GEOG 4550 – Advanced GIS

Spring 2020, Mondays 6:00 – 8:50 PM, ENV 336

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Office Hours: 5:00 – 6:00 pm, Mondays and Wednesdays, or by appointment.

Prerequisite

GEOG 3500: Introduction to GIS (or consent of department)

Objectives

This course is built on GEOG 3500 "Introduction to GIS". Some advanced GIS topics will be introduced through a combination of lectures, hands-on exercises, homework, and an individual project. The course objectives are to:

(1) Understand vector and raster data models and conversions;
(2) Develop skills in local, focal, and zonal raster data manipulation in ArcGIS;
(3) Develop skills in spatial interpolation, surface analysis, hydrological modeling, 3-D analysis, and network analysis;
(4) Learn how to design and implement a GIS project.

References

(1) ArcGIS Extensions: http://desktop.arcgis.com/en/arcmap/10.7/extensions/main/about-arcgis-for-desktop-extensions.htm (Spatial Analyst, ArcScan, 3D Analyst, and Network Analyst)

(2) Michael J. de Smith, Michael F. Goodchild, and Paul A. Longley, *Geospatial Analysis*, 6th Edition, 2018. (Free web version: http://www.spatialanalysisonline.com/HTML/index.html).

Software

ArcGIS Desktop 10.7.1 with Spatial Analyst, ArcScan, 3D Analyst, and Network Analyst extensions.

Labs and Homework

Labs and homework should be submitted to Canvas. All labs and homework assignments will be graded. Late labs and homework will be marked down 10% each day.

Course Project

Each student will design and implement a course project involving raster data analysis. A project report of 4-5 single-spaced pages (including tables, figures, and references) will be graded. More instructions on the project will be provided in class.

Quizzes

The course has three quizzes. Each quiz has 10 questions (True/False, multiple choice, and short answer questions).

Grading Structure

Class attendance	10%
Labs (34 labs)	26%
Three homework assignments (9% each)	27%
Three quizzes (each quiz has 10 questions, 5%)	15%
Three online discussion topics (3% each)	9%
Project report	13%
Total	**100%**
90-100: A; 80-89: B; 70-79: C; 60-69: D; 0-59: F. A minimum grade of "B" is required for the GIS Certificate.	

Schedule

Date	Topics	Assignments
01/13	**1. Review of GIS Basics** 1.1 Review of basic GIS concepts 1.2 Vector data model 1.3 Feature selection 1.4 Attribute tables 1.5 Clip, intersect, union, and buffer 1.6 Merge, dissolve, and spatial join 1.7 Feature editing 1.8 Projection	Lab 1.1 Selecting features (0.5 point) Lab 1.2 Working with tables (0.5 point) Lab 1.3 Creating points and lines (0.5 point) Lab 1.4 Creating polygons (0.5 point)
01/20	**Martin Luther King Day (no class)**	
01/27	**2. ModelBuilder** 2.1 Executing tools in ModelBuilder 2.2 Creating tools with ModelBuilder	Lab 2.1 ModelBuilder (1) (1 point) Lab 2.2 ModelBuilder (2) (1 point)
02/03	**3. Basics of Raster Data** 3.1 Raster data model 3.2 Categorical rasters 3.3 Continuous rasters 3.4 Digital images 3.5 Displaying raster values 3.6 Raster formats 3.7 Raster naming conventions 3.8 Raster vs. vector	Lab 3.1 NLCD data (0.5 point) Lab 3.2 Continuous rasters (1) (0.5 point) Lab 3.3 Continuous rasters (2) (0.5 point) Lab 3.4 Digital images (0.5 point)
02/10	**4. Raster Conversion and Extraction** 4.1 Environment settings 4.2 Vector to raster conversion 4.3 Raster to vector conversion 4.4 Raster to ASCII conversion 4.5 Raster layer to KML conversion 4.6 Raster to raster conversion 4.7 Raster to video conversion 4.8 Raster extraction by attributes 4.9 Raster extraction by mask 4.10 Extracting rater values to points	Lab 4.1 Vector to raster (0.5 point) Lab 4.2 Raster layer to KML (0.5 point) Lab 4.3 Raster extraction (1) (0.5 point) Lab 4.4 Raster extraction (2) (0.5 point)
02/17	**5. Local Analysis** 5.1 Frequency 5.2 Highest position 5.3 Lowest position 5.4 Cell statistics	Lab 5.1 Cell statistics (1 point) Lab 5.2 Local analysis (1 point) **Quiz 1 (5 points)** **Online Discussion Topic 1 (3 points)** **Homework 1 (due 03/16)**

02/24	**6. Focal Analysis** 6.1 Definition of focal analysis 6.2 Shape and size of neighborhood 6.3 Focal statistics 6.4 Point statistics 6.5 Line statistics	Lab 6.1 Focal statistics (1 point) Lab 6.2 Point statistics (1 point) **Online Discussion Topic 2 (3 points)**
03/02	**7. Zonal Analysis** 7.1 Definition of a zone 7.2 Zonal statistics 7.3 Zonal statistics as table 7.4 Zonal geometry 7.5 Zonal histogram	Lab 7.1 Zonal statistics (1) (1 point) Lab 7.2 Zonal statistics (2) (1 point)
03/09	**Spring Break**	
03/16	**8. Map Algebra and Distance Transformation** 8.1 Map algebra 8.2 Raster calculator 8.3 Euclidean distance 8.4 Euclidean allocation 8.5 Weighted Voronoi diagrams	Lab 8.1 Raster calculator (1) (0.5 point) Lab 8.2 Raster calculator (2) (0.5 point) Lab 8.3 Distance/allocation rasters (1 point) **Quiz 2 (5 points)** **Homework 1 due** **Homework 2 (due 04/13)**
03/23	**9. ArcScan** 9.1 Interactive vectorization 9.2 Automatic vectorization	Lab 9.1 Interactive vectorization (1 point) Lab 9.2 Automatic vectorization (1 point)
03/30	**10. Spatial Interpolation** 10.1 Definition of spatial interpolation 10.2 Inverse distance weighed interpolation 10.3 Natural neighbor 10.4 Spline 10.5 Trend surface	Lab 10.1 Spatial interpolation (1 point) Lab 10.2 Trend surface analysis (1 point)
04/06	**11. Hydrological Modeling** 11.1 Digital elevation models (DEM) 11.2 Flow direction 11.3 Flow accumulation 11.4 Flow length and flow distance 11.5 Sink and fill 11.6 Basin 11.7 Watershed	Lab 11.1 Hydrologic modeling (2 points)
04/13	**12. Surface and 3D Analysis** 12.1 Surface models 12.2 Slope and aspect 12.3 Cut Fill 12.4 Hillshade 12.5 Viewshed 12.6 Line of sight 12.7 Stack profile 12.8 ArcScene	Lab 12.1 Surface analysis & 3D analysis (2 pts) **Homework 2 due** **Homework 3 (due 05/04)** **Online Discussion Topic 3 (3 points)**
04/20	**13. Network Analysis** 13.1 Network dataset 13.2 Closest facility 13.3 Vehicle routing 13.4 Service area	Lab 13.1 Creating a network dataset (0.5 point) Lab 13.2 Finding the best route (0.5 point) Lab 13.3 Finding the closest facility (0.5 point) Lab 13.4 Calculating service area (0.5 point) **Quiz 3**
04/27	Project Week (work on your project)	
05/04	Final Week	**Homework 3 due; project report due.**

Extra Credit

The Department of Geography and the Environment does not allow extra credit assignments (work not specified on a course syllabus).

Academic Dishonesty

Students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam. Additionally, the incident will be reported to the Office of Student Rights and Responsibilities for further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to:

a. Use of any unauthorized assistance in taking quizzes, tests, or examinations;
b. Dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments;
c. The acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university;
d. Dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or
e. Any other act designed to give a student an unfair advantage.

The term "plagiarism" includes, but is not limited to:

a. The knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and
b. The knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

Accommodations

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

Classroom Courtesy

Please follow these guidelines to avoid disrupting the class:
(1)   Turn off cell phones before arriving.
(2)   Do not arrive late or leave early (except for a bathroom break or emergency).
(3)   Do not sleep or eat during class.
(4)   Do not work on other assignments during class.
(5)   Do not talk when the instructor is lecturing, unless prompted for feedback by the instructor.

Course Evaluation

You will receive an email with a link to the UNT Student Perceptions of Teaching (SPOT) Course Evaluation by the end of the semester.