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

**1. 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 various techniques for the analysis of spatial data and will be comprised of lectures and computer labs. Lecture topics include geographic distributions, pattern identification within spatial data, 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, and model builder, as well as with Microsoft Excel spreadsheet functions.

- Spring semester, 3 credits
- 100% online
- http://elearning.ufl.edu/

**Course prerequisites:** No formal course pre-requisites. GIS3072C or any other introductory GIS course is recommended, so is some working experience with ArcGIS Pro. Basics in statistics are essential, so is competence with Microsoft Excel software.

**Instructors:**

- **Dr. Hartwig Henry Hochmair**, Ft. Lauderdale Research & Education Center, phone: (954) 577-6317; e-mail: hhhochmair@ufl.edu
- **Dr. Amr Abd-Elrahman**, Gulf Coast Research and Education Center, phone: (813) 757-2283; e-mail: aamr@ufl.edu

**Communication:**

- Please use the Canvas conversation system for fastest response.
- Virtual office hours on Zoom can be arranged by appointment.

**Lectures:**

Links to pre-recorded lectures and other lecture materials will be posted in weekly modules on the course Web site

**Primary recommended reading materials:**

- O'Sullivan D, Unwin DJ (2010). Geographic Information Analysis (2nd ed.). Hoboken, New Jersey, Wiley & Sons

**Further recommended 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.
- Short instructional videos closely related the lecture content can be found at the Geomatics @ FLREC YouTube channel

**Software requirements:**

- The latest ArcGIS Pro version and Microsoft Excel will be used for many topics taught in this course.
- ArcGIS Pro download and installation instructions are provided on the course website under the Week 1 module.
- Additional free software packages used (e.g. CrimeStat) will be introduced in corresponding course modules.

## 2. LEARNING OUTCOMES

The course objective is to provide students with the following competencies at the completion of the course:

1. Investigate spatial analysis methods in spreadsheet applications
2. Use spatial statistics to identify geographic patterns
3. Demonstrate correct handling of vector and raster data with GIS tools to answer spatial research questions
4. Apply multi-dimensional data ordination and clustering techniques to address spatial problems
5. Implement deterministic and geostatistical spatial interpolation methods
6. Automate geoprocessing functionality through Python scripting and ModelBuilder
7. Apply critical thinking skills in GIS analysis

The course Website (see under Modules/Course Overview) contains a course map which visually illustrates how course activities (e.g. assignments, discussion posts, quizzes) are linked to these competencies.

## 3. COURSE LOGISTICS

- For each assignment, quiz, and discussion item a due date and time is given, which is usually a week after the handout and on Wednesdays right before midnight.
- Assignments are graded based on timeliness, correctness of computations and interpretation of numerical results, creativity and technical versatility with written feedback by the instructor; quizzes are auto-graded based on correctness of multiple choice questions with correct answers shown after completion, and discussion items are graded within a week based on creativity, completeness, technical correctness and the number of comments provided to peers.
- There is a 1-week turnaround for assignment grading and a 2-week turnaround for discussion grading. Quizzes are autograded instantaneously in Canvas.
- Undergraduate and graduate students will receive different home assignments reflecting different levels of complexity.
- This is an asynchronous distance education course which uses pre-recorded lectures. Recordings 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 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 view lectures or join live sessions.
- ArcGIS Pro runs only on Microsoft operating systems. If students use a Mac computer or other operating systems, they are encouraged to use ArcGIS Pro in UF Apps (https://info.apps.ufl.edu/).

- For Zoom: A supported web browser on a supported operating system (Windows, Mac OS, Linux); and minimum bandwidth. More details can be found here.

**Using Zoom:**
Occasional, informal Q&A sessions (after announcement), or office hour meetings (per individual student requests) will be conducted with Zoom web conferencing software. Zoom sessions can be joined by clicking a link provided on the course Web site or through Canvas e-mail.

**Grades:**

| ***Item*** | ***Percentage*** |
|---|---|
| Home assignments (8 assignments @ 10% each) | 80% |
| Quizzes (3 quizzes @ 5% each) | 15% |
| Online discussions (2 discussions @ 2.5% each) | 5% |
| Total | **100%** |

**Grading scale:**

| ***Grade*** | ***Percentage*** | ***Grade*** | ***Percentage*** |
|---|---|---|---|
| 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

**4. COURSE CONTENT**

| Week | Topic (Assignments in parentheses) | Readings |
|---|---|---|
| Week 1, Jan 5 (H) | Course introduction (live), review concepts of statistics and distributions, matrix notation [D1] | O'Sullivan Appendix A |
| Week 2, Jan 12 (H) | Statistics review (cont.) [Q1] | |
| Week 3, Jan 19 (H) | Spatial processes, Quadrat count methods [H1] | O'Sullivan ch 4.1-4.4, p. 121-130 |
| Week 4, Jan 26 (H) | Distance based point pattern measures [H2] | O'Sullivan p. 130-155 |
| Week 5, Feb 2 (H) | Attribute-based cluster detection; spatial autocorrelation, hot-spot analysis [H3] | O'Sullivan ch 7, ch.8.1-8.4 |
| Week 6, Feb 9 (H) | Location based cluster detection (hierarchical, K-means) [Q2] | CrimeStat IV manual ch. 7-16, 7-36, 8-20 |
| Week 7, Feb 16 (H) | Geographically Weighted Regression (GWR); autoregressive models [H4] | O'Sullivan ch 8.5<br>de Smith ch. 5.6 |
| Week 8, Feb 23 (A) | Multidimensional space and spatialization: dissimilarity and clustering [H5] | O'Sullivan ch 11.1 and 11.2 |
| Week 9, Mar 2 (A) | Multidimensional space and spatialization: multi-dimensional scaling- principal component analysis – factor analysis [H6] | O'Sullivan ch 11.4-11.6 |
| *Mar 7 – Mar 12* | *SPRING BREAK* | |
| Week 10, Mar 16 (A) | Spatial interpolation: deterministic and stochastic models [H7] | O'Sullivan ch 8, 2.4 |
| Week 11, Mar 23 (A) | Surface modeling, TIN and Raster representation - Raster data analysis - neighborhood, zonal, global functions [D2] | O'Sullivan ch 9<br>*Online book (Map Analysis): Topic 22 & 23* |
| Week 12, Mar 30 (A) | Raster analysis application example 1 & 2: Fire Risk and Species Mapping using ArcGIS Model Builder [H8] | *Model downloads through canvas* |
| Week 13, Apr 6 (A) | Automating geoprocessing through ArcPy Python scripting | Handouts: ESRI white papers and documentations |
| Week 14, Apr 13 (A) | Raster analysis application example 3: Dynamic Fire Growth using ArcGIS Model Builder | *Model downloads through canvas* |
| Week 15, Apr 20 (A) | Recap (Q3) | |

D: Discussion, Q: Quiz, H: Home assignment
H…Hochmair, A…Abd-Elrahman

**5. POLICIES AND REQUIREMENTS**

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 assignments 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 discussions 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).

**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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-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, as laid out in the UF Netiquette Guide for Online Courses. . Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office.

**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 them 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
View this video for more information on how to avoid plagiarism.

**University Policy on Accommodating Students with Disabilities:**
Students requesting accommodation for disabilities must first register with the Dean of Students Office (https://disability.ufl.edu/). 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.

**Lecture recordings:**
All live lectures and Q&A sessions will be recorded and made available via Canvas. Policies regarding student in-class recordings are detailed here http://aa.ufl.edu/policies/in-class-recording/.

## 6. CAMPUS RESOURCES

**Academic Resources:**

- For issues with technical difficulties for e-learning 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 | https://helpdesk.ufl.edu/
- SFFGS Academic Hub https://ufl.instructure.com/courses/303721
- Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.
- Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more

information.

- On-Line Students Complaints: View the Distance Learning Student Complaint Process.

**Health and Wellness:**

- *U Matter, We Care*: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.
- *Counseling and Wellness Center*: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.
- *Student Health Care Center*: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.
- *University Police Department*: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).
- Career Resource Center http://www.crc.ufl.edu/
- GatorWell Health Promotion Services https://gatorwell.ufsa.ufl.edu/