Welcome to GEOG 176A:
Introduction to Geographic Information Systems
Instructor and TA

● Instructor: Rui Zhu
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  ○ Office hours: Thursday 1:40 pm – 3:40 pm @ Ellison 4839

● TA (Monday): Meilin Shi
  ○ Email: meilin.shi@geog.ucsb.edu
  ○ Office hours: Monday 10:00 am - noon @ Ellison 4837

● TA (Tuesday): Zachary Canter
  ○ Email: canter@geog.ucsb.edu
  ○ Office hours: Wednesday 3:00 pm - 5:00 pm @ Ellison 4838
Who am I?  
http://www.geog.ucsb.edu/~zhu/

Education:

- **2014 - Now**: Ph.D. Candidate in GIScience, Department of Geography, UC Santa Barbara, USA
- **2012 - 2014**: M.S. in Information Science, School of Information Sciences, University of Pittsburgh, USA
- **2008 - 2012**: B.A. in Information Systems and Management, Shanxi University of Finance and Economics, China

Research Interests:

- Spatial Statistics & Geostatistics
- Geospatial Semantics
- Deep Learning
- Navigation Services
Course information:

● **Textbook:**

● **Lectures:**
  ○ MTWR: 12:30 pm - 1:35 pm, Phelps Hall 1160

● **Labs:**
  ○ Monday: 2:00 pm - 4:50 pm, Ellison: 3620
  ○ Tuesday: 2:00 pm - 4:50 pm, Ellison: 3620

● **Course Material:**
  ○ Gauchospace https://gauchospace.ucsb.edu
Textbooks reserved at the library

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Grades:

- Your total score will be weighted as:
  - Mid-term Examination: 25% (08/20)
  - Final Examination: 30% (09/12)
  - Lab Assignments: 40% (7% for lab1-lab5, 5% for lab6)
  - In-class activities, participations, and attendance: 5%

- Zero tolerance on copy or plagiarism! We take it seriously!
Overview of GEOG 176 series

- GEOG 176A - Introduction to Geographic Information Systems
  - An introductory level GIS course; provide an overview of GIS concepts and hands-on experience on basic GIS functions

- GEOG 176B - Technical Issues in GIS
  - Discusses more advanced topics in GIS, such as spatial modeling, spatial simulation and spatial analysis

- GEOG 176C - GIS Design and Applications
  - A capstone course for GEOG 176. Students are required to apply what they have learned in A and B to solve practical geospatial problems in the real world
What you will learn in this 176A class?

- An overview of GIS
- Be comfortable working with ArcGIS and Google Earth softwares
- Understand fundamental concepts and data models about GIS
- Know where and how to find/obtain GIS data
- Gain the abilities to process, store, analyze and visualize GIS data
- Be able to evaluate the pros and cons of GIS
- Have experience of solving practical GIS problems
Components of this class

- Introduction: What is GIS (2 lectures)
- GIS Roots in Cartography (2 lectures)
- Geographic Data Models (4 lectures)
- Geographic Database Management (1 lecture)
- Spatial Analysis (6 lectures)
- GIS Systems (2 lectures)
- GIS Applications and the Future (3 lectures)
How to learn?

- Attend lectures and lab sessions
- Read textbooks and related materials
- Conduct lab assignments
Access to ArcGIS software:

- **Lab computers**
  - ArcGIS, and other relevant softwares, are already installed in the lab (Ellison 3620). So please attend the lab sessions!

- **On your own machine**
  - All ucsb students are eligible for a free one year trial version of ArcGIS
  - You have to have a windows PC, with at least 4GB RAM
  - Check [http://www.library.ucsb.edu/mil/esri](http://www.library.ucsb.edu/mil/esri) for details

- **Other resource**
  - Labs at Ellison Hall
  - UCSB Collaborate Labs ([http://labschedule.collaborate.ucsb.edu/](http://labschedule.collaborate.ucsb.edu/))
  - The Collaborate (Library) has several Windows PCs with ArcGIS and Google Earth installed
GEOG 176A: Introduction to Geographic Information Systems

Lecture 01: What is GIS?
(Chapter 1)

Rui Zhu
What is a GIS?

Geographic Information Systems (GIS)

GISs are simultaneously the telescope, the microscope, the computer, and the Xerox machine of regional analysis and synthesis of spatial data. (Ron Abler, 1988)

- Acquisition
- Management
- Retrieval
- Analysis
- Visualization
Where did GIS come from?

- Backgrounds in Geography, Cartography, Computer Science, Statistics, and Mathematics
- Fusion of information systems and imaging/positioning technologies
- Geographic Information Science is a new interdisciplinary field built out of the use and theory of GIS → spatial@ucsb (UCSB Center for Spatial Studies)
Defining GIS

- Different definitions of a GIS have evolved in different areas and disciplines.
- All GIS definitions recognize that spatial information are unique because they are linked to maps; and the way of dealing with spatial data is special!
- A GIS at least consists of a database, map information, and a computer-based link between them.

What is the "link" here?
Spatial data -- Geographic Primitive

\[ G = f(x, y, z, t, F) \]
# Spatial vs Non-Spatial

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## Crimes during 2003

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<td>24-Jan</td>
<td>22 Smith St.</td>
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<td>13-Feb</td>
<td>12 Fifth Avenue</td>
<td>Breaking and Entering</td>
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<tr>
<td>14-Feb</td>
<td>17 Del Playa</td>
<td>Drunk and Disorderly</td>
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Geographic Information

- Data vs. Information vs. Knowledge vs. Wisdom?
- Information vs. Spatial/Geographic Information?
- Spatial vs. Geographic?
Definition 1: A GIS is a toolbox

"a powerful set of tools for storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes"

-------- Burrough, 1986, p.6 (*from a functional perspective*)

"automated systems for the capture, storage, retrieval, analysis, and display of spatial data"

-------- Clark, 1995, p.13 (*from a process perspective*)
GIS as a toolbox

- General or Specific
- Cutting or Joining
- Complex or Simple
- Cheap or Expensive

Input → Transformation → Output
Definition 2: A GIS is an information system

"An information system that is designed to work with data referenced by spatial or geographic coordinates. In other words, a GIS is both a database system with specific capabilities for spatially-referenced data, as well as a set of operations for working with the data"

-------- Star and Estes, 1990, p.2
GIS as an information system

Storage

Query

Please ring bell for service
Map storage: Layers and themes
Dueker's 1979 definition (p.106)

"A geographic information system is a special case of information systems where the database consists of observations on spatially distributed features, activities or events, which are definable in space as points, lines, or areas. A geographic information system manipulates data about these points, lines, and areas to retrieve data for ad hoc queries and analysis."

The Feature Model

- **Human's role**: "activities" link to geographic patterns and distributions. Activities link to features → e.g., migration
- **Time**: "event" part of GIS implies space and time. → e.g., car accident

![Feature Model Diagram](image)