Introduction to Geographic Information Science

Geography 4103 / 5103

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Today's Outline

• What is this course about
• Your expectations
• Some admin and rules (readings, labs)
• GIS education @ CU

Your Expectations

• Why GIS?
• Your motivation to come to this class
• Your future plans and intentions?
• Please fill out the short survey. This helps me to adopt the contents to your interests.
This Course

- This is GIS “1”, which follows from Cartography introduction
- Introducing GIS, theoretical basis & hands-on training
- Understanding of tools available and getting a solid foundation in GIScience
- Materials, data: adjusted/adapted on a continuous basis (Babs Buttenfield, Frank Witmer, myself…)

This Course

- An intro to GIS, the “whys” and “hows” …
- Understanding Spatial Data
- Scale/Resolution
- Spatial Reference & Map Projections
- Raster & Vector Data (Models)
- Vector Operations
- Database Management
- Raster Operations, RS, Terrain data
- Application Examples & Discussions
- Lab sessions

This Course: Contents

- What is a GIS? What’s in a GIS?
This Course: Contents

- Spatial data, their representations and management; scale, resolution

This Course: Contents

- Projections

This Course: Contents

- Application of GIS and analysis tools

Examples of "natural disasters":
- Recognizing, measuring and communicating the extent
- Spatial operations and tools
- Aral lake
- Flooding from Tsunami

Vector

Raster

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This Course: Contents

• Operations (vector and raster), spatial databases
• Discussions, examples

This Course: Contents

• Solving spatial multi-facetted problems independently and in groups!

Labs

• Labs will be linked to the contents of the classes
• … which means you will apply what you have learned from class (and vice versa)
• … train your skills in using GIS tools for different assignments
• Attendance absolutely required!!
• Submit ALL lab assignments to pass the class
• KESDA lab with restricted hours of access
• See syllabus
• Lab TAs!
Software / Tools

• We will use ESRI’s ArcGIS (v. 10.3), but: This is not an ArcGIS or ESRI course!
• While Arc is a good choice, there are MANY other GIS on the market; MOST are cheaper or free (see Steiniger & Hay, Steiniger & Bocher, 2009)
• We will look at some of them during the semester
• Depending on resources, budget and purpose the tool should be selected carefully
• Arc CDs for Student licenses!!!

Learning Objectives

• Learn about and understand important theoretical concepts in geospatial analysis and spatial data handling/management
• Without conceptual understanding and theoretical basis you will not fully understand what you are doing!
• Develop a “critical attitude” regarding uncertainty, complexity, scale and automation (precise technology for real world phenomena)
• Develop skills in working with GIS (tools and data) to understand the inherent complexity

Some Admin and Rules

• Lectures: T/R12:30-1:45am
• Labs: R 3:30-6:20pm / F 9-11:50am
• Labs mandatory (including your presence)!
• Submitting lab assignments due date (beginning next lab); downgrading rules for late assignments
• Class: Mandatory for Reading discussions
• Course homepage:
  http://www.colorado.edu/geography/leyk/GIS1/Introduction.html
Textbooks


- Further textbook recommendations:
  - Additional readings during the semester (see reference list in your syllabus)

Reading Discussions & Short Essays

See instructions on the homepage for more detail.

- RD1 GIS Applications: TBD.

For everyone: Short essays on two of these four topics on paper; submit before the discussion, no late submissions
Grad students: …

Reading Discussions & Grad Essays

See instructions on the homepage for more detail.

- RD1 GIS Applications: TBD.

Grad students:
Choose one topic (groups of 2+ students)
Presentation and discussion lead
Critical essay on the chosen topic (final paper)
What’s expected of you?

- You talk too! – Ask me if you have questions or problems
- I will ask you questions, too! Chalk board and discussions
- **Handouts online** to supplement your notes
- I expect you to have read the material and to remember what we were talking about a week (or more) ago…

The GIS Levels in Geography

- GEOG 3053 Cartography
- GEOG 4103 Introduction to GIScience
- GEOG 4203 GIS modeling
- GEOG 4303 Spatial programming in GIS
- Dynamically adapted to ensure a logical thematic sequence and appropriate transitions
- Special topics: Fuzzy Sets, Scale, Spatial databases, Generalization
- GIS Certificate
- Statistics and Remote Sensing
GIScience Research

Pattern Recognition in Historical Maps
“Landscape” over Long Time Periods

- Extraction of cartographic information is complex
- Quality & Uncertainty of historical spatial information for GIS

Pattern Recognition in Maps

Multi-Step Recognition

- Colored objects
- Text
- Lines
- Forest prototypes
- Associated forest symbols

Extracted forest cover

Comparing extracted data with visual inspection
Forest cover extraction
Kappa = 0.94
Uncertainty in Historical Maps

... uncertainty assessment to improve historical maps for more reliable historical spatial data: Fuzzy Sets

Putting People in Their Place

Dasymetric modeling: tract and subtract-level estimations for many demographic attributes

Migration Models and Environment

- Does environmental change affect migration in resource-dependent communities?
Migration Models and Environment

- What drives migration and at what scale? Spatial non-stationarity MAUP...

Spatial & Spatiotemporal Epidemiology

- Modeling (in order to predict) diarrheal disease using socio-economic and environmental variables

Next time

- We will talk about the reason why GIS could be useful
- Find out how to define a GIS
- Learn about the components of a GIS, their tasks and functionalities
- See the big picture of GIS and its role in society
What is a GIS?

- Something that helps us with our spatial knowledge by quantifying locations
- A computer-based system to aid in the collection, maintenance, storage, analysis, output, and distribution of spatial data
- Dozens of definitions reflecting different perspectives, concepts and experiences

GIS in an Institutional Context