Course Syllabus: Advanced geo-spatial methods

URPL 6260

Preliminary Course Syllabus for 2021

Instructor Austin Troy
Austin.troy@ucdenver.edu; 303-315-1006; office hours: Thursday 9:30-11:30 (tentative)
Grader: Sarah Dunmire
Meets Tues 2-4:45 in North 5033

Description: This is an advanced GIS techniques course for students who already have a solid gr ounding in ArcGIS or ArcGIS Pro. It consists of both lectures on theoretical topics in Geographic I nformation Science as well as a weekly computer lab covering GIS techniques. The course labs a re divided into three thematic modules: 1) geoprocessing, 2) automation, and 3) visualization. T he first module builds on tools that students typically learn in their introductory GIS class to tea ch advanced methods for doing multi-layer analyses, including vector geoprocessing, raster ove rlay, viewshed, network analysis, topology, and spatial statistics. The second module teaches st udents how to automate, simplify and share complex and repetitive processes through the use of model builder, iterators, and basic Python scripting. And the third module instructs students on topics including basic imagery classification, LiDAR processing, and 3D urban modeling with City Engine. Throughout the semester students will also learn about theoretical topics in geo-sp atial sciences, such as spatial reference systems. In addition to the weekly labs students have a midterm exam and a final project that is meant to simulate a real-world GIS consulting report. I' ve attached some images you can use too

Learning Objectives:

- Learn to integrate diverse geoprocessing skills to address complex geographic problems
- Learn introductory geo-statistical tools and concepts to look for statistically significant trends
- Learn how to save time and boost productivity by automating processes and models using Model Builder, including looping through processes using iterators, all while integrating diverse geoprocessing tools
- Learn how to increase workflow efficiencies using Python
- Learn how to turn LiDAR data sets into actionable information about built and natural landscapes.
- Learn basic functionality in City Engine to allow for development of simple urban models and do visualize of urban development scenarios.

- Learn the fundamentals of spatial references systems, including the meaning and integration of datums, spheroids, graticules, projections and plane coordinate systems to allow for skilled handling of raw data.
- Learn about key public data sources.

Grading:
- Lab assignments: 50%
- Final project: 25% (22% for paper, 2% for presentation, 1% for proposal)
- Exam: 22%
- Participation/ attendance: 3%

Course Requirements

Lab assignments: these are weekly exercises conducted over the first 11 weeks. All are original and will be available as PDFs on Canvas. You may work alone on lab assignments or with a partner. However, if working with a partner, please try to ensure that each person participates in all steps of the lab. Lab data is available on the FAST data share drive, but assignment PDFs must be uploaded to Canvas (or published to ArcGIS Online if we can make that option work). They will be graded by our TA. All labs are due by the start of the following week's class unless otherwise noted on the syllabus. I will allow up to two late assignment submissions per semester with no credit taken away IF and ONLY IF you have a valid reason for not being able to turn in the assignment on time AND let me know you more than 48 hours before the due date. Typically I will allow late assignments to be turned in up to 5 days late. Keep in mind that there is a lab almost every week in this class, so if you turn in a lab late, it will make it that much more difficult to complete the lab the following week and the backlog can quickly cascade, so you should avoid this option unless absolutely necessary.

Final project : this is a chance to utilize your GIS skills to an applied problem. These can be done in groups of up to three people. You can work on your own project or on one of several topics that I will present in class for which extensive data sets are available. We have several potential real-world clients for these projects this semester that I will outline later. Detailed guidelines will be on Canvas.

The **exam** is in the middle of the term will cover most of the topics from lecture and readings up to that point. A review will be provided in advance

Students are requirement to **attend** class and **participate.** If you can't make it to class, please let me know by email at least by the Friday before. The first two unexcused absences will result in you losing half a percentage point each on your attendance grade. The next four will be one point each. Students are expected to do the reading before class too and come prepared with questions.

Required readings:
- Bolstad, P. 2016. *GIS fundamentals* . White Bear Lake, Mn: Eider Press. Fifth Edition ONLY. On schedule below, readings marked PB= Paul Bolstad (at bookstore)
- several short PDFs on Canvas (see schedule)

Academic Integrity:

Students must adhere to UCD's code on academic honesty which can be found at http://catalog.ucdenver.edu/content.php?catoid=6&navoid=530 (Links to an external site.)Links to an external site.. Please take care to cite references correctly, use quotations appropriately and avoid plagiarism in doing your final project. Clear cases of plagiarism in the project will result in a zero.

Preliminary Schedule

Subject to change: please consult the syllabus on Canvas for updates

Date	**Topic**	**Links**	**Reading (readings due on day given below)**
Part 1: Geoprocessing			
19-Jan	Lab and lecture: Review of vector skills: Select by location and a vector geoprocessing site selection analysis	Lab 1 Lecture 1	
26-Jan	Lab and Lecture: Review of raster GIS skills: raster overlay site selection, viewshed, zonal 4	Lab 2 Lecture 2	PB pp. 56-57; 445-471
2-Feb	Lab : Network analysis, including drive time service areas, OD matrices, nearest facility Lecture : topology and network analysis	Lab 3 Lecture 3 Extra Credit topology lab	PB pp. 46-49; 420-425
9-Feb	Lab and Lecture: Spatial statistics: local and global autocorrelation and spatial clustering, spatial sampling	Lab 4 Lecture 4	TBD+ Fortin and Dale
Part 2: Automation			
16-Feb	Lab: Model Builder 1 Lecture: live demo of model builder by Austin (no PowerPoint)	Lab 5	PB Ch 13
23-Feb	Iterators and Python 1 Lecture: Lidar and Datums/ spheroids	Lab 6 Lecture 5 **Project proposal due**	TBD
2-March	Iterators and python 2 Lecture: Projections and Plane Coordinate Systems	Lab 7 (2 week lab) Lecture 6	TBD

	Preliminary midterm study guide issued		
9-Mar	Study session and continue Lab 7		TBD
16-Mar	Exam		
Part 3: Visualization, imagery and 3 D			
23-Mar	Spring Break		
30-Mar	Lecture: LiDAR Lab: Arc GIS LiDAR functions	Lab 9	TBD
6-Apr	Lab: LiDAR analysis with QT modeler No lecture, but more discussion of projects	Lab 10	
Part 4: Projects			
13-Apr	Lecture and lab: 3D visualization with City Engine	Lab 11	
20-Apr	projects		
27-Apr	projects		
4-May	projects: final project due May 7		
11-May	Finals week: Presentations		