Syllabus: GEOG654 - GIS and Spatial Modeling - Fall 2017

Instructor
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Office Hours: On-campus: Wednesdays, 3 to 5 pm (or by appointment)
Location: 1137 LeFrak Hall
Teaching Assistant
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Office Hours: Online After Lab Sessions
About the Course
Time: 5:30 to 8 pm Wednesdays (Lectures); 5:30 to 7:30 pm Thursdays (Labs)
Location: Online: http://elms.umd.edu; Campus Location: 1171 LeFrak Hall (Lectures)

Description
This is an advanced course in spatial modeling developed specifically for students in the Master of Professional Studies, Geospatial Information Sciences program. This course is to provide foundations and understanding on various issues related to modeling and simulation in the GIS context. It will address the concepts, tools, and techniques of GIS modeling. In addition, it will present modeling concepts and theory as well as provide opportunities for hands-on model design, construction, and application. The focus will be on both vector- and raster-based modeling. This course is application-orientated, particularly in fields such as terrain modeling, land use change modeling, hydrological modeling, suitability modeling, etc.

Upon completing this class, students will be able to:

- Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Apply, integrate, and develop models with geospatial data through a GIS.
- Utilize spatial models to make simulations and predictions of real life phenomena.
- Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Use a system-based approach for problem solving, with an emphasis on sustainability.

The format of this course will consist of lectures, lab assignments, readings, and a final project. The lectures will be presented online via the Live Classroom on the Enterprise Learning Management System (ELMS). All lectures involve the interaction between students and instructor in real-time. Lectures will be archived into videos which will be made available on ELMS. Please note that video archives are only intended for occasional or backup use in case students have to miss lectures due to personal, business, or medical reasons. Real-time, online participation is strongly recommended.

Prerequisites
Students should be proficient in GIS (GEOG653). Students may also find it helpful to have some background in statistics (GEOG651), linear algebra, and computer programming (GEOG656).

Textbooks
There are no required textbooks. Supplemental reading materials (in electronic format or as links to certain web sites) will be posted on ELMS by the instructor. Some recommended books include:

1. Maguire, D., M. Batty, and M. Goodchild. 2005. *GIS, spatial analysis, and modeling*. ESRI Press (G70.212 .G584 2005)
2. Goodchild, M., B.Parke, and L.Steyaert. 1993. *Environmental Modeling with GIS*. Oxford University Press. (TD153 .E58 1993)
3. Zeiler, M. 2010. *Modeling Our World: The ESRI Guide to Geodatabase Design*. Second Ed. ESRI Press, Redlands, California

Assignments
There are a total of seven (7) lab assignments and each will count towards 10% of the final grade. The due date will be specified in the lab document. Late submission of lab reports may result in a deduction of points. However, in some situations (e.g. medical or family emergency), extension is possible if you contact the instructor before the due date.

Final Project
A final project is required to complete this course. It will provide students an opportunity to design and implement a spatial model that is closely related to their interests, field of study, research, or work. The project must be carried out individually and independently.

Potential Topics:
-Regression Modeling; Suitability Modeling; Hydrological Modeling; Agent-based Modeling, etc.
-All projects should also contain a model evaluation component (e.g. validation, sensitivity, etc.)

The final project consists of two parts: a proposal and a final report (i.e. a poster and presentation). The proposal of your project must be two pages (single space). The proposal should: (1) identify the research problem; (2) provide background information; (3) list the objectives; and (4) describe the methodology. Specific guidelines will be provided later on. Students are encouraged to contact the instructor early during the semester to discuss potential topics and scope.

Grading
Final grades will be determined by the following items:
Lab Assignments = 70%
Final Project = 20% (Proposal = 5% and Poster / Discussion = 15%)
Participation and Discussion = 5%
Weekly Quizzes = 5% (The lowest quiz grade will be dropped)
The plus/minus grading system will be used to assign student grades. Minor adjustments to this scale might be made based on the performance of the class as a whole.

Hardware and Software
You can use either a PC or Mac to access ELMS. Whichever you choose, it must be equipped with a webcam and headset (headphones and microphone). You should also have the following plug-ins installed: Real Media, Flash Player, and Quicktime.

The software required for this class is ESRI ArcGIS 10.X (ArcInfo) which is available in the open lab (located in 1136 and 1138 LeFrak Hall). If you need a personal copy of ArcGIS for your computer, please contact me by e-mail before class. Note: The free software that comes in books and other venues does not have the ArcInfo license and cannot be used to complete most labs.

Communication and Support
Email
Both the TA and the instructor will always be available by email. Use the email link in the sidebar to send us an email at any time. We will try to answer within 24 hours and usually sooner.

Offline and Online Office Hours
I will be available to meet on campus for face-to-face office hours at specified times. You can also email either the TA or the instructor to set up individual office hours by appointment.

If needed, I can provide online office hours if you are unable to meet on campus. To do so, simply send me an e-mail to request a time to meet online.

Discussion Board
The discussion board is a place on the ELMS site for you to visit your classmates. This is an open forum for discussion about course material and for casual conversation. We encourage any general questions about the course material or lab assignments to be posted here so that students can help learn from each other. We will try to help answer any course-related questions that are posted here. In addition, there will be study rooms set up for you to form study groups. We will not be monitoring these rooms. Remember that the University Code of Academic Integrity specifies that you are free to work together and to discuss the assignments, but that you must produce your own original and independent work.

Class Attendance and Environment
You are strongly recommended to attend every lecture in real time at the online site. We will meet online at the announced time for a live audio/video lecture. During this time you can follow along with the lecture and ask any questions that you may have. The lecture will be archived for anyone who absolutely must miss a class, but I encourage you to join the class online at the appointed time so that you can ask questions and keep up with the course schedule.

In this class, students will meet in a virtual space online which will be treated as a classroom. Our class will meet within the Enterprise Learning Management System (ELMS), the university's online learning system. Go to http://elms.umd.edu to access the course. After login, the course will be listed in the right column under "My Courses".

It is important to recognize that the classroom is an environment that requires respect for all participants. Therefore, students are expected to conduct themselves in a considerate manner.

Disabilities and Religion
Any student with a disability is encouraged to meet with the instructor privately during the first week of class to discuss accommodations. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and provide a DSS accommodation form.

Please refer to the Online Undergraduate Catalog Policy on Religious Observance.

Academic Integrity
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets the standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.

Within our class, students may work together to review class notes and lab assignments. However, labs must be done individually. Students must turn in their own work without assistance from another student.

Sustainability
In an effort to promote greater understanding of sustainability among students, faculty, and staff at the University of Maryland, this course has been adapted to include discussion about larger sustainability issues, such as global climate change, food security, and systems modeling. Visit the University of Maryland's office of sustainability at: http://www.sustainability.umd.edu/.

Course Schedule

This is a tentative schedule and may be adjusted. Changes will be announced and posted on ELMS.

Week	Date	Lecture Topics	Readings	Assignments
1	Aug. 30	Course Overview Introduction to Modeling Systems-based Modeling	(Turner, 2002)	Lab 1 Out
2	Sept. 6	Spatial Modeling GIS / Model Integration	(Goodchild, 2005) (Resop, 2012)	Lab 1 Due Lab 2 Out
3	Sept. 13	Vector-based Modeling Regression Modeling (R)	(Pearsall, 2012) ESRI - Regression	Lab 2 Due Lab 3 Out
4	Sept. 20	Geoprocessing (Model Builder) Model Evaluation (Validation)	(Moriasi, 2007) (Kok, 2001) ESRI - Geoprocessing	Lab 3 Due Proposal Out Exercise 1 Out
5	Sept. 27	Raster-based Modeling Suitability Analysis - Part I	(Resop, 2011) ESRI - Map Algebra	Lab 4 Out
6	Oct. 4	Spatial-Temporal Change Cellular Automata Agent-based Modeling (NetLogo)	(Brown, 2007) NetLogo - Manual	Lab 4 Due Lab 5 Out Exercise 2 Out
	Oct. 11	**No Lecture - Independent Study**		Proposal Due
7	Oct. 18	Surface Modeling (Interpolation) Hydrologic Modeling (ArcHydro)	(Mitas, 1999) ESRI - Interpolation	Lab 5 Due Lab 6 Out
8	Oct. 25	Suitability Analysis - Part II Habitat Modeling (MaxEnt) Sensitivity Analysis	(Erdogan, 2007) (Chen, 2010) ESRI - Weighted Overlay	Lab 6 Due Lab 7 Out
9	Nov. 1	Climate Modeling (CMIP5) Fire Modeling (FarSite) Uncertainty Analysis (MCS)	(Hession, 1996) (Auffhammer, 2011) IPCC - Climate Models	Lab 7 Due
10	Nov. 8	3-D Modeling Machine Learning (R)		
	Nov. 15	**No Lecture - Independent Work on Project**		Project Due*

** The last week will have time set aside to spend on your final projects, which will be due by **Nov. 19**.*

Lab Assignment Topics

Lab 1 - Understanding Models
Lab 2 - Model Integration with GIS
Lab 3 - Linear Regression Modeling
Exercise 1 - Model Builder and Model Evaluation
Lab 4 - Raster-based Modeling
Lab 5 - Agent-based Modeling
Exercise 2 - Feed the Turtle
Lab 6 - Hydrological Modeling
Lab 7 - Soil Erosion Modeling