GEOG 4760 / GEOG 5760 Advanced Spatial Analysis & GIS Applications

Spring Semester 2019-20

Lecture: M/W/F @ 10:45 am – 11:40 am
Lab: F @ 11:50 am – 1:40 pm

Name	Contact	Office Hours
Dr. Gaurav Sinha *(Instructor)*	Office: Clippinger, 105A Email: sinhag@ohio.edu Phone: 740.593.0304 Web: http://ohio.edu/people/sinhag	M/W/F @ 9:15 am – 10:45 am (*and by appointment*)
Wael Hasan *(Teaching Assistant)*	Office: Clippinger, 102 Email: wh675518@ohio.edu	Th @ 2 pm – 4 pm (*and by appointment*)

Course Content

This course is designed to foster advanced spatial analysis skills in students. The course assumes that students have a basic understanding of statistics and GIS. In this advanced course, the goal will be to understand the mathematical techniques devised for analyzing different kinds of geographic data. The role of uncertainty in spatial decision making will be a constant theme in all discussions and lab exercises. Special topics such as terrain and hydrologic analysis, spatial multicriteria decision making, and spatial statistics and interpolation will be used to teach advanced spatial analytical skills with GIS software. In digital terrain analysis, students will derive quantitative geomorphometric parameters, identify topological primitives for describing terrain shape, and implement drainage network and watershed segmentation algorithms. In multi-criteria analysis, students will get introduced to some traditional spatial decision-making frameworks. Finally, a basic introduction to spatial statistics and spatial interpolation will prepare students with a variety of exploratory spatial statistical methods for detecting and quantifying spatial patterns. Spatial interpolation techniques such as Voronoi tessellation, inverse distance weighing, and spline techniques will be discussed and compared to each other. Spatial autocorrelation statistics, and point pattern analysis will also be introduced at the end of the class. All these concepts and projects will strengthen independent quantitative analysis capabilities and give students practical experience with a variety of analytical software tools such as Microsoft Access, Excel, ArcGIS, and possibly other software.

Learning Objectives

The course lectures and lab exercises will learn the

- theoretical principles based on which geographic information can be analyzed
- application of conventional GIS tools and software to geographic information analysis
- advanced vector and raster GIS analysis and modeling
- techniques for developing GIS software based workflows
- basics of spatial multicriteria analysis
- basics of spatial statistics and spatial interpolation
- basics of terrain analysis
- basics of network analysis using GIS

Outcome Goals

- Recognize the impact of scale, spatial context, and multiple representation in geospatial analysis.
- Identify spatial uncertainty effects and use appropriate methods to test the impact of such uncertainty on quality of spatial analyses.
- Demonstrate operational knowledge of GIS software for advanced spatial analysis methods for vector and raster GIS data.
- Demonstrate theoretical understanding and practical application of spatial multicriteria analysis methods in GIS based problem solving.
- Apply spatial statistics to analyze and test the validity of geospatial patterns.
- Demonstrate practical knowledge of terrain analysis principles

Pre-Requisite Courses

GEOG 4730/5730 – Principles of GIS OR
GEOG 4660/5660 – Principles of Remote Sensing OR
GEOG 3600/5600 – Cartography I

Instruction Material

There is no prescribed text book for the class. Lecture and lab material will be based on several text books, articles, journal publications, and the instructor's research and professional background in application and development of GIS principles and software. The lecture slides will be provided for reference. Class lectures and lab exercise material will be the basis for lab exercises and exams. Students may be working in groups whenever possible. Attending classes together is, therefore, highly encouraged.

Grading (4 credits)

The lectures and lab exercises will be considered together for grading purposes. All lecture, class discussions, assigned readings, student presentations, lab exercises, and relevant book chapters will define the scope of quizzes and exams. The final exam will be given at least a week before the due date on the official final exam date for this class. Students will be expected to show motivation and write reports for each lab to summarize lessons learned. Students will also be expected to demonstrate independent thinking and analysis capabilities through a self-directed final project (15% of the final grade). For the project, they will select and then get the problem approved by the instructor before beginning any work. The final project grade will depend on a comprehensive report summarizing their problem, review of relevant literature offering theoretical and experimental support, methods implemented, comparison of results from the different strategies, and conclusions.

The following is the grading strategy and schedule that will be used to determine the final grade:

Lab Projects / Assignments	60%
Final Exam (*Mon, Apr 27, 10:10 am*)	25%
Final Project & Portfolio (*Mon, Apr 27, 10:10 am*)	15%

Grading Schedule

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
% Range	100-94	93-90	89-87	86-84	83-80	79-77	76-74	73-70	69-67	66-64	63-60	≤59

Class Technology Instructions

The course will utilize Blackboard only partially for online quizzes and submission and grading of assignments. All lecture and lab material will be made available only through the Box cloud service. All lectures will be made available as slide handouts, but only after the entire lecture set is completed. Please check your Ohio University email regularly as that will be the preferred system of communication. Also note that this course, especially the lab exercises, are quite time intensive. Please allocate sufficient time to work on labs beyond the officially allocated class hours. During lectures, computer monitors should be switched off unless being used for taking notes and authorized by the instructor. No phone calls or texting (except for responding to in-class quiz questions) is allowed during class. No recording of class lectures is allowed, without prior approval from the instructor.

Student Responsibility

Students are ultimately responsible for their own learning. The instructor and teaching assistant can only facilitate learning. We will help you as much as we can, but learning the material is ultimately up to the student. This includes: attending class meetings without fail, getting assignments and notes from others for missed classes, asking questions, either in class or out of class, doing the assignments on time and participating in class; and contacting us to resolve personal and academic difficulties. Since the course relies heavily on in-class demonstrations and project work, punctuality and attendance are critical and required for every lecture and lab class. Any planned absence from lab or lecture must be communicated in writing to the TA and the instructor ahead of time.

Academic Integrity and Misconduct

Please help maintain an academic environment of mutual respect and fair treatment. Academic misconduct will not be tolerated and will be dealt with procedurally in accordance with the Ohio University Student Code of Conduct policies. Students should read the code and be careful to abide by the code. Specifically, for this class, it should be noted that although collaborative learning and working on assignments is encouraged, students must write up their assignments individually. Plagiarism from your current or former students will not be tolerated and reported to proper authorities. Additionally, depending on the perceived severity of the violation, the instructor's response may range from imposing grade penalty to assigning an automatic failure grade. Students may appeal academic sanctions through the grade appeal process. Note that University Judiciaries may impose additional sanctions.

Institutional Equality

In compliance with the Americans with Disabilities Act (ADA), all students who have a document disability are entitled to "reasonable academic accommodations." Any student who suspects s/he may need an accommodation based on the impact of a disability should contact the class instructor privately to discuss the student's specific needs and provide written documentation from the Office of Student Accessibility Services. If the student is not yet registered as a student with a disability, s/he should contact the Office of Student Accessibility Services.