Applied GIS (GEOG 489)

Week 1: Course Introduction

Slides of this class: https://git.io/vMR3X

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What is Applied GIS?

- How it is different from fundamental GIS?
- Examples of applied GIS?
- What do you want to learn from this course?

Course Topics (tentative)

- Geoprocessing with ArcGIS (2 Weeks)
- Suitability Modeling (2 Weeks)
- Land cover change modeling (2 Weeks)
- Terrain and watershed analysis (2 Weeks)
- Spatial Interpolation (2 weeks)
- Advanced spatial analysis (2 weeks, TBD)

Approaches to Lectures & Demos

- A bit of theory on certain new topics
- Applications and case-studies from the readings
- Review / demonstration of particular GIS analysis or software skills on as-needed basis
- Compared to the other GIS courses, there will be much more time to work on lab assignments during scheduled class time
- Develop research ability through proposal/report writing and project presentation.

Course Material

- Slides, lab instructions and assignments can be accessed from https://github.com/qiang-yi/GEOG489
- Lab assignments, project reports should be submitted to the course site in Laulima.

Readings

- Several required readings for each topic - most are journal articles
- Text book is not necessary - but some chapters are recommended to read.
- Most of the readings are closely related to the lab assignments - we can't cover all the advanced techniques from the literature, but doing the readings will help with the lab assignments, in particular answering the questions
- Some readings use very advanced statistical methods or other non-GIS techniques - don't worry, you don't have to understand the nuts and bolts of each method - focus on the GIS elements

Expected Knowledge: ArcGIS

- Basic knowledge of ArcGIS is required
  - Support will be provided by the instructor on a as needed basis.
  - Learn to find solutions to your problems from the Internet, e.g. ESRI training, Stack Overflow and Google.
- A basic knowledge of Spatial Analyst is required -we'll do more advanced stuff throughout this course.

Expected Knowledge: Vector and Raster Analysis Tools

Vector analysis tools	Raster analysis tools
Query (spatial/attribute)	Raster calculator
Join/relate	Map algebra
Buffering	Reclassification
Dissolve	Distance functions
Merge	Zonal statisitcs
Intersect	Neighborhood
Union	Surface interpolation
...	...

Expected Knowledge: Statistics & Remote Sensing

- Hands-on Knowledge of basic statistics is required, for example, exploratory statisitc analysis or simple linear regression analysis.
- Knowledge of advanced statistics will help with readings, but is not required.
- Knowledge of remote sensing is not required but useful.

Lab Assignments

- Important part of this course
  - Learning-by-doing is essential for developing GIS skills
  - Reflect in 60% of final grade
- Assignments contain
  - Limited step-by-step software instructions
  - Questions ranging from fairly basic to very advanced
  - Some questions that are open-ended
  - Some parts that are optional
- Lab assignments broken up in many small parts - if you get stuck somewhere, you can skip ahead to another part without having to wait for instructor feedback

Suggestions for Lab Assignments

- Don't leave the assignments to the last minute.
  - You can't precisely estimate the time to finish it.
  - Doing assignment along with classes can help you better understand the classes and save your time
- Try to get work done during the scheduled class times, and ask questions.
- If you get stuck with something, contact the instructor or TA - don’t struggle too long on your own.
  - During class
  - E-mail
  - Office hours or by appointment

Project Guidelines

- The emphasis should be on using GIS as a problem solving, analytical or research tool.
- While some data collection effort is OK, most (if not all) of your data should already exist in usable form – at least 2/3 of the project time should be spent on analysis
- You are welcome to explore other spatial modeling software, so you are not limited to ArcGIS, or to even to using only GIS software.

Project Topics

- You will choose your project topics by:
  - Option 1: Select from a set of suggested projects
  - Option 2: Expand on an existing lab assignment
  - Option 3: Develop your own project

Option 1: Suggested Project Topics (1)

- Advanced suitability modeling – More advanced techniques needed.
- Least-cost path and corridor analysis for conservation – Developing a technique to determine the most appropriate linkages between existing conservation areas.
- Land cover change modeling – Deriving transition rules from a time series of images and simulating land cover change using these rules.
- Sea level rise impact and social vulnerability analysis - Estimate infrastructure or population at risk of future sea level rise and evaluate the impact.
- Advanced terrain analysis techniques - flow routing, DEM reconditioning, depression removal.

Option 2

- Expand on lab assignments
  - Expand upon the analysis in one of the lab assignments using the existing data;
  - Applying a similar analysis to another dataset;
  - Combing various analysis techniques with new and/or existing data into a new exercise.
- The key requirement here is that you truly expand upon the existing exercises, in terms of data complexity or analysis techniques.

Option 3

- You are free to develop a project of your own
  - Within the scope of GIS - but you can use GIS to solve problems in other areas
  - Mainly use methods introduced in this course - but you can combine with other methods;
  - Need explicit problem to be solved, logical methods and reasonable interpretation/conclusion.
  - Most of your data should be (almost) ready to use - don't spend most of your time on data collecting and cleaning.

Project Deliverables 1

- Project Proposal (less than 1 page)
  - Motivation for doing this project (4-5 sentences). Include any relevant citations/figures.
  - A clearly stated hypothesis (1-2 sentences).
  - An outline of the datasets you need and methods to analyze them.

Project Deliverables 2

- Project Report (Maximum 6 pages, excluding references)
  - Background (~ 0.5 page): Motivation of problem
  - Hypothesis (~ 0.5 pages): Succinct statement of problem
  - Methodology (~ 1 pages): Appropriate use of GIS
  - Results (~ 1 pages): Do results address hypothesis
  - Discussion and Conclusions (~ 1 - 2 pages): Interpretation of results, conclusions of the study
  - Future Work (~ 0.5 pages): Next steps

Project Deliverables 3 & 4

- Poster
  - A succinct and comprehensible version of project report - documenting all major components in project report.
  - Consider how to deliver information efficiently and effectively in a limited space.
  - Produce in a print-ready format in 36" * 48" size - you don't need to print
- Project presentation
  - <=20 mins in total (<=15 mins for presentation and <=5 mins for Q&A and transition)

Project Timeline

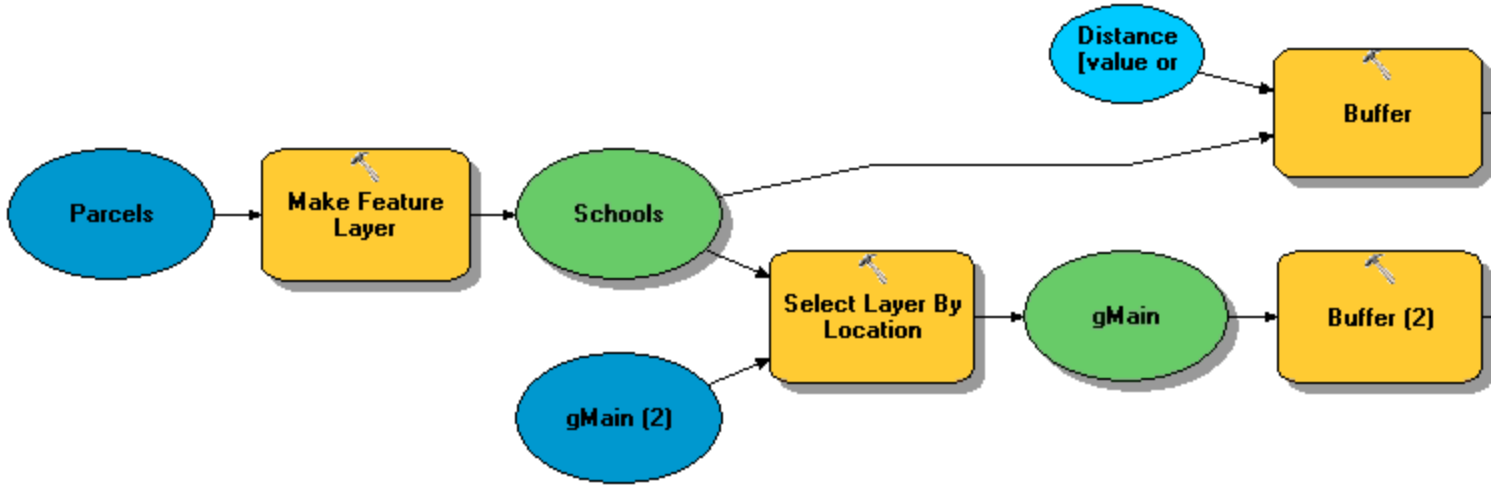
- Project proposal due: Week 7
  - Submit Word/pdf file to laulima
  - Feebacks will be given before spring break
- Report submission: Week 15
  - Submit word/pdf file using laulima
- Poster submission: Week 15
  - Submit word/ppt/pdf file using laulima
- Project presentation: Weeks 16-17
  - Submit ppt/pdf file using laulima

Project Grading

Items	% grade
Project proposal	10%
Project report	40%
Poster	20%
Project presentation	30%

Geoprocessing Model and ModelBuilder in ArcGIS

- Geoprocessing model:
  - a workflow consists of one or more multiple geoprocessing tools
  - The geoprocessing tools are connected by their interfaces (input and output variables)
  - represent a meaningful spatial analysis in a logical order



A geoprocessing model

ModelBuilder

- Visual programming language/platform that enables you to create a program without writing code.
- You create a program by adding data and tools and connecting them into a workflow.
- Models created by ModelBuilder is explicit, automated, re-usable and sharable.

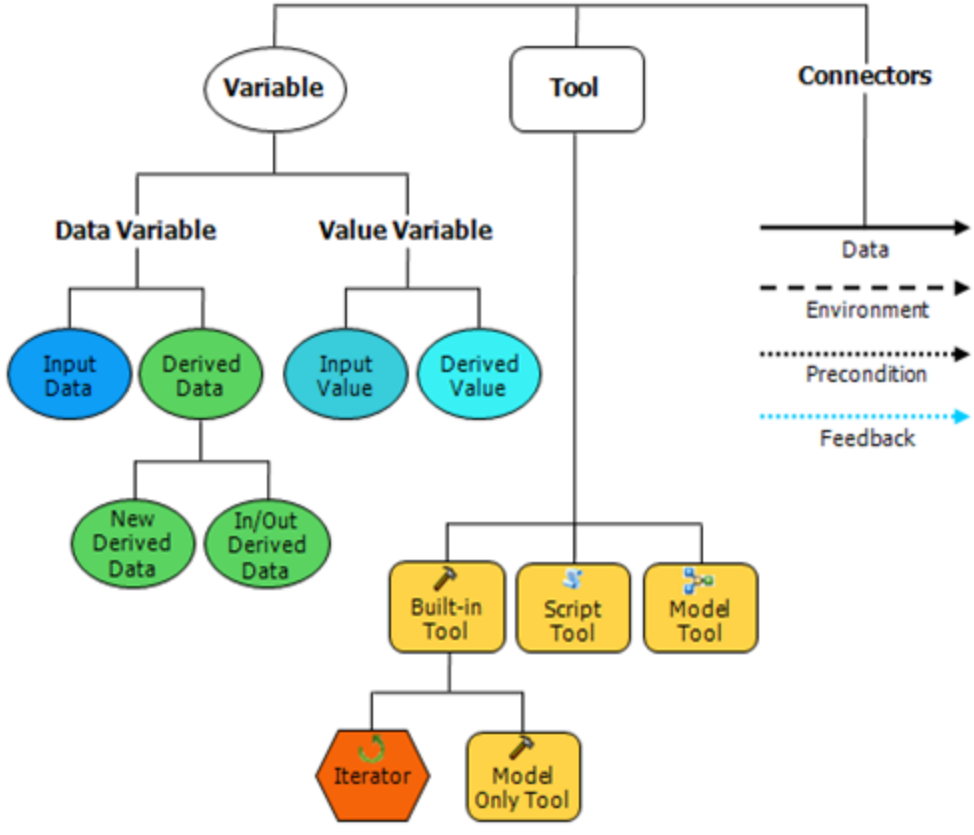
Elements in ModelBuilder

Variable: Input and output of tools

Tool: a wrapped program that operate a certain analysis task

Connector: Connecting **data, environment, precondition and feedback** with tools

Iterators: ***for*** and ***while do*** loops



Lab Computer Account

- Your account name is **the initial of your first name plus your last name, all in lower case.**
- The temporary passowrd is **change**
- In the drop list of Log on to, please select **Cartography**. If this is the first time for you to use your account, you will be prompted to **change your password**. Make a note of your password so that you can access it in the future with the same account.
- After logged on, you will see your personal drive on My Computer. (U:\ )

Account Management

- Do NOT save your work on the desktop!!!
- Do NOT save your work on the C drive !!!
- Save your work on a continuous basis to your personal folder (U drive), which is essentially a network folder.
- Use different folders to store different labs in your personal drive to easy track your work.

Using Relative Path for Your ArcGIS Projects !!!

- If you move data between computers, you will have to use relative path names for your ArcMap documents
- For ArcGIS 10.X, you can change the path setting by click File->Map Document. Check Store relative pathnames to data sources.

Lab 1 (part 1): Building Models for GIS Analysis Using ArcGIS

Please complete the lab exercises following the instruction and finish the lab assignment.

- Lab instruction: https://git.io/vMR3W
- Lab assignment: https://git.io/vMR5c

The assignment should be submitted to Laulima by Fri. Jan. 27.