GEOG 176A: Introduction to Geographic Information Systems

Lecture 02: Introduction to ArcGIS

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UCSB Geography Research Pool

- Provide a source of research participants for faculty and graduate student researchers in the Department of Geography.
- For each hour of research in which you participate, you will earn extra-credit points equal to 1% of the total points in the class.
- You cannot participate for more than 3% of credit during summer session B
- Contact geog-pool@ucsb.edu for questions

Students in Geography 5, and sometimes other courses, may earn extra-credit by participating in the Geography Research Pool. The pool provides a source of research participants for faculty and graduate student researchers in the Department of Geography. In addition to an opportunity to get some extra-credit points, participation in the pool provides you firsthand experience with the conduct of geography research and helps you to learn more about some of the research in human geography being conducted at UCSB. Participation in the Pool is voluntary; you are not required to do so and will not be adversely affected if you choose not to participate.

**Participation**

The Pool is managed by the Geography Research Pool web system: [http://geog.ucsb.edu/research-pool/](http://geog.ucsb.edu/research-pool/). To participate in the Pool, you will need to register there (further instructions are posted on the site). When a study is being conducted, the researcher will list it on the system, including a short description and time-date slots for signing up. You can cancel or reschedule on the system as well. Please show up if you have signed up. You may participate in a particular study only once!

For each hour of research in which you participate, you will earn extra-credit points equal to 1% of the total points in the class. For example, if your class has a total of 300 points possible for all exams and assignments, you would get 3 class points for one hour of research participation. Although studies may vary in their length and points awarded, all studies will be worth at least 1% point, even if they are shorter than one hour. You may not participate for more than 3% of credit during the quarter (totaled over all classes that offer the Pool and in which you are enrolled). However, opportunities to sign up and participate depend on the research demand at that time—at times when no studies are being conducted, there will be no sign-up opportunities. Your last chance to sign up for a study will be the end of the 5th week of the quarter—the system will not accept sign-ups after that. All studies will finish collecting data by the end of the regular quarter—the end of the 6th week.
Post your questions for discussions!
Review

- What makes GIS special compared to other information systems?
- Spatial information vs. geographic information?
- GIS vs. GISciences
- Five definitions of GIS:
  - Tool
  - Information system → feature model (Dueker's 1979 definition)
  - Science
  - Business
  - Society
- History of GIS: BC(Cartography/overlay) → AC (CGIS)
- GIS community
  - Journals, conferences, communities, web resource, job markets
GIS community - Web resources

Data:

- OpenTopography (www.opentopo.sdsc.edu)
- USGS (www.earthexplorer.usgs.gov)
- US Census (www.census.gov)
- Esri Open Data (www.hub.arcgis.com/pages/open-data)
- OpenStreetMap (www.wiki.openstreetmap.org)
- ...

GIS Blogs/Forums/Q&A

- StackExchange-GIS (www.gis.stackexchange.com)
- GISGeography (www.gisgeography.com)
- ArcGIS (www.desktop.arcgis.com/en/arcmap)
- GISLounge (www.gislounge.com)
- ...
ArcGIS Online

http://ucsb.maps.arcgis.com/home/index.html
Esri / A map for every story

- Dangermond and Esri
- A Map for every story → But GIS is even more beyond maps!
What is ArcGIS?

ArcGIS is a ‘family’ of software products produced by Esri.
ArcGIS Desktop

ArcTools

ArcMap

ArcCatalog
ArcMap

View and edit data

Create maps

Analyze data (Geoprocessing)
ArcCatalog

- View data (like a file browser)
- Graphical previews
- Metadata
- Tables

View your GIS data holdings.
Preview geographic information.
Work with tables.
Arc Toolbox

Map Projections
ESRI GIS history

Arc/Info (coverage model)
Versions 1-7 from 1980 – 1999

ArcGIS (geodatabase model)
Version 8.0, ..., 9.3, and 10.3 ... 10.6

ArcView (shapefile model)
Versions 1-3 from 1994 – 1999
Data models

- Coverage, shapefile, and geodatabases are spatial data models used in ArcGIS.
- A data model is a structure for organizing data so that data can be easily stored and retrieved.
- A spatial data model organizes spatial data.
Coverage model

- Standard vector model for Arc/Info software
- Widely used from 1980s to 1990s
- Preserves topologies, but has a complex structure
- Old but you may run into it in the future
Shapefile model

- New vector model for ArcView
- Widely used since 1993, and still popular today
- Open specification; can be processed by many GIS software packages
- Simple structure but does not preserve topologies

ArcCatalog view

Three required files:
- *.shp: geometry information
- *.shx: index file for faster geometry retrieval
- *.dbf: attribute file

File explorer view
Geodatabase model

- Both coverage and shapefile are file-based data models
- The fast development of relational database in 1990s enables geodatabase model
- A geodatabase is built on a relational database but extends it with capabilities to manage spatial data
- A geodatabase obtains the powerful storing, indexing, and retrieving functions of databases
Geodatabase model

- Stores geographic coordinates as one attribute (shape) in a relational database table
- Uses MS Access for “personal geodatabase” (single user)
- Uses Oracle, MS SQL Server, Postgres/PostGIS or other commercial relational databases for “enterprise geodatabases” (many simultaneous users)
Other concepts in ArcGIS

- Feature class
- Feature dataset
- Relationship
- Network
Feature class

- A feature class is a collection of **geographic objects** in tabular format that have the same behavior and the same attributes.
Feature datasets

- A feature dataset is a collection of feature classes that share the same spatial references
A relationship is an association or link between two objects in a database. A relationship can exist between spatial objects (features in feature classes), non-spatial objects (objects in object classes), or between spatial and non-spatial objects.
**Network**

- A network is a set of edges (lines) and junctions (points) that are topologically connected to each other.
- Each edge knows which junctions are at its endpoints.
- Each junction knows which edges it connects to.
GIS datasets

- Vector datasets
- Raster datasets
- TIN (Triangulated Irregular Network) datasets
Vector datasets

- Points, polylines (lines) and polygons (areas)
Raster datasets

- GRID datasets
- Remote sensing images
TIN datasets

- Triangulated irregular network (TIN)
- Usually used to model terrain
Esri software / References

- Reference material and brochures about Esri products: [www.esri.com/library](http://www.esri.com/library)
- Esri virtual campus - provides online training: [http://campus.esri.com](http://campus.esri.com)

Or Google it, you will find a lot of resources!
Alternatives to ArcGIS
QGIS

https://qgis.org/en/site/
Aside from these technical concepts, there are also a series of high-level (conceptual) concepts involved in GIS, which will help you better understand and thus utilizing GIS.
Core concepts in GIS

Kuhn, 2012

location  field  object  network  event

granularity  accuracy
In our future study, you will hear about these concepts many times!
Your tasks:

- Read Chapter 1
- Review slides
- Read the paper: Kuhn 2012: Core Concepts (supplementary reading)
- Go to lab session
- Work on lab 1 - due 08/12, Sunday, 11:55pm
Next two lectures:

Map scale + modeling of locations → Coordinate systems