Geography 187 Geographic Information Analysis

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Office hours: Weds 10:30-12:30 sign up for 20 minute slots on my office door

GSI Seth Denizen, sethdenizen@berkeley.edu
Office hours: Mon 10:30-11:30 in McCone 583, or by appointment

Lectures Mon, Wed, 9:30-10:30, 145 McCone
Labs Tue 10:30-12:30, Thu 1-3, 535 McCone (the CAGE Lab)

Course description

Recording the geographical location of scientific, social, and business data is now routine so that a very large proportion of all data have become spatial in nature. The question of what we can learn from the spatial aspect of data naturally arises. This class explores the challenges of analyzing spatial data, particularly *spatial dependence* and *geographical scale*. We will look at key concepts such as *spatial autocorrelation*, *spatial process* and its relationship with *pattern*. Various analytical methods will be considered such as point pattern analysis, hotspot detection, interpolation, and map overlay. The emphasis throughout is hands on and practical, but attention will also be paid to related theoretical concerns, and simple statistical understanding will be useful. Even so, which methods are appropriate to use and why, will be our focus rather than the underlying statistical theory.

The lectures are supported by a sequence of **five laboratory assignments** introducing a variety of tools for performing spatial analysis. The lab assignments will introduce practical skills with the tools at the same time as reinforcing what you learn in the lectures, particularly the strengths and limitations of the methods.

Finally a **group project** aims to reinforce what you have learned in the lecture and lab sessions, while also allowing you to explore spatial analysis in the context of a particular problem or topic that interests you and your group.

Lecture schedule

This schedule may change a little, as the semester unfolds.

Week	*Monday*	*Wednesday*	**Lab**
Jan 16	NO CLASS	Introduction to the class	NO LAB
Jan 23	Course overview: what's so special about spatial data?	Measuring spatial autocorrelation	**Lab Sign up**
Jan 30	Local indicators of spatial autocorrelation	Spatial dependence	**Lab 1**
Feb 6	Spatial processes	Describing point patterns	||
Feb 13	Measuring point patterns	Statistical point pattern analysis	**Lab 2**
Feb 20	NO CLASS	Detecting clusters in point patterns	**Lab 3**
Feb 27	Introduction to spatial interpolation	Simple interpolation methods	||
Mar 6	Demo of ArcGIS interpolation	Trend surface analysis and variograms	**Lab 4**
Mar 13	Geostatistics: kriging	Dealing with two or more variables	||

Mar 20	Areal interpolation and overlay	**MIDTERM**	**Lab 5**
Mar 27	SPRING RECESS		‖
Apr 3	Topics as required to support projects and/or consultation		‖
Apr 10	Topics as required to support projects and/or consultation		
Apr 17	Topics as required to support projects and/or consultation		
Apr 24	Lightning presentations of projects		
May 1	READING WEEK final project reports due beginning of this week		
May 8	**THERE IS NO FINAL; REPEAT: THERE IS NO FINAL**		

Lecture attendance is **expected, and strongly advised**. The course assessments will draw on the lecture materials, but you will learn more by attending the lectures, participating in discussions, asking questions, and all the other stuff that happens there. Lecture slides will be available at

http://southosullivan.com/geodos/pages/geog-187.html

but when they become available relative to class-time is likely to vary. A few days after class the version of the lecture at that web address will be 'final'.

DO NOT assume that lecture slides will provide a complete account of everything that is said and learned in class. [See also **Readings**, below.]

Lab schedule

The labs for this course are intended to compliment the lecture material, and also constitute a substantial part of the course assessment (a combined 50%). Attendance is not mandatory, but it is only during the scheduled times that you are guaranteed access to assistance from the course Graduate Student Instructor (GSI).

Week starting	***Tue 9:30-11:30 / Thursday 1-3 / submission deadlines are Mon 11:59PM***
Jan 16	No labs this week
Jan 23	Attend your lab section to sign up for access
Jan 30, Feb 6	**Lab 1** (10%) Measuring global spatial autocorrelation and local indicators of spatial autocorrelation (LISA) (due Feb 13)
Feb 13	**Lab 2** (5%) Introduction to *R*, and point processes (due Feb 20)
Feb 20, 27	**Lab 3** (15%) Point pattern analysis in *R* (due Mar 6)
Mar 6, 13	**Lab 4** (10%) Spatial interpolation using *ArcGIS* (due Mar 20)
Mar 20, Apr 3	**Lab 5** (10%) Map overlay and regression (due Apr 10)
Apr 10, 17	Assistance to group projects

Each lab will consist of written instructions and guidelines to help you work through a practical task of some kind. The instructions will not be complete 'point-and-click' guides to what to do, every step of the way, but will leave you some room to explore and figure some things out for yourself. If you get stuck you can seek help from the GSI, who will be available in the scheduled lab sessions. Even better, you should work with other students. This can help both the person who is stuck and the person who is

giving assistance.

Of course, even if you work with others on figuring out how to complete the assignment, the work you submit for assessment must be your own individual work [see **Academic Integrity** below].

As noted above, all labs are due on **Mondays at midnight (end of the day)**. Submission method is electronic via *bCourses*.

No late submissions will be accepted. If you anticipate problems submitting a lab on time, then please contact the GSI *ahead of the due date*, and we can discuss options to accommodate you, depending on the circumstances. We cannot accommodate you if we don't hear about the problem *in advance*.

Group project

The group project component of this class is an opportunity to apply ideas you learn in the lectures and labs in a context you are interested in, and also to experience some of the challenges of finding and organizing spatial data. The brief is simply to (i) identify a topic are of interest; (ii) to find some spatial data that pertain to the topic of interest; (iii) to organize those data so that you can analyze them; (iv) to performs some spatial analysis on the data; and (v) to present your results both to the class (in a lightning talk) and in a short term paper.

At its simplest the project could involve repeating the analysis performed in one of the lab assignments, but using data you have found and organized yourselves. A more ambitious project might involve trying a method not covered in the labs or lectures.

The first part of the group project process will be to form project groups of three or four students. We will do a simple in-class survey to help with this, and assign students to groups with at least somewhat similar interests. In a class of this size it is easier to assign you to groups than to allow students to form their own groups. Group composition (i.e. who is in what groups) will be announced by **February 3** to give you plenty of time to figure out who your group partners are, before the project assignment proper starts.

By **March 3** you should submit by email to me (dosullivan@berkeley.edu) your group project topic idea. This does not need to be a detailed description of the project plan, more a general statement of intent. The key issues are, what is the topic area, what question (or questions) do you want to address, and most importantly, what data and methods do you anticipate using to address your questions. Data is particularly critical, and it is *strongly recommended* that project groups spend some time between **February 3** and **March 3** identifying data sources and downloading sample data, to minimize the possibility of surprises, when you actually get started on the project. Sometimes possible data sources look really promising, and then, when you retrieve the data, it really is not what you were expecting. A discussion forum on *bCourses* entitled 'Group project ideas and discussions' will be available to support this stage of the project development. You can post links to useful data resources you identify, ask the class more broadly than just your own group if they know of potential data sources relevant to your ideas, and generally share thoughts and ideas.

By **March 10** I will provide feedback on the project ideas. It's conceivable the feedback might be 'this is a crazy idea, think of something else more feasible instead!' but hopefully not. If you do need to have a rethink, there is a week or so before Spring Recess to come up with a revised or new plan.

After Spring Recess, you will have plenty of opportunity to get assistance and advice in class time and in the lab times between then and the final week of lectures (when the lightning talks are scheduled). Where there are questions arising from the projects that are common across many groups, I will put together materials and informally lecture on those topics as needed (common topics of interest can be surfaced via the 'Group project ideas and discussions' forum on *bCourses*). Most class time between

Spring Recess and the last week of lectures will be free-form, with groups working on their projects and with assistance on hand for advice and support.

Assessment of the project will be based on a 'lightning talk' presentation of your work in class in the final week of lectures (i.e. a 5 minute presentation – maybe 5 slides at most), and on a short written report on the work completed. Each student should submit an individual report. You may make use of common materials (maps, results, etc.) but the write-ups will be individually assessed. Reports do not need to be very detailed, but should focus on a brief description of the topic, where the data were obtained, any processing you needed to do on the data, and some maps and analysis results. Full details of the expectations will be provided at the outset of the project stage of the class. If you keep good notes as you work on the project, you should find that it won't take long to put together your report.

Reading

More or less everything in the class is covered in

> O'Sullivan, D. and D. J. Unwin. 2010. *Geographic Information Analysis.* Wiley, Hoboken, NJ.

which you will find useful, *although it is not required*. I will provide PDFs of key chapters on bCourses, and an e-copy is available through the library.

There may be other relevant materials, both from books, the research literature, and online. These will be linked from lecture slides (available online as noted above), and where possible, provided via *bCourses*.

Assessment

Course assessment consists of 50% across the 5 lab assignments (note that the labs are not all worth the same percentage of credit), 30% on the lab project (15% for the lightning presentation in the last week of lectures and 15% for a write-up), and 20% on the midterm. Contrary to what is stated on the published schedule, ***there will be no final***.

Details of the assessment criteria for each lab assignment will be clear in the associated materials.

The midterm exam will consist of some short answer questions on the lecture and additional reading materials, and will take place soon after Spring Recess.

David O'Sullivan
January 9, 2017

Additional logistical information

Academic Integrity

Any test, paper or report submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your instructor.

In all of your assignments, including your homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. "Proper attribution" means that you have fully identified the original source and extent of your use of the words or ideas of others that you reproduce in your work for this course, usually in the form of a footnote or parenthesis.

As a general rule, if you are citing from a published source or from a web site and the quotation is short (up to a sentence or two) place it in quotation marks; if you employ a longer passage from a publication or website, please indent it and use single spacing. In both cases, be sure to cite the original source in a footnote or in parentheses.

If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your instructor or GSI beforehand.

Finally, you should keep in mind that as a member of the campus community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits. So be proud of your academic accomplishments and help to protect and promote academic integrity at Berkeley. The consequences of cheating and academic dishonesty—including a formal discipline file, possible loss of future internship, scholarship, or employment opportunities, and denial of admission to graduate school—are simply not worth it.

In fairness to students who put in an honest effort, cheaters will be harshly treated. Any evidence of cheating will result in a score of zero (0) on that assignment or examination. Cheating on the final exam results in an "F" for the course. Cheating includes but is not limited to bringing notes or written or electronic materials into an exam or quiz, using notes or written or electronic materials during an exam or quiz, copying off another person's exam or quiz, allowing someone to copy off of your exam or quiz, and having someone take an exam or quiz for you. Incidences of cheating will be reported to Student Judicial Affairs, which may administer additional punishment.

Accommodation of religious creed

In compliance with Education code, Section 92640(a), it is the official policy of the University of California, Berkeley to permit any student to undergo a test or examination, without penalty, at a time when that activity would not violate the student's religious creed, unless administering the examination at an alternative time would impose an undue hardship that could not reasonably have been avoided. Requests to accommodate a student's religious creed by scheduling tests or examinations at alternative times should be submitted directly to the faculty member responsible for administering the examination by the second week of the semester.

Reasonable common sense, judgment and the pursuit of mutual goodwill should result in the positive resolution of scheduling conflicts. The regular campus appeals process applies if a mutually satisfactory arrangement cannot be achieved.

The link to this policy is available in the Religious Creed section of the Academic Calendar webpage.

Conflicts between extracurricular activities and academic requirements

The Academic Senate has established Guidelines Concerning Scheduling Conflicts with Academic Requirements to address the issue of conflicts that arise between extracurricular activities and academic requirements. These policies specifically concern the schedules of student athletes, student musicians, those with out-of-town interviews, and other students with activities (e.g., classes missed as the result of religious holy days) that compete with academic obligations.

These policies were updated in Spring 2014 to include the following statement:

-The pedagogical needs of the class are the key criteria when deciding whether a proposed accommodation is appropriate. Faculty must clearly articulate the specific pedagogical reasons that prevent accepting a proposed accommodation. Absent such a reason, the presumption should be that accommodations are to be made.

The guidelines assign responsibilities as follows:

-It is the instructor's responsibility to give students a schedule, available on the syllabus in the first week of instruction, of all class sessions, exams, tests, project deadlines, field trips, and any other required class activities.

-It is the student's responsibility to notify the instructor(s) in writing by the second week of the semester of any potential conflict(s) and to recommend a solution, with the understanding that an earlier deadline or date of examination may be the most practicable solution.

-It is the student's responsibility to inform him/herself about material missed because of an absence, whether or not he/she has been formally excused.

The complete guidelines are available on the Academic Senate website. Additionally, a checklist to help instructors and students comply with the guidelines is available on the Center for Teaching and Learning website.

Absences due to illness

Instructors are asked to refrain from general requirements for written excuses from medical personnel for absence due to illness. Many healthy people experience a mild-to-moderate illness and recover without the need to seek medical attention. University Health Services does not have the capacity to evaluate such illnesses and provide documentation excusing student absences. However, UHS will continue to provide documentation when a student is being treated by Tang for an illness that necessitates a change in course load or an incomplete.

From time-to-time the Academic Senate has issued guidance concerning missed classes and exams due to illnesses such as influenza advising that students not attend class if they have a fever. Should a student experience repeated absences due to illness, it may be appropriate for the faculty member to ask the student to seek medical advice. The Senate guidelines advise faculty to use flexibility and good judgment in determining whether to excuse missed work, extend deadlines, or substitute an alternative assignment. Only the Committee on Courses of Instruction (COCI) can waive the final exam. However, a department chair can authorize an instructor to offer an alternative format for a final exam (e.g., paper, take-home exam) on a one-time basis (http://academic-senate.berkeley.edu/committees/coci/toolbox#16).