructional settings. Violation of these standards will result in referral to appropriate campus authorities. Prohibited conduct includes:

- Willful, material, and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including:
  - Physical abuse, threats, intimidation, or harassment.
  - Sexual misconduct.

### **Land Acknowledgement**

For millennia, the Kumeyaay people have been a part of this land. This land has nourished, healed, protected and embraced them for many generations in a relationship of balance and harmony. As members of the San Diego State University community, we acknowledge this legacy. We promote this balance and harmony. We find inspiration from this land, the land of the Kumeyaay.

### **Notes**

The course syllabus and schedule may change due to various circumstances. You are responsible for any announcement made during class, even if you were absent.