API-231 / Geographic Information Systems for Public Policy
Shopping Session

Yuri M. Zhukov
Visiting Associate Professor of Public Policy
Harvard Kennedy School

January 18, 2024

What is GIS?

What are **Geographic Information Systems**?

1. tools for the collection, maintenance, storage, analysis, visualization and distribution of geospatial data
2. a.k.a. "geospatial data science"

Policy applications

1. GIS help us understand
   a) where social, economic, public health problems occur
   b) who is affected by them
   c) how to monitor, manage and mitigate them

Scientific applications

1. GIS help us
   a) acquire data
   b) test hypotheses
   c) make forecasts and predictions

Figure 1: GIS is super cool

Examples

Figure 2: Example: Track international shipping

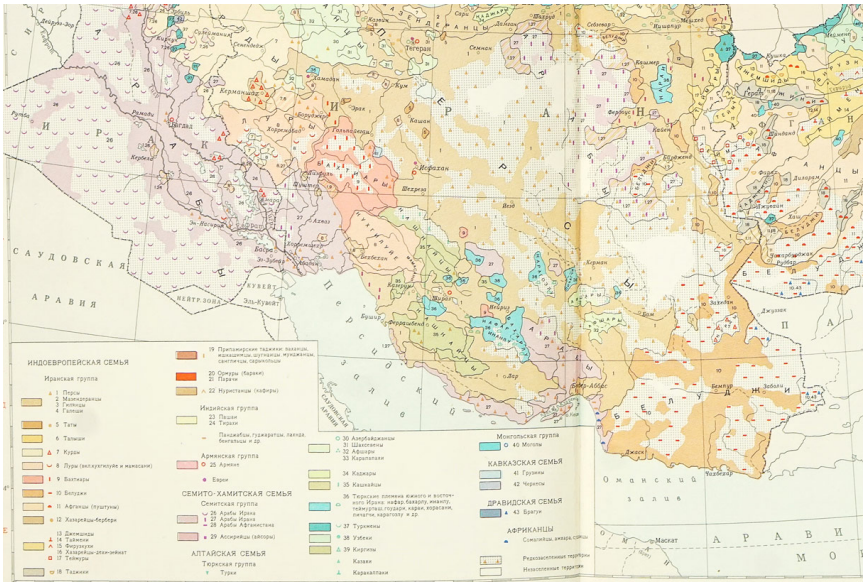

Figure 3: Example: Find out where Baloch people live in Iran

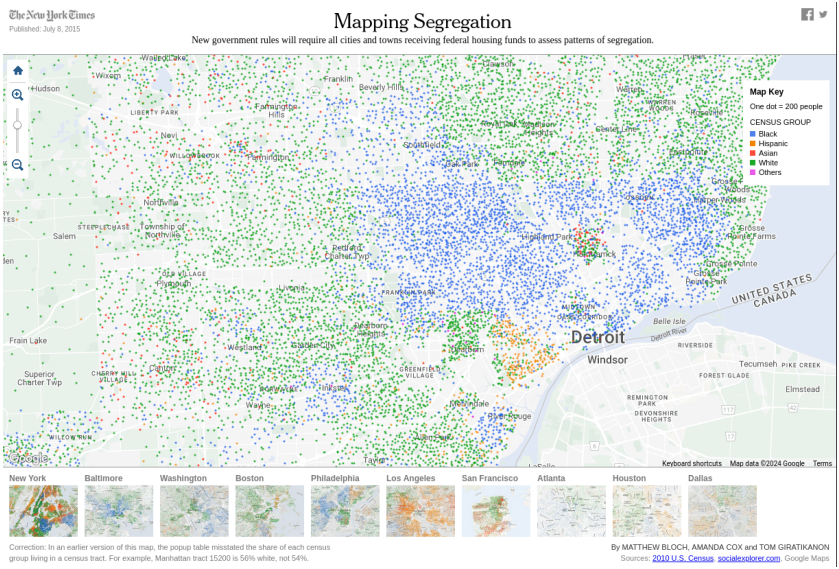

Figure 4: Example: Analyze residential segregation in American cities

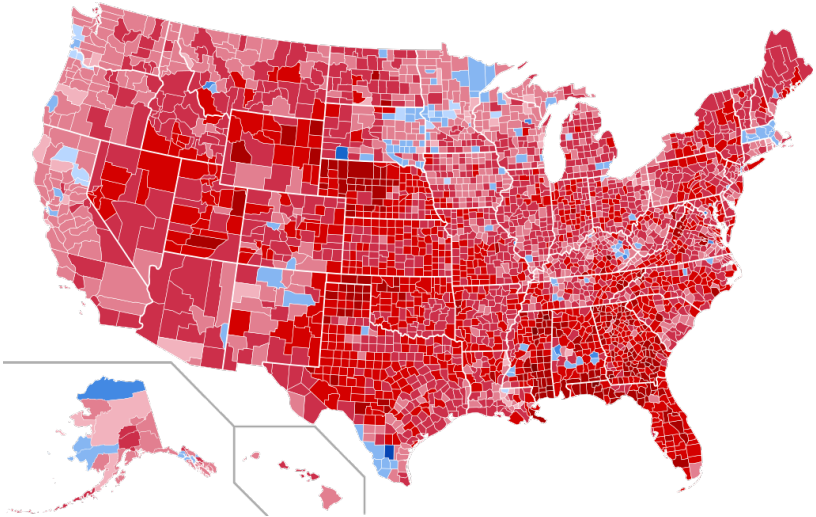

Figure 5: Example: Compare election results (1972: Nixon v McGovern)

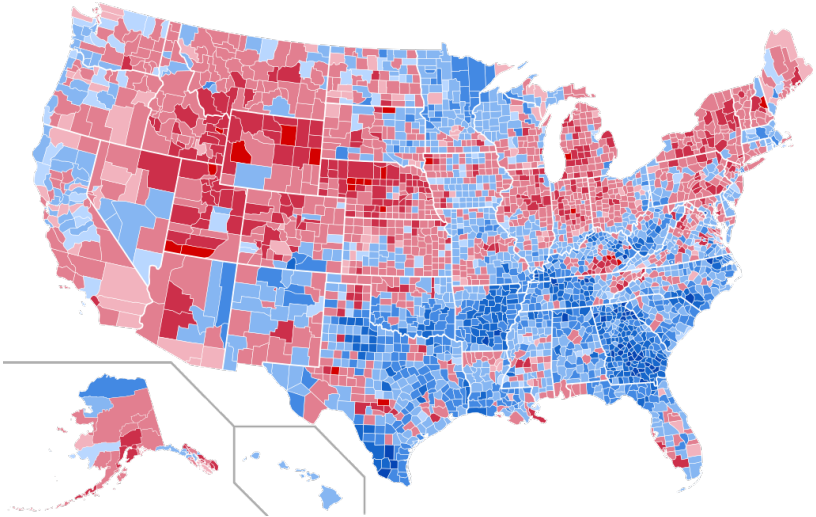

Figure 6: Example: Compare election results (1976: Carter v Ford)

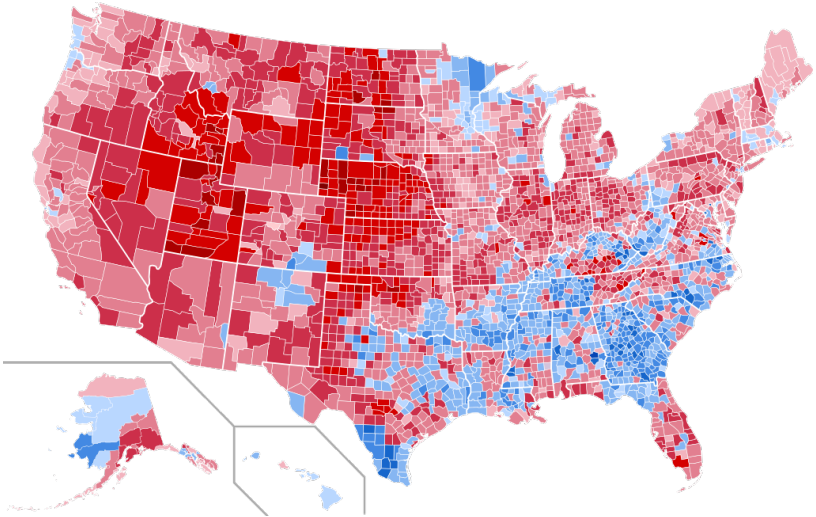

Figure 7: Example: Compare election results (1980: Reagan v Carter)

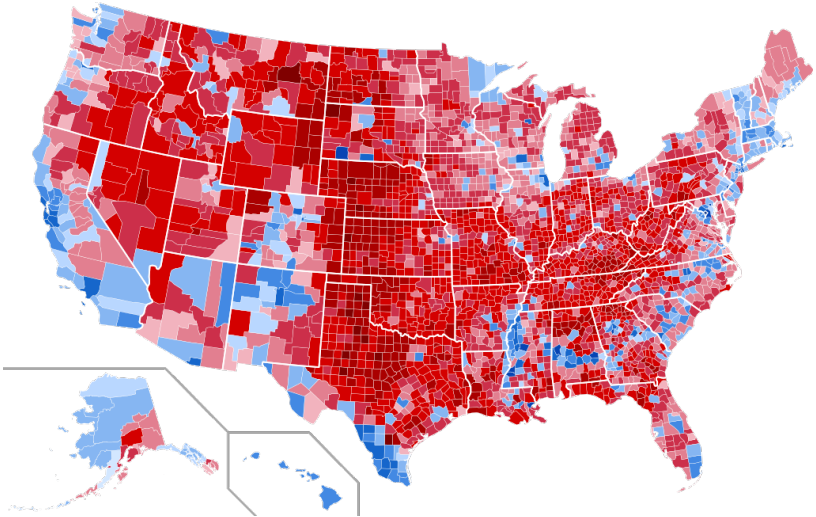

Figure 8: Example: Compare election results (2016: Trump v Clinton)

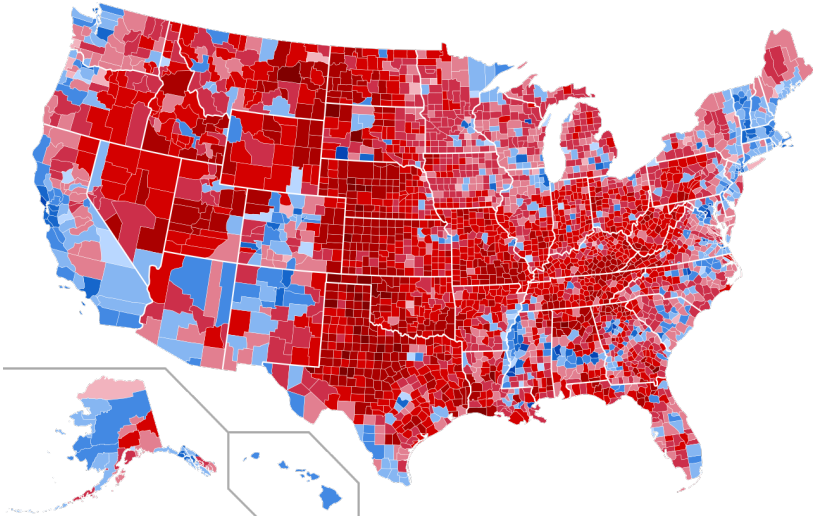

Figure 9: Example: Compare election results (2020: Biden v Trump)

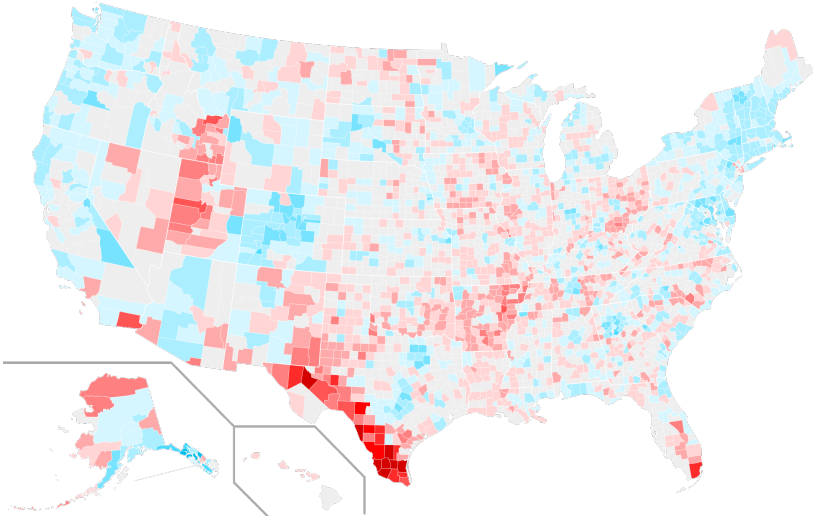

Figure 10: Example: Compare election results (2016 to 2020 swing)

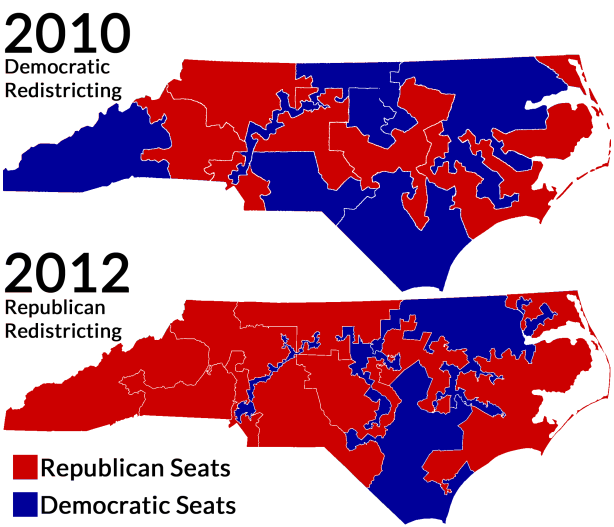

Figure 11: Example: Draw new Congressional districts

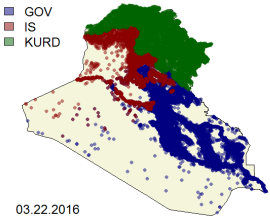

Figure 12: Iraq

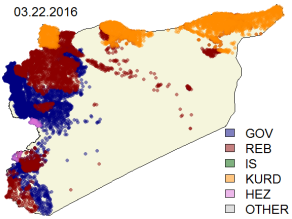

Figure 13: Syria

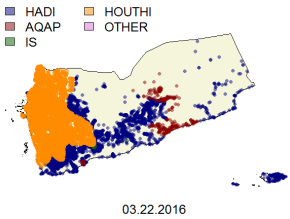

Figure 14: Yemen

Example: Track violence and territorial control in armed conflicts

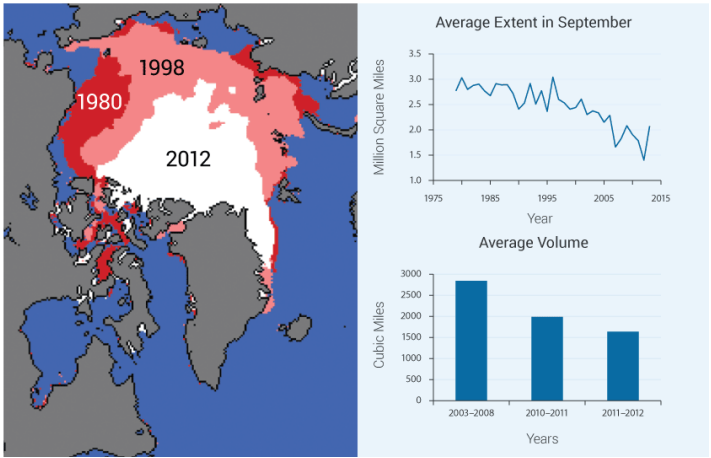

Figure 15: Example: Measure loss of Arctic sea ice

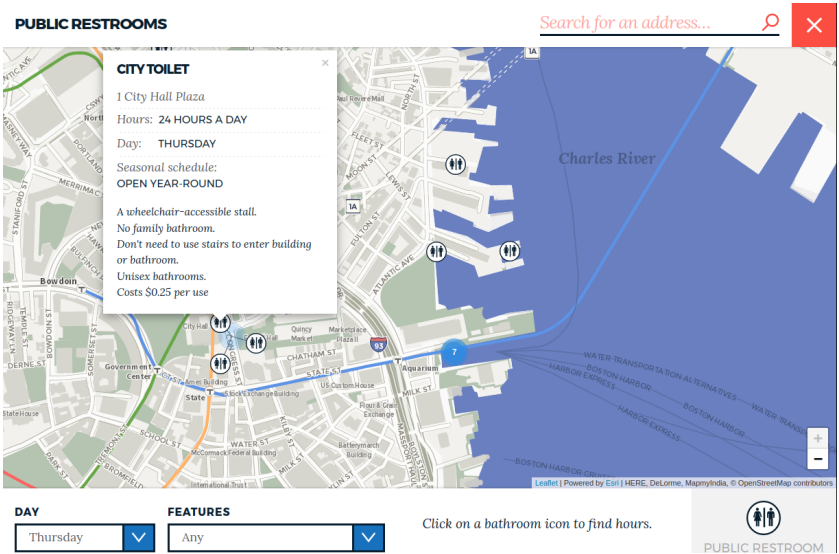

Figure 16: Example: Find a public restroom

Figure 17: Example: Find your way home

About the Class

Goals and Structure

Goals of the class

1. Introduce basic GIS concepts
2. Provide hands-on experience in using open-source GIS software
3. Find, open and edit geospatial data
4. Visualize geospatial data (make cool maps)
5. Conduct basic geospatial data analyses
6. Create new geospatial data (georeferencing, geocoding)
7. Apply these skills to an original research project

Who should take this class?

1. Students working on research projects, theses
2. Students interested in data visualization & management
3. Students who want to add new software/programming skills to CV
4. Policy wonks
5. History buffs
6. People who hang antique maps on their walls

No prerequisites!

Figure 18: This could be you

How will we learn?

1. Methods boot camp
   a) first half of semester
   b) weekly lectures (45-75 min)
   c) weekly computational tutorials
   d) weekly problem sets
2. Research workshop
   a) second half of semester
   b) weekly "walk-throughs" of data collection & analysis on student-selected topics
   c) no problem sets
   d) focus 100% on research project

Figure 19: Learn new methods

Figure 20: Apply them to research

Research "walk-throughs"

1. Step-by-step guides
   a) where to find and download data
   b) how to pre-process, integrate the data
   c) how to conduct a very rudimentary analysis of the data
2. Options (students select 3 of 10)
   a) agriculture and crop productivity
   b) Congressional redistricting
   c) climate-conflict nexus
   d) crime and policing
   e) international migration
   f) nighttime luminosity
   g) piracy and transnational shipping
   h) political repression
   i) racial and ethnic segregation
   j) Russian-Ukrainian War

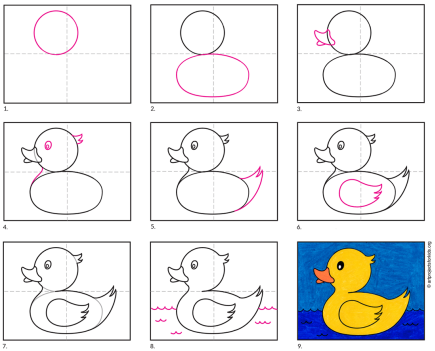

Figure 21: Like this, but for GIS

Grading

1. Problem sets (40%)
   a) 8 × 5% each
   b) due no later than 11:59 PM each Sunday
   c) collaboration encouraged
2. Final project (40%)
   a) 1-paragraph project abstract
      - due 11:59 PM, 3/8
   b) 5-minute class presentation
      - 4/23 or 4/25
   c) 5-7 page report
      - due 11:59 PM, 5/3
3. Attendance & participation (20%)
   a) show up, ask questions, help others

Figure 22: Don't worry

Final Project

1. Overview
   a) goal: use GIS to answer a *political/social/economic question*
   b) *descriptive question*: answer through mapping & visualization (e.g. "Which neighborhoods are the most violent?")
   c) *explanatory question*: answer through analysis of geospatial data (e.g. "Why are some neighborhoods more violent than others?")
   d) collaboration/co-authorship permitted
2. Project abstract (1 paragraph)
   a) summarize research idea, needed spatial & non-spatial data
3. In-class presentation (5 min, 2 slides)
   a) slide 1: Research question
   b) slide 2: Map(s)
4. Written report (5-7 pages)
   a) section 1: Research question
   b) section 2: Data & methods
   c) section 3: Preliminary results

Software

Software & programming

1. QGIS (option 1)
   a) free, open-source alternative to ArcGIS
   b) visualize, manage, edit, analyze spatial data, create maps
   c) intuitive graphical user interface (GUI)
   d) multiplatform (runs on Linux, Mac, Windows, Android)
   e) download it here: `qgis.org`

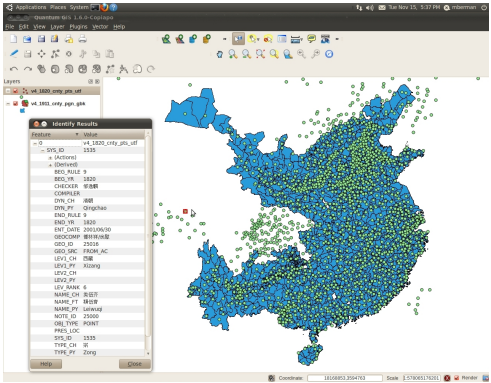

Figure 23: QGIS

Software & programming

2. R (option 2)
   a) open-source statistical programming language
   b) can do (most) of what you can do in QGIS, and lots more
   c) can run R from the command line
      ... or using source code editor (e.g. Sublime Text, XEmacs)
      ... or using integrated development environment (e.g. RStudio Cloud)
   d) also multiplatform (runs on Linux, Mac, Windows, Android)
   e) download R here: `r-project.org`
      ... or RStudio here: `posit.co`

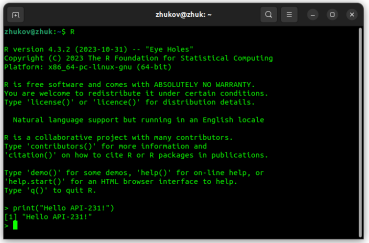

Figure 24: R

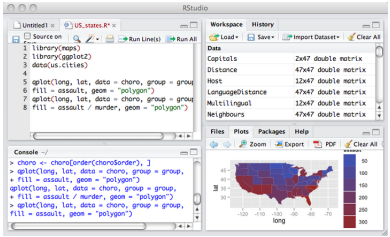

Figure 25: RStudio

Remember: there are no prerequisites!

- never used QGIS or R?
- never took stats?
- never seen a map?
- no problem

Help us help you!

- please fill out this survey
- tell us about your research interests and software/programming background (even if you have none)
- `tinyurl.com/api231-intro`

Figure 26: Survey QR Code

If you're interested...

1. Check out syllabus on Canvas or KNet
   a) `canvas.harvard.edu/courses/132841`
2. Email me any course-related questions
   a) `yzhukov@hks.harvard.edu`
3. Sign up for my virtual office hours
   a) `calendly.com/zhukov-hks`

Figure 27: Stay cool. Learn GIS