

## **GEOG 318 / PLAN 353 – Spatial Analysis – Winter 2014**

Instructor: Richard Kelly, rejkelly@uwaterloo.ca, room EV1-119  
Office hours: Tuesdays 2:00–3:00pm  
Instructor: Derek T. Robinson, dtrobins@uwaterloo.ca, room EV1-105A  
Office hours: Thursdays 3:00–4:00pm  
Teaching Assistant: Aaron Thompson, a4thomps@uwaterloo.ca  
Lecture: Mondays 1:30–4:20pm, room EV3-3412  
Prerequisites: ENVS 278 Advanced Environmental Research Methods  
CourseID: 005908

### **Course Description**

Spatial analysis techniques are developed and applied in diverse fields such as geography, spatial epidemiology, spatial econometrics, geocomputation, and spatial statistics to explain and predict spatial phenomena. Today, spatial analysis is mainly based on statistical techniques and geoprocessing using geographic information systems (GIS). The spatial character of data implies several methodological challenges in spatial data analysis especially related to the spatial dependence of the data, which often invalidates non-spatial modeling and evaluation approaches and leads to special techniques for spatial sampling and spatial regression modeling.

The course gives an overview of statistical and computational techniques for spatial regression modeling, spatial classification, spatial interpolation, and point pattern analysis. In addition, selected topics such as spatial data mining and spatial analysis software will be addressed, depending upon the progress of the course. Several real-world applications of spatial analysis techniques are explored, including landslide susceptibility analysis, geostatistical modeling of soil contaminant distribution, and distribution modeling of crime or disease incidence.

### **Course Objectives**

At the end of this course, you should:

- Have gained an understanding and awareness of potential and pitfalls of spatial analysis;
- Have developed a general understanding of a variety of spatial modeling techniques;
- Be able to interpret and critically discuss spatial models and their results.

Statistical concepts and techniques known from ENVS 178/278 (or similar courses) will be reinforced (but not re-introduced), and typical misconceptions will be addressed.

### **Reference Books**

The following references are available on course reserve at the Porter Library. We will follow O'Sullivan and Unwin (2002) closely. You may purchase this book or find access to it (for free) online via the library. The other two books may also be used.

De Smith, M.J., M.F. Goodchild and P.A. Longley, 2006. *Geospatial Analysis*, Troubador Publications. Available online at <http://www.spatialanalysisonline.com/output/>  
Lloyd, C.D., 2010. *Spatial Data Analysis: an Introduction for GIS Users*. Oxford Univ. Press.

O'Sullivan, D. and D. Unwin, 2010. *Geographic Information Analysis*, 2<sup>nd</sup> Edition, Wiley.  
Available online through the library.

### Course Schedule

Class	Instructor	Date	Contents	Evaluation
1	DR	6 Jan	Introduction and overview <b>ch 1, 2, 3</b>	A1 assigned
2	DR	13 Jan	Point Pattern Analysis <b>ch 5, 6</b>	
3	DR	20 Jan	Point Pattern Analysis <b>ch 5, 6</b>	A1 Due, A2 assigned
4	DR	27 Jan	Spatial Regression (local statistics)	
5	DR	3 Feb	Logistic Regression	A2 Due, A3 assigned
6	RK	12 Feb	Interpolation; Geostatistics: Variograms <b>ch 7</b>	
-		17 Feb	<i>No class: Reading Week</i>	-
7	RK	24 Feb	Geostatistics: Kriging <b>ch 9, 10</b>	A3 Due, A4 assigned
8	RK	3 Mar	Geostatistics: Kriging <b>ch 9, 10</b>	
9	RK	10 Mar	Spatial Classification: Classification Trees	A4 Due, A5 assigned
10	RK	17 Mar	Spatial Classification: Accuracy Assessment	
11	DR	24 Mar	Selected Topics	A5 Due
12	RK	31 Mar	Review Session	

Chapter references in the course schedule refer to the O'Sullivan and Unwin (2010) book. Other readings will be assigned/suggested throughout the term.

### Method of Evaluation

Item	Format / Topic	Contribution
Assignment 1	Spatial analysis case studies, and potential and pitfalls of spatial analysis	5%
Assignment 2	Point pattern analysis	15%
Assignment 3	Interpretation and discussion of regression models	15%
Assignment 4	Interpolation	15%
Assignment 5	TBD/Classification	15%
Final Exam	True-false, multiple choice, and open questions, calculations, sketches.	35%

Pocket calculators (with exponential function and logarithm) may be required for tests and class participation.

### Computer Labs

You can use the Galileo (EV1-240), Geddes (EV2-1002A) or Magellan (EV2-1014) labs for practical work in this course when they are not booked for other courses. Access codes are available at the Mapping Analysis and Design helpdesk in EV2. Software found in these labs is also available off-campus by logging on to the terminal server (festerterm1.uwaterloo.ca). Directions for accessing the terminal server can be found here: <http://uwaterloo.ca/environment-computing/services-support/geospatial-support/windows-terminal-server>

*NOTE: No food or drink is allowed in the labs. Failure to abide by this rule may result in your computer accounts being suspended.*

### **Course Website**

A course website has been created on the new learning platform “Learn” (Desire2Learn). Information on access to the website will be provided in class. An automatic forward from the old learning platform UW-ACE should be in place, but this may change since “Learn” is still under development. Students registered in the course can access the course website after September 10<sup>th</sup> by going to the LEARN website (<http://learn.uwaterloo.ca>) and logging in using your WatIAM/Quest username and password. Once logged in, you will see the course listed under “My Courses and Communities”. Click on GEOG 318 to see the course content.

The course website provides access to lecture presentations, course notes, and other relevant information. Online material in LEARN can be opened or downloaded by clicking on the appropriate link. In addition, the course website supports announcements, discussion groups and e-mail. Assignments will be handed in via the LEARN course website and students should become familiar with the website and submission process early so as not to receive a late submission.

### **Getting Help**

Students are expected to get into the habit of using the on-line help files as the **first** source of help. The TA and instructor will be available during scheduled help sessions and office hours to answer questions related to the assignments. Additional help is available from the MAD help desk.

### **Email**

Please include the course shortcode and your family name in the subject of your email (e.g. Robinson GEOG/PLAN 318). We will try to respond to emails within 24hrs excluding weekends (i.e. Friday 5pm to Monday 8am). We will respond to emails regarding course content or logistics, while questions or concerns regarding evaluation will be reserved for discussion during office hours. Because the course is co-instructed, it is your responsibility to contact the appropriate instructor for the course materials that you are requesting assistance with.

Email and online discussions are governed by the same rules of academic conduct as your behaviour in class. Please use common courtesy, be polite, and, of course, avoid sending or forwarding aggressive, sexist, racially discriminatory, obscene, offensive, libellous, or defamatory comments of any kind. If I do not respond to your email within 24 hours please send me another email or see me in person as it may have been deleted by a spam filter or a server may have been down

when the email was sent. Email can be a benefit to both the student and instructor objectives; however, email is not a substitute for one-on-one discussion and therefore I prefer to meet with you during office hours.

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/). Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at: <http://www.lib.uwaterloo.ca/ait/>

**Research Ethics:** Please also note that the University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.).

If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: [www.research.uwaterloo.ca/ethics/human/](http://www.research.uwaterloo.ca/ethics/human/)

**Note for students with disabilities:** The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

**Religious Observances:** Please inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt, please contact your Undergraduate Advisor for details.

**Discipline:** A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, [www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm). For typical penalties, check Guidelines for Assessment of Penalties, [www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm](http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm)

**Appeals:** A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals). See: [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)

**Consequences of Academic Offences:** ENV students are strongly encouraged to review the material provided by the university's Academic Integrity office (see: <http://uwaterloo.ca/academicintegrity/Students/index.html>).