GIST 4302/5302: Spatial Analysis and Modeling

Lecture 1: Overview

Guofeng Cao

www.spatial.ttu.edu

Department of Geosciences
Texas Tech University

guofeng.cao@ttu.edu

Spring 2020

Texas Tech GIS Graduate Certificate

Geographic Information Science and Technology (GIST)

- Three core courses
  - GIST 5300: Geographic Information Systems (3)
  - **GIST 5302: Spatial Analysis and Modeling (3)**
  - GIST 5304: Advanced Geographic Information Systems (3)
- Two elective course from
  - **GEOG 5330. Applied Spatial and Spatiotemporal Analysis (3)**
  - GIST 5308. Cartographic Design (3)
  - GIST 5310. GPS Field Mapping (3)
  - GIST 5312. Internet Mapping (3)
  - GEOG 5301. Remote Sensing of the Environment (3)
  - GEOL 5341. Digital Imagery in the Geosciences (3)
  - GEOL 5342. Spatial Data Analysis and Modeling in Geosciences (3)
  - NRM 5404. Aerial Terrain Analysis (4)

Geographic Information Science and Technology (GIST)

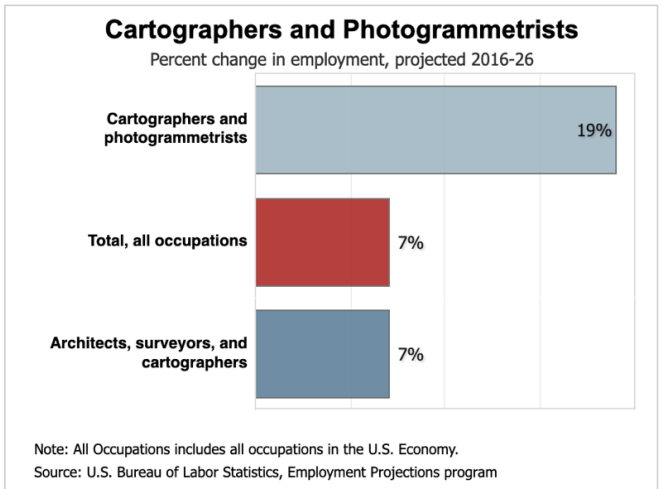
- Two core courses
  - GIST 3300: Geographic Information Systems (3) (Required for Geography Major)
  - **GIST 4302: Spatial Analysis and Modeling (3)**
- Four elective course from
  - GIST 4304: Advanced Geographic Information Systems (3)
  - GIST 4308. Cartographic Design (3)
  - GIST 4310. GPS Field Mapping (3)
  - GIST 4312. Internet Mapping (3)
  - GEOG 3301. Remote Sensing of the Environment (3)
  - GEOL 4341. Digital Imagery in the Geosciences (3)
  - GEOL 4342. Spatial Data Analysis and Modeling in Geosciences (3)
  - NRM 4404. Aerial Terrain Analysis (4)

Job Market for GIS Professionals

Job outlook

Summary

Quick Facts: Geographers	
2018 Median Pay	$80,300 per year $38.60 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2016	1,500
Job Outlook, 2016-26	7% (As fast as average)
Employment Change, 2016-26	100



BEST JOBS U.S.News RANKINGS

Cartographer Overview

Overall Score 7.1 / 10

#1 in **Best Engineering Jobs** | **#10** in **Best STEM Jobs** | **#18** in **100 Best Jobs**

Overview | Salary | Reviews and Advice | Job Openings

What is a Cartographer?

Job Market for GIS Professionals

2017 URISA GIS salary survey

Average Salary by Job Title	Average Salary
Director of Geographic Information Systems/ Geographic Information Officer (GIO)	$98,696
GIS Manager	$81,029
GIS Coordinator	$70,141
GIS Specialist	$63,418
GIS Programmer	$80,752
GIS Analyst	$62,336
GIS Technician	$47,225
User of GIS (Heavy)	$67,137
Educator/Trainer	$76,111
Independent Consultant	$114,097
GIS Business Development/Sales & Marketing	$103,883

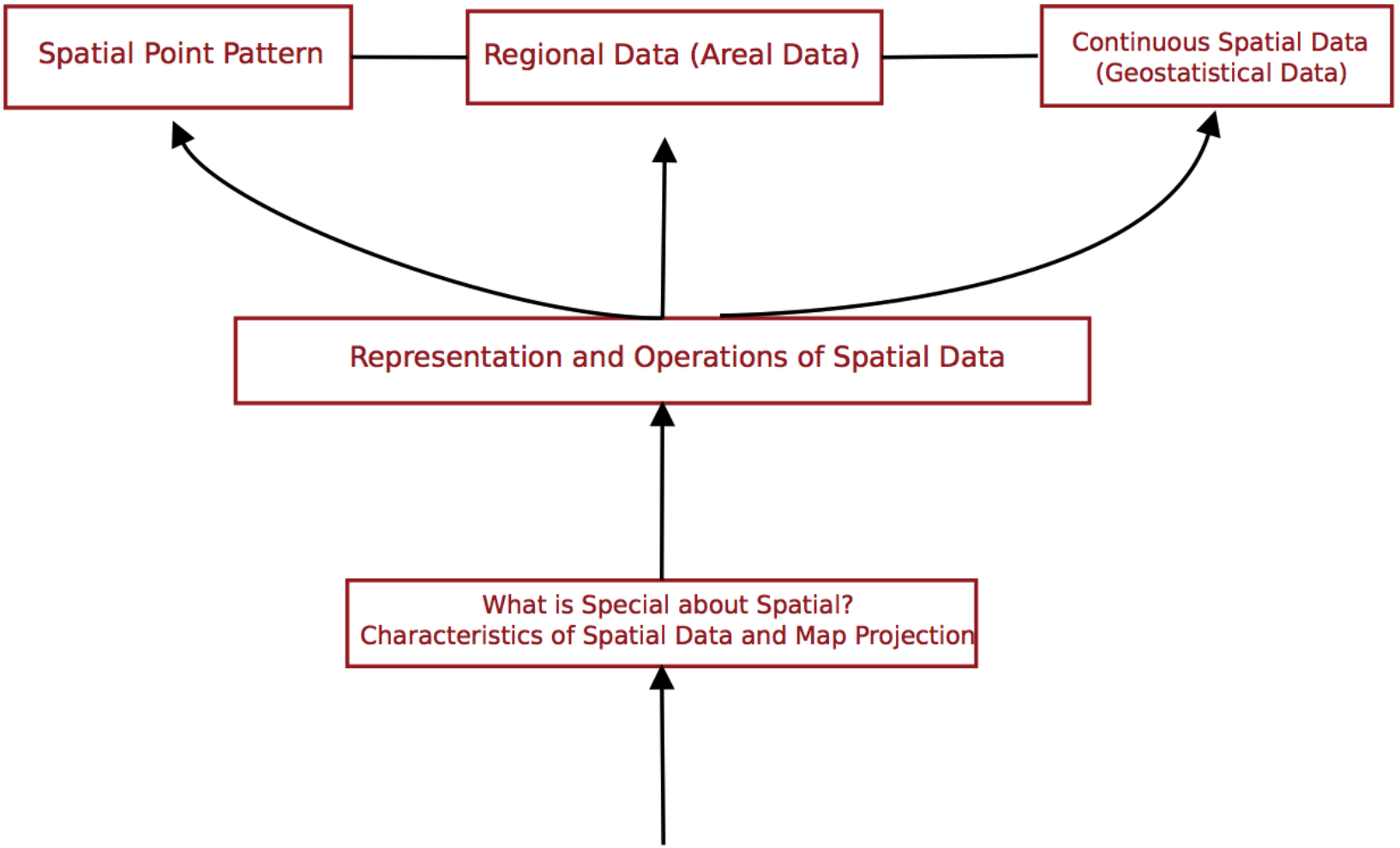
Average Salary by GISP Certification	Average Salary
Yes, I am a GISP	$76,632
No, I'm not a GISP	$66,550

Course Description

Content overview

- This course will introduce concepts and commonly used methods in quantitative analysis of (geographic) spatial data
- Contents include:
  - Characteristics of spatial data
  - Representation of spatial data in GIS
  - Commonly used spatial analysis methods
  - Concepts in spatial data mining/statistics
- Class webpage: http://www.gis.ttu.edu/gist4302

Course Outline



Course Description

Audience

- This class is intended for students (undergraduate and graduate students) from relevant disciplines (e.g., geography, geology, environmental science and social sciences) who are interested in analysis of spatial data
- Students will be encouraged to engage this course with their thesis/dissertation topics and research interests

Please note:

- General knowledge of statistics or quantitative skills will be very helpful and equations will appear significantly in some lectures
- We have a mix of undergraduate and graduate students with diverse background and expectation

Course Description

Course objectives

- After completing this course, undergraduates students are expected to learn how to:
  - formulate real-world problems in the context of geographic information systems and spatial analysis
  - utilize mainstream software tools (commercial or open-source) to solve spatial problems
  - have a good understanding of how common spatial analytical methods methods
- In addition to the above, graduates students are expected to:
  - communicate results of spatial analysis in the forms of writing and presentation
  - evaluate and assess the results of alternative methods
  - apply the introduced methods in the dissertation and thesis research

Course Format

Lectures

- Instructor: Guofeng Cao (guofeng.cao@ttu.edu)
- Holden 121
- TR: 2:00-2:50pm
- Office hours: TR: 1:30-2:30 at Holden Hall 211

Lab sessions

- Three lab sessions
- Teaching Assistant: Chan-mi Lee
- GIS lab: Holden Hall 221
- Office hours: W 3:00-4:00pm, R 1:20-2:20pm at Holden Hall 214

Lab Assignments

Lab assignments

- ~ 2 hours each week
- Multiple software will be utilized:
  - ArcGIS
  - Open GeoDa
  - R or Matlab (Optional)

Final project

- The project could be used as a setting for your thesis and dissertation topics, other course topics or research interests
- Group collaboration is encouraged, but for each group, no more than two graduates are allowed
- Start to think of the project ideas early and communicate with the instructor and TA for comments
- Project presentation or poster session: *PechaKucha* style `http://en.wikipedia.org/wiki/PechaKucha`

Grading

Grading policy

- Two written exams: 40% (20% each)
- Lab assignments: 45%
- Final project: 25% including proposal (5%), class presentation (10%) and project report (10%)
- Class and lab attendance is mandatory (New attendance tracking tool!)

Textbook

- Required
  - O'Sullivan, David and David J. Unwin, 2010. Geographic Information Analysis
- Optional:
  - de Smith, Michael J., Paul A. Longley and Michael F. Goodchild (2013), Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools, 4th Edition. Available in both print and web (*free!*) version at
    `http://www.spatialanalysisonline.com`
  - Allen, David W. (2011), GIS Tutorial 2, Spatial Analysis Workbook for ArcGIS 10, Esri Press
  - Mitchell, A. (2009), The ESRI Guide to GIS Analysis, vol. 2: spatial measurements and statistics, ESRI Press
  - Bivand Roger S., Pebesma, Edzer J., and Gmez-Rubio, Virgilio (2008), *Applied Spatial Data Analysis with R*, Springer.

Logistics

- ArcMap Software available at: `\\software.itts.ttu.edu\shared\ARCGIS`
- Email: You are required to have a valid TTU email address for class announcements and updates
- USB Flash Drive: To save your homework, lab assignments and projects, you will need a USB flash drive. Given that GIS data can take up a lot of space, a minimum 2 GB flash drive is recommended
- Withdrawing: You are responsible for dropping the class

Quiz

Please try to answer the following questions

Quiz

1. Which one of the following best approximate the radius of the Earth?
   (a) 4356 km
   (b) 6356 km
   (c) 8356 km
2. Which one of the following best approximate the latitude of Lubbock or this classroom?
   (a) 33°
   (b) 43°
   (c) 53°
3. How far does one degree of latitude approximate on the ground?
   (a) 10 km
   (b) 110 km
   (c) 1100 km
4. GPS device on my smart phone gave me the reading $(47.640120461583138, -122.12971039116383)$. Does it make sense?

Quiz

6. What is buffer analysis?
7. How would you find out the total population resided within 5 miles of U.S. freeway?
8. The following is a map published in an article of *The Economist* describing the missle threat of North Korea. Is there anything wrong with the following map?

North Korea's missile threat

Type	Maximum range	Payload	Status
Nodong	1,300 km (810 miles)	700 kg (1,550 pounds)	Currently deployed
Taepodong-1	Up to 10,000 km	Several hundred kg	Test failed 1998, not yet operational
Taepodong-2	10,000-15,000 km	Several hundred kg	Not yet tested

Source: Task Force for US Korea Policy, Centre for International Policy

Quiz

Then *The Economist* realized it, and gave the corrected map as the following.

North Korea's missile threat

Type	Maximum range	Payload	Status
Nodong	1,300 km (810 miles)	700 kg (1,550 pounds)	Currently deployed
Taepodong-1	Up to 10,000 km	Several hundred kg	Test failed 1998, not yet operational
Taepodong-2	10,000–15,000 km	Several hundred kg	Not yet tested

Source: Task Force for US Korea Policy, Centre for International Policy

Quiz

9. Does the distribution of these daisies look randomly for you?

10. Suppose for counties of Texas, we found that the countries that consume more coffee have less cases of heart diseases. Can we conclude that drinking more coffee causes less heart diseases?

Thank you

Questions/comments?