

Exploring Geospatial Data:

An Introduction to Geographic Data, Analysis and Visualization

Lecture / Lab: Tuesdays, 3-5pm, Evans B6

Instructors

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Class website

bCourses: <https://bcourses.berkeley.edu/courses/1457914>

Course Description

From interactive web maps to spatial data analysis, digital geographic data and information are becoming an important part of the data science landscape. Almost everything happens somewhere that can be located on the surface of the earth. In many cases *the where* matters as much to an analysis as *the what* and *the why*. Geographic data analysis allows a researcher to consider location explicitly. This course provides an introduction to working with digital geographic data, or geospatial data.

A key goal of this course is to present fundamental spatial concepts through an exploration of geospatial data. Lectures will introduce concepts and methods. Computer lab activities and assignments will provide hands-on learning opportunities with geographic data representation, methods for processing and analysis, and techniques for creating compelling visualizations. No prior knowledge is assumed or expected.

Computing Environment

Course assignments will use the following free and/or open software: QGIS 2.18, the [Data 8](#) online Python/Jupyter environment and CARTO.com. These will be accessible via UCB computers or your own computer using a web browser or software download. Campus computer labs with the software installed include the Earth Sciences and Maps Library, 432 Evans computer lab and the Geospatial Innovation Facility (gif.berkeley.edu) in Mulford Hall.

Grading

There will be 10 graded homework exercises, all mandatory. Exercises will be made available and discussed at the beginning of the second hour of each class and are due 1 week later, prior to the start of class. Late assignments will be penalized 10% per day and will only accepted up to one week late unless prior arrangement has been made and/or special circumstances. *If you want an extension of time for turning in your homework you need to ask for it before the due date.* There will be one quiz and one larger assignment as the final project. The final project must be turned in on time. The final class grade will be calculated as follows:

Homework Exercises	65 %
Quiz	5 %
Final Project	25%
Participation	5 %
	100 %

Class Format

The first hour of each class will be a lecture-style with discussion questions. The second hour will be demo and/or lab time to work on computer based exercises based on the lecture topic and learning goals.

Expectations

Weekly lecture and lab attendance is expected. Students are required to submit their own work, although discussion is strongly encouraged. Any use of outside materials must be cited. Please ask for clarification if needed.

Class Schedule (Subject to change; readings should be done *before* class meetings)

Week	Date	Topic	Assignment
1	1/17	<i>Introduction and motivation:</i> What are geographic data? How are they used? Why is this important. Course goals and logistics.	Reading: GISS , ch1. Geographic Information: Science, Systems, & society EX 0. Review QGIS website and install latest version of QGIS
2	1/24	<i>Representing location:</i> Conceptual views and spatial data representation models.	Reading: GISS , ch3. Representing Geography EX 1. Intro to Desktop GIS with QGIS EX 0 due
3	1/31	<i>Spatial is Special: Tobler's First Law.</i> The many meanings of scale & its implications on representation and analysis.	Reading: GISS , ch 2. the Nature of Geographic Data (ch4 in 3rd edition); Montello, D. R. 2001. Scale, in geography EX 2. Exploring scale & representation EX 1 due
4	2/7	<i>Coordinate reference systems and map projections.</i> Specifying locations on the surface of the Earth.	Readings: GIS , ch4. Georeferencing EX 3. CRS and map projections EX 2 due
5	2/14	<i>Describing locations and relations:</i> Spatial metrics and topological relationships	Readings: GISS , - ch 9, Creating & maintaining geo databases (skim) - ch 12, Geovisualization (Visualization & UI in older editions), esp. spatial queries - ch 13, Spatial data analysis, 290 - 301 (Geographic query & analysis in older editions) EX 4. Spatial Queries in QGIS EX 3 due
6	2/21	<i>Describing locations and relations:</i> Spatial queries	Readings: see above EX 5. Spatial Queries in Python EX 4 due
7	2/28	<i>Exploring point data I.</i> Visualizations	Reading: GISS , ch11, Cartography & Map production plus ch12, Geovisualization; Optional: O'sullivan & Unwin ch 3, pp 55-72 EX 6. Mapping points EX 5 due
8	3/7	<i>Exploring point data II:</i> descriptive summaries, patterns & transformations	Reading: GISS , ch13, Spatial Analysis (excluding interpolation) p. 301 - 313; ch14, Spatial Analysis & Inference, pp321-324.

			EX 7. Point patterns EX 6 due
9	3/14	<i>Data Sources & Data Creation</i>	Reading: GISS , ch 8 Data Collection EX 8 Data creation EX 7 due
10	3/21	<i>Intro to Raster data & analysis</i>	Reading: GISS , ch14, Spatial Analysis & Inference (Geographic query & analysis in older editions) EX 9. Raster data (nothing to submit) EX 8 due
11	3/28	<i>Spring Break</i>	
12	4/4	<i>Exploring Area data I. Representations, considerations & visualizations</i> Discussion: GR 2.3	Reading: Osullivan & Unwin, ch 3, pp 72-87; GISS : ch13, pp319-320, ch11, Cartography & Map production, ch12, Geovisualization EX 10: Mapping Data by Areas
13	4/11	<i>Exploring Area data I. US Census geography and demographic data and related issues. Guest speaker Jon Stiles. Part I, Part II, Part III</i>	Review: Census web site: www.census.gov and Census Geographic areas reference manual . Read Chapter 2: Geographic Overview EX 11: Mapping Census Data EX 10: due
14	4/18	<i>Exploring Area data III. Spatial dependence and spatial autocorrelation</i> Discussion: GR 4.1	Reading: Review GISS Nature of Geographic data; & Spatial Analysis (excluding interpolation). Optional, O'sullivan & Unwin , ch 2, pgs. 33 - 46 EX 12: Spatial Autocorrelation EX 11 due
15	4/25	<i>Wrap up & review. Where to go from here.</i>	Final project distributed and questions EX 12 due
		Final Project - combines the concepts and techniques of the semester in a single geospatial analysis context.	Discussion Session (optional): TBD Due date: Tuesday, May 9, 2017 at 5pm

Required Text:

- Longley, Goodchild, Maguire, & Rhind. *Geographic Information Systems & Science, Edition 4 or (GISS)*. The references in the syllabus are to edition 4. You can compare editions by viewing the table of contents in Amazon.com. You can rent or purchase less expensive used copies of the text on Amazon. One copy is on reserve in Earth Sciences and Map Library.

Optional online Texts:

These provide another perspective and online access, which is especially helpful before you obtain the text.

- O'Sullivan & Unwin. *Geographic Information Analysis*, 2nd Edition. 2010. (available online via UCB Calnet Authentication at: <http://onlinelibrary.wiley.com/book/10.1002/9780470549094>).
- DiBiase, David. *The Nature of Geographic Information, An Open Geospatial Textbook*. Available online at: <https://www.e-education.psu.edu/natureofgeoinfo/node/1672>