

GIS 4121 (Geospatial Analysis)/GIS 6116 (GIS Analysis)

OVERVIEW

GIS analysis involves the process of analyzing and identifying patterns in geographic data, and describing relationships between spatial features and phenomena. This course introduces a number of techniques aimed at the analysis of spatial data and will be comprised of lectures and computer labs. Lecture topics include characterization of spatial data, geographic distributions, pattern identification within point and area objects, analysis of field data, spatial modeling and interpolation, regression methods, and cluster analysis. On the practical side, students will conduct spatial analysis with GIS software including ArcGIS Pro, Python scripting, model builder, and Microsoft Excel spreadsheet functions.

- Spring semester, 3 credits
- 100% online, synchronous and asynchronous component
- <http://elearning.ufl.edu/>

Recommended course Prerequisites: GIS3072C or any other introductory GIS course. In general, some working experience with ArcGIS or ArcGIS Pro is recommended. Basics in statistics are essential, so is competence with MS Excel software.

Instructors:

- **Dr. Hartwig Henry Hochmair**, Ft. Lauderdale Research & Education Center, phone: (954) 577-6317; e-mail: hhhochmair@ufl.edu
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Please use the Canvas conversation system for fastest response. Virtual office hours on Canvas can be arranged by appointment

Lectures:

Wednesdays, 1:55 pm - 4:30 pm (period 7-9), via Zoom; links to recordings are provided on the course Web site

Required reading materials:

- O'Sullivan D, Unwin DJ (2010). *Geographic Information Analysis* (2nd ed.). Hoboken, New Jersey, Wiley & Sons
- Additional references to books, book chapters, and online resources will be given during the lecture

Further optional reading materials:

- de Smith, M. J., Goodchild, M. F., and Longley, P. A. (2018). *Geospatial Analysis (6th ed.)*: Winchelsea Press. Available online at <http://www.spatialanalysisonline.com/>
- Rogerson, P. and Yamada, I. (2009). *Statistical Detection and Surveillance of Geographic Clusters*. Boca Raton, FL: CRC Press.

Software requirements:

- ArcGIS Pro 2.2 and Microsoft Excel will be used for many topics taught in this course. If unfamiliar with this software it is recommended to run through practice tutorials beforehand.
- Instructions on how to obtain a copy of the ArcGIS Pro software package and the necessary ArcGIS Online Pro account, as well as links to ArcGIS Pro tutorials are posted on the Course introduction page under the Week 1 module.

LEARNING OUTCOMES

The course objective is to provide students with (1) the theoretical foundation of spatial processes, (2) skills to characterize spatial point patterns and detect clusters in point and polygon data, (3) basic and advanced techniques of raster data analysis and spatial interpolation, (4) basic skills to automate geoprocessing through scripting

At the completion of the course, the student should be able to:

- apply spatial statistics to identify and describe geographic patterns
- select an appropriate analysis method to solve a given spatial research question
- work with vector and raster data and conduct spatial analysis functions using GIS
- perform Geostatistical analysis functions on spatial data using
- automate and customize geoprocessing ArcGIS functionality through Python scripting and ModelBuilder

COURSE LOGISTICS

- Throughout the semester, the students will be given approximately 8 home assignments and 3 quizzes. For each assignment/quiz a due date and time is given, which is usually the beginning of the next class.
- Undergraduate and graduate students will receive different assignments reflecting different levels of difficulty.
- This course is a distance education course taught primarily as live lectures using the virtual classroom software Zoom. Lecture materials can be downloaded from weekly modules on the Canvas website.

The Canvas system should be used as the primary platform for written communication between students and the instructor. Questions and suggestions to the whole class can also be posted under the Discussions tab. Any short-term changes concerning lectures or other course components will be announced through Canvas. Feel free to contact the instructors with any questions.

Technology Requirements:

- A computer or mobile device with high-speed internet connection and a headset and/or microphone and speakers to join lectures
- ArcGIS Pro runs only on Microsoft operating systems. If students use a Mac computer or other operating systems no technical support can be provided.

Using Zoom:

Live lectures (as announced) and office hour meetings (per individual student requests) will be conducted with the Zoom web conferencing software. Sessions can be joined by clicking a link posted by the instructor on Canvas. Zoom only requires an internet connection and a web browser. More details can be found [here](#).

GRADING:

Grading items:

<i>Item</i>	<i>Percentage</i>
Timeliness and completeness of assignments	85%
Online quizzes	12%
Online introduction	3%
Total	100%

Grading scale:

<i>Grade</i>	<i>Percentage</i>	<i>Grade</i>	<i>Percentage</i>
A	92.0-100.0	C+	78.0-79.9
A-	90.0-91.9	C	72.0-77.9
B+	88.0-89.9	C-	70.0-71.9
B	82.0-87.9	D	60.0-69.9
B-	80.0-81.9	E	0-59.9

For information on current UF policies for assigning grade points, see
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

COURSE CONTENT

Week	Topic	Readings
Week 1, Jan 9 (H)	Course introduction, review concepts of statistics and distributions, matrix notation	O'Sullivan (2002) Appendix A
Week 2, Jan 16 (H)	Statistics review (cont.)	
Week 3, Jan 23 (H)	Spatial processes, Quadrat count methods	O'Sullivan ch 4.1-4.4, p. 121-130
Week 4, Jan 30 (H)	Distance based point pattern measures (NN, F, G, L functions)	O'Sullivan p. 130-155
Week 5, Feb 6 (H)	Cluster detection based on attribute values; spatial autocorrelation, hot-spot analysis	O'Sullivan ch 7, ch.8.1-8.4
Week 6, Feb 13 (H)	Location based cluster detection (hierarchical, K-means, SatScan)	de Smith ch. 4.3.4 CrimeStat IV manual ch. 7-16, 8-20
Week 7, Feb 20 (H)	Geographically Weighted Regression (GWR); autoregressive models	O'Sullivan ch 8.5
Week 8, Feb 27 (A)	Analyzing geographic relationships, multivariate statistical analysis	O'Sullivan ch 11.1 and 11.2
<i>Mar 6</i>	<i>Spring Break</i>	
Week 9, Mar 13 (A)	Dimensionality Reduction: Multi-dimensional Scaling - Principal Components Analysis (PCA)	O'Sullivan ch 11.4-11.6
Week 10, Mar 20 (A)	Spatial interpolation: deterministic and stochastic models, IDW, kriging, and linear regression	O'Sullivan ch 8, 2.4
Week 11, Mar 27 (A)	Analysis of field data, Surface modeling, TIN and raster	O'Sullivan ch 9
Week 12, Apr 3 (A)	Map overlays (raster, vector) - Raster data analysis	O'Sullivan ch 11 <i>Online book (Map Analysis): Topic 22</i>
Week 13, Apr 10 (A)	Raster data analysis (cont.) - neighborhood, zonal, global functions – Raster Analysis Applications	<i>Online book (Map Analysis): Topic 23</i>
Week 14, Apr 17 (A)	Automating geoprocessing through Python script	Handouts: ESRI white papers and documentations
Week 15, Apr 24 (A)	Raster Analysis Applications (cont.)	

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POLICIES

This syllabus represents current plans and objectives for this course. As the semester progresses, changes may need to be made to accommodate timing, logistics, or to enhance learning. Such changes, communicated clearly, are not unusual and should be expected.

Late submissions and make-up requests:

It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory

progress in the course.

- A 10% penalty per day will be applied to late assignments. A late submission on the due date results also in a 10% deduction.
- Assignments will not be accepted if handed in more than seven days after the due date.
- Quizzes cannot be taken past the deadline.
- Online introductions cannot be completed past the deadline.
- Exceptions to the late policy are only allowed per university policy.

Computer or other hardware failures, except failure of the UF canvas system, will not excuse students for missing assignments. Any late submissions due to technical issues **MUST** be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You **MUST** e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration.

For computer, software compatibility, or access problems call the HELP DESK phone number—352-392-HELP = 352-392-4357 (option 2).

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Semester Evaluation Process:

Student assessment of instruction is an important part of efforts to improve teaching and learning.

At approximately the mid-point of the semester, the School of Forest Resources & Conservation will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required, but encouraged. This is not the UF Faculty Evaluation!

At the end of the semester, students are expected to provide UF with feedback on the quality of instruction in this course using a standard set of university and college criteria (UF Faculty Evaluations). These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Netiquette: Communication Courtesy Semester Evaluation Process:

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office. <http://teach.ufl.edu/docs/NetiquetteGuideforOnlineCourses.pdf> Student

Academic Honesty Policy:

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.*"

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment.*"

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of

your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>

University Policy on Accommodating Students with Disabilities:

Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

Software use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

GETTING HELP

For issues with technical difficulties for canvas in Canvas, please post your question to the Technical Help Discussion in your course, or contact the UF Help Desk at:

- Learning-support@ufl.edu | (352) 392-HELP - select option 2 | <http://elearning.ufl.edu>
- Library Help Desk support <http://cms.uflib.ufl.edu/ask>
- SFRC Academic Hub <https://ufl.instructure.com/courses/303721>

Student Life, Wellness, and Counseling Help:

- Counseling and Wellness resources <http://www.counseling.ufl.edu/cwc/>
- U Matter, We Care <http://www.umatter.ufl.edu/>
- Career Resource Center <http://www.crc.ufl.edu/>
- Other resources are available at <http://www.distance.ufl.edu/getting-help> for online students

Student Complaint Process:

The School of Forest Resources & Conservation cares about your experience and we will make every effort to address course concerns. We request that all of our online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered.

If you have a more urgent concern, your first point of contact should be the SFRC Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration:

- Students in online courses: <http://www.distance.ufl.edu/student-complaint-process>
- Students in face-to-face courses: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf