Spatial Data Science

Sankofa Curriculum - Summer 2025

Lesson 03:
What is GeoAI?

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Data provided by GeoDI Lab
Basemap by MapBox
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Activity – Share your Map!

- Share your map with a neighbor!

Agenda

I. **Lying with Maps**

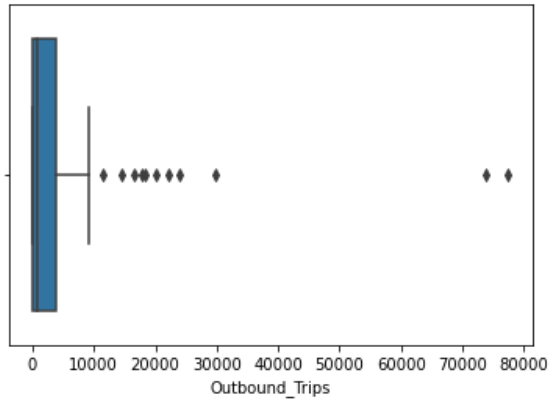
II. **What is GeoAI?**

III. **Computational Thinking**

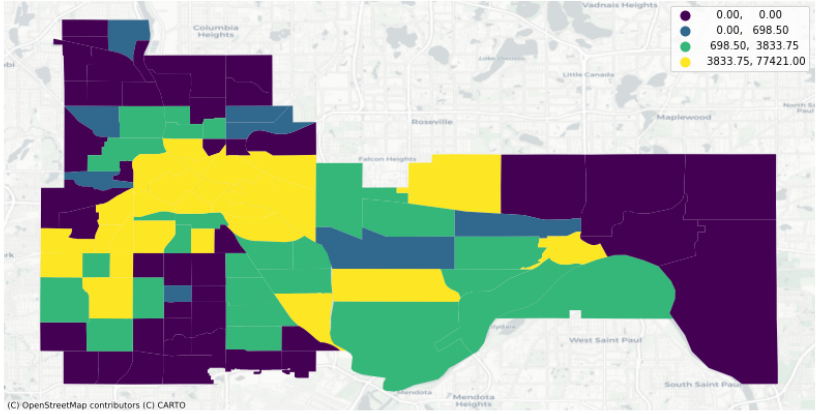
~~~ BREAK ~~~

IV. **Lab**
~~~

Lying with Maps

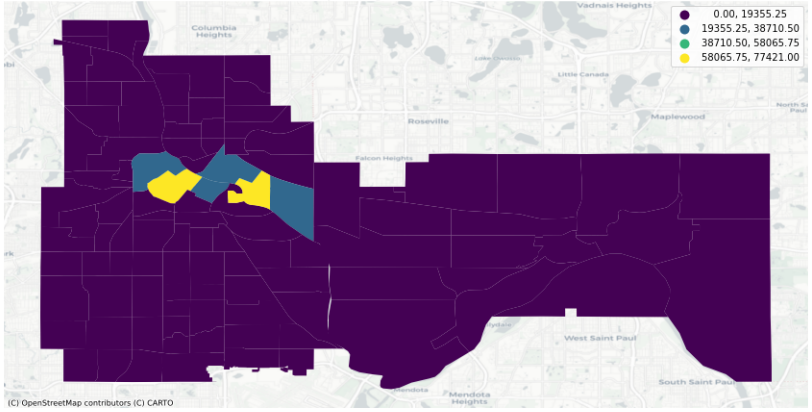
Map Data Classifications



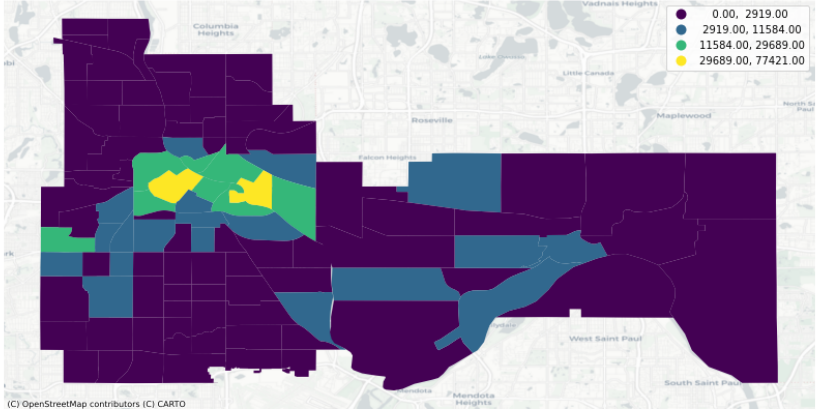
Outbound NiceRide Trips by Neighborhood (Quantiles)



Outbound NiceRide Trips by Neighborhood (Equal Interval)



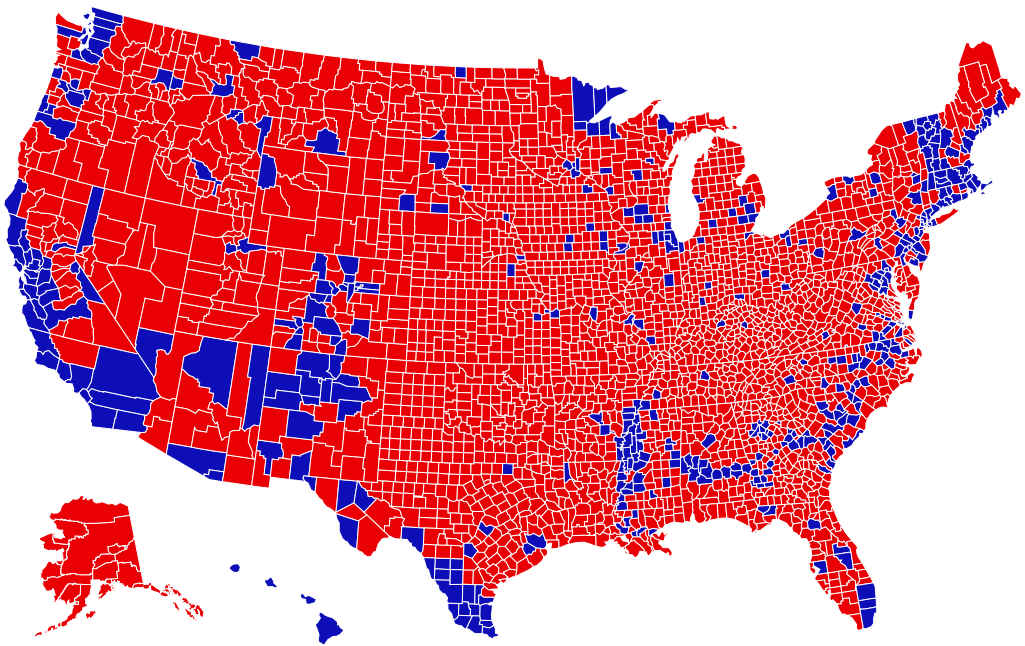
Outbound NiceRide Trips by Neighborhood (Natural Breaks)

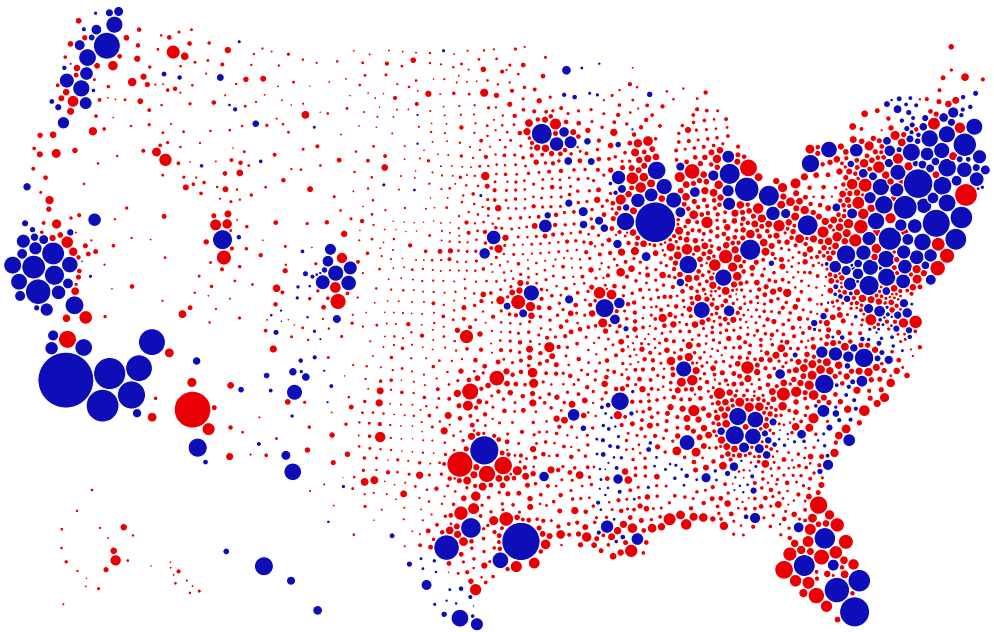


Further reading: https://gisgeography.com/choropleth-maps-data-classification/

Ecological Fallacy

- Occurs when aggregated datasets are used to make **inferences about individuals**

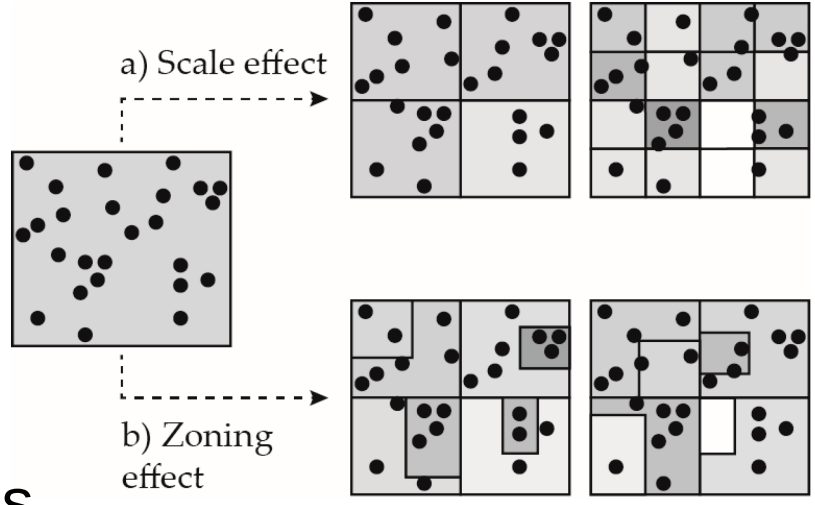




Images from: https://observablehq.com/@karimdouieb/try-to-impeach-this-challenge-accepted

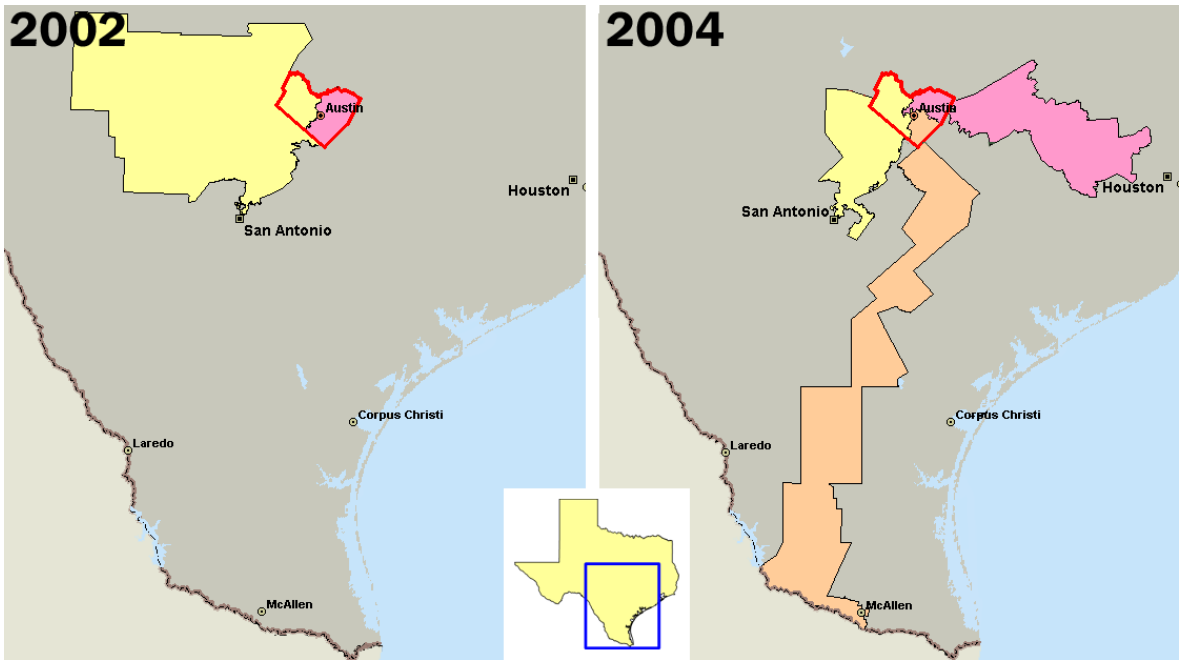
Modifiable Areal Unit Problem (MAUP)

- "the areal units (zonal objects) used in many geographical studies are arbitrary, modifiable, and **subject to the whims and fancies of whoever is doing, or did, the aggregating**"
  - Openshaw 1984
- Often emerges when aggregating point data into polygons (areal units)
- Two “Effects”
  - Scale: Larger and smaller units
  - Shape: Zones can take many forms



Source: Loidl et al. (2016)

Gerrymandering



By PHenry at English Wikipedia - Transferred from en.wikipedia to Commons., Public Domain, https://commons.wikimedia.org/w/index.php?curid=1838278

Change of Support Problem (COSP)

- What to do when the spatial unit changes between measurements, datasets, and/or analyses?

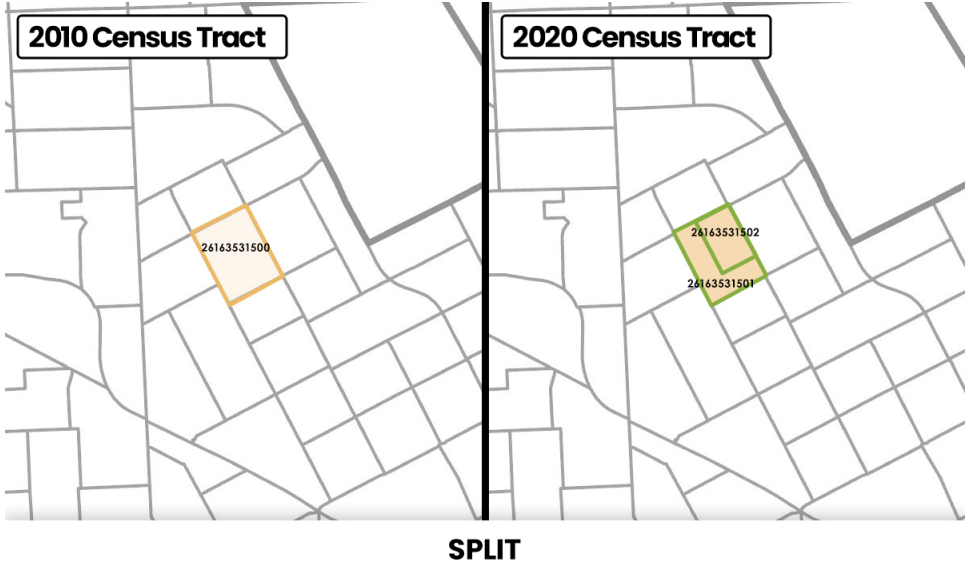


Image from: https://datadrivendetroit.org/blog/2021/09/16/2020-census-tract-changes/

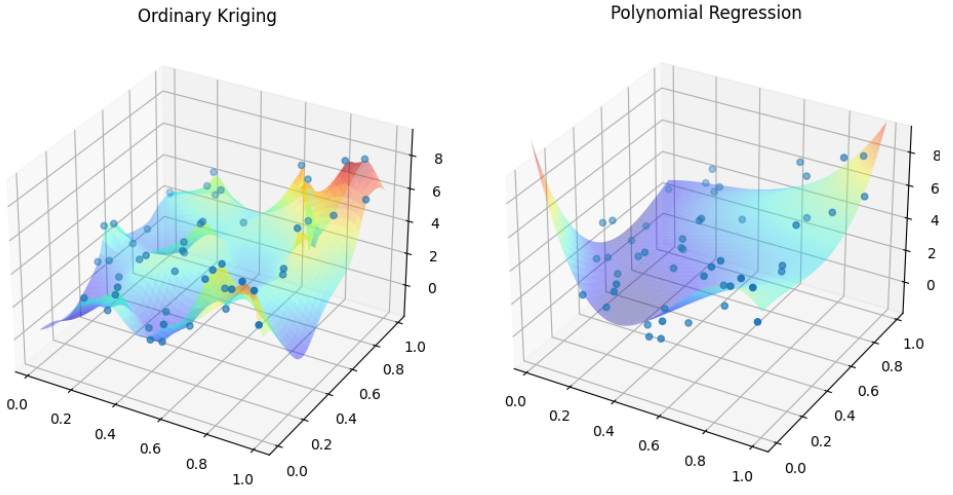
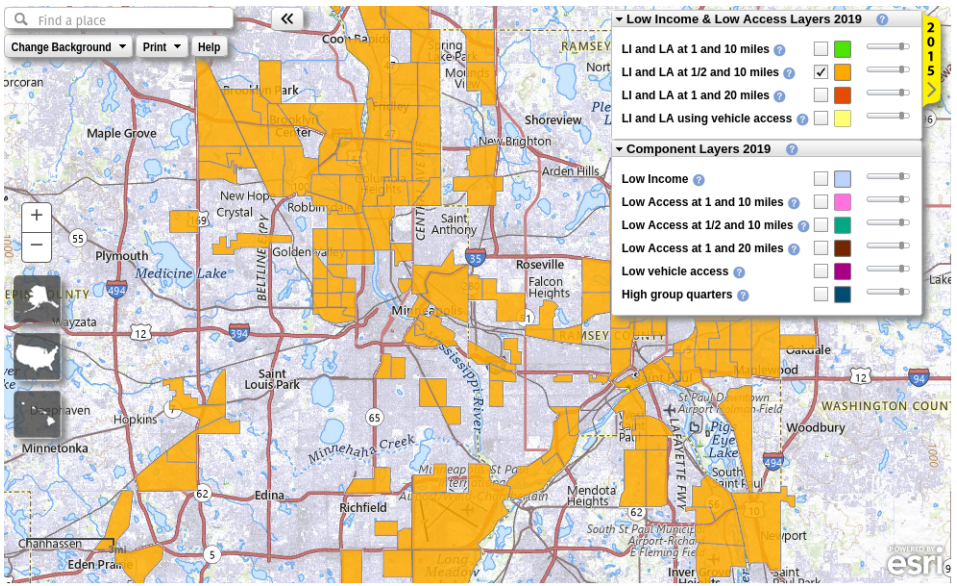


Image from: https://shuchanel.com/2d-data-fitting-ordinary-kriging-regression-by-python/

Activity – Lying with Maps

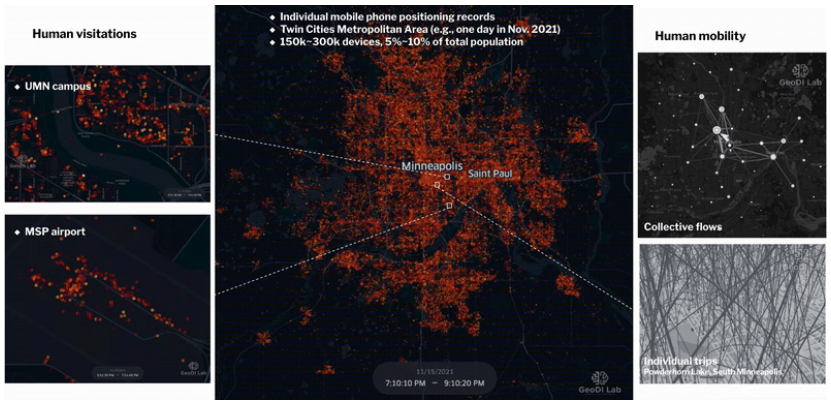
- Find a problematic map!
  - Take 5 minutes to find a map on the internet that you think is “lying”
  - Share with your neighbor



What is GeoAI?

What is GeoAI?

- **A marriage of spatial and computational thinking**
  - Accelerates decision-making & understanding of our world
- **Improve data quality, consistency, and acquisition**
  - Tedious tasks become manageable with AI assistance
- **Perform predictive analysis using machine learning**
  - Leverages power of computation even more than before



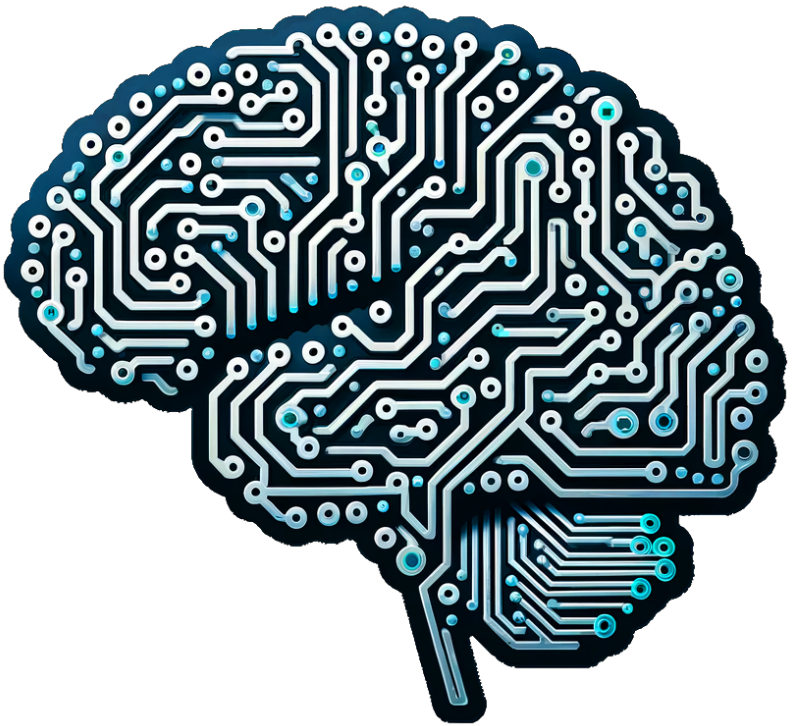
Source: https://geodi.umn.edu/

A customized LLM for spatial analysis - https://geoda.ai/

From https://www.esri.com/en-us/capabilities/geoai/overview

Things to Consider with GeoAI

- **Algorithm Bias**
- **Misinformation**
- **Dominance by Big Tech**
- **Power Consumption**
- **Privacy & Surveillance**



By JPxG - DALL-E 3, Public Domain, https://commons.wikimedia.org/w/index.php?curid=144161107

From https://en.wikipedia.org/wiki/Artificial_intelligence#Ethics

Many Definitions of Spatial and Computational Thinking

"**Spatial thinking** is a skill used in everyday life, the workplace, and science to solve problems using concepts of space, visualization, and reasoning. By visualizing relationships of spatial structures in terms of locations, distances, directions, shapes, and patterns, we can understand and analyze the properties of objects and relationships between objects."

Learning to Think Spatially, *National Academy of Sciences Report in Brief*

Computational thinking is "a way of solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science"

Jeannette M. Wing, 2006, "Computational Thinking," *Communications of the ACM* 49(3):33-35.

Computational Thinking

Computational Thinking

```
sum = 0
for elem in list:
    sum += elem
print("sum is  ", sum)
```

“a way of solving problems, designing systems, and understanding human behavior ...”

Show video 9:58-16:50

Abstraction is key

Most important high-level thought process in computational thinking is the abstraction process.

Used in:

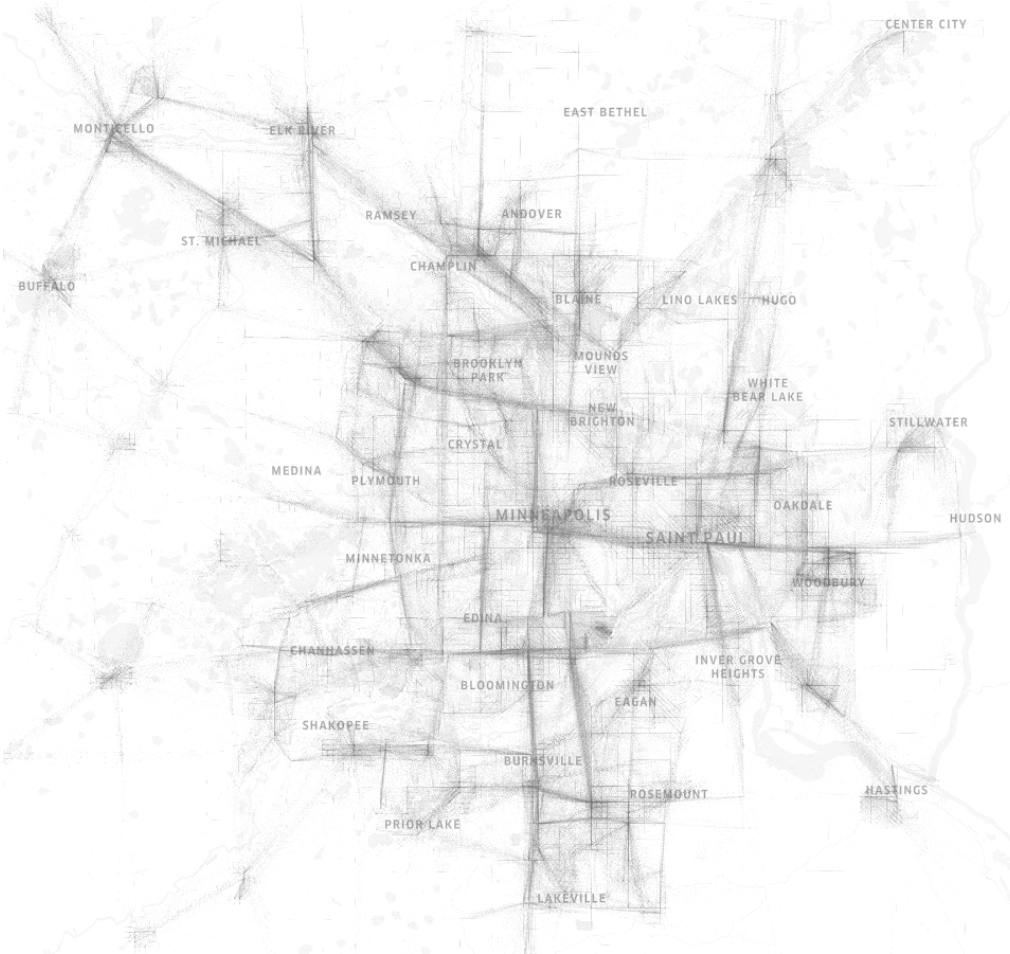
- Defining patterns
- Generalizing from specific instances
- Parameterization
- Capture essential and common properties

Source: Social Issues in Computing
http://socialissues.cs.toronto.edu/index.html%3Fp=279.html

Computational thinking gives us the power to scale and deal with complexity

Activity – Computation & Sankofa

- What is a way that computational thinking could help us better our local food system?
  - Take 5 minutes to complete #4 on the activity sheet
  - Share with your neighbor



BREAK!

(Please be back in 10 minutes)

Lab Time!

Please go to

https://github.com/RwHendrickson/SankofaClass/blob/main/Session03/LabInstructions.pdf

Github.com/RwHendrickson/SankofaClass

Thank you!