CyberGIS Center for Advanced Digital and Spatial Studies

University of Illinois at Urbana-Champaign

Social Media and Visualization

Human Mobility During A Pandemic: Chicago and the Illinois Stay At Home Order

Ben Liebersohn, Dr. Su Han, Mike Qin, Yuchen Zhang, Bin Peng

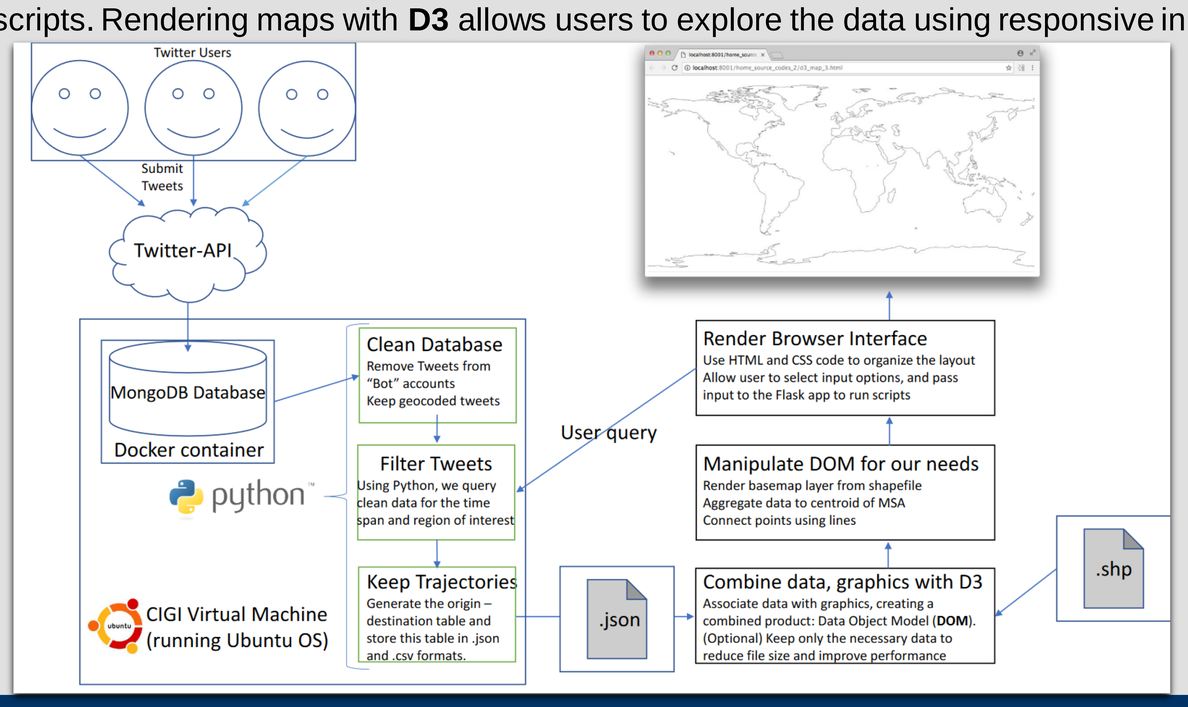
Goal: Collect data using Twitter API and visualize the spatiotemporal trajectories of Chicago residents and visitors before and after the stay-at-home order went into effect in Illinois on May 1, 2020.

Core components for research: Twitter API, MongoDB, Python, and D3.js

The Twitter API provides a real-time subsample of the Twitter social media platform. A **MongoDB** database store and organize the Twitter data in an efficient manner. Cleaning and querying of Twitter data is accomplished using **Python** scripts. Rendering maps with **D3** allows users to explore the data using responsive in a web browser.

Purpose

- Twitter API provides insight into human behavior
  - Tweets may contain precise latitude and longitude of the origin of a Tweet, as well as a time stamp when it was sent.
- Humans who chose to travel may transmit Covid-19 may spread highly infectious diseases to communities they visit.
  - This analysis can be used to validate and even detect changes in the changing ways in which public policy impacts the spread of the novel coronavirus



Workflow Overview and Example

Computational Resources

- Twitter Developer Platform
  - Twitter API App
- CIGI VM
  - Connected to NFS server
  - Ubuntu Linux OS
  - Docker Containers

Backend Interface

- Python 3 Code
  - CyberGISX Jupyter Notebook (in progress)
  - PyMongo library is used to interact with database systems using Python
- Node.js compiles the data we retrieve into a D3 and web browser friendly format

Web Interface

- HTML/CSS
- D3.js
- Flask

Data Storage

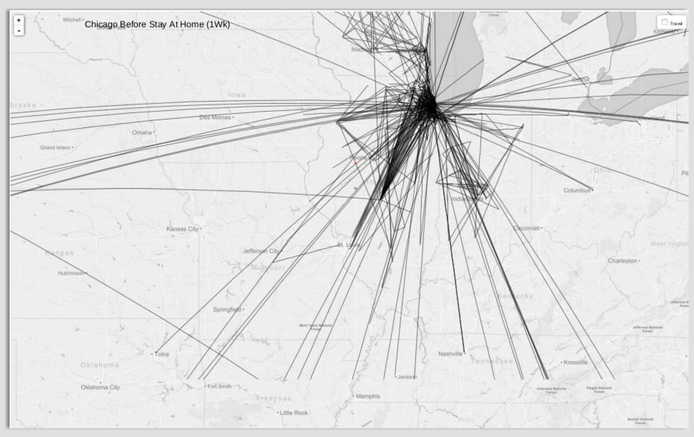
- MongoDB (collection)
- NFS Server (storage

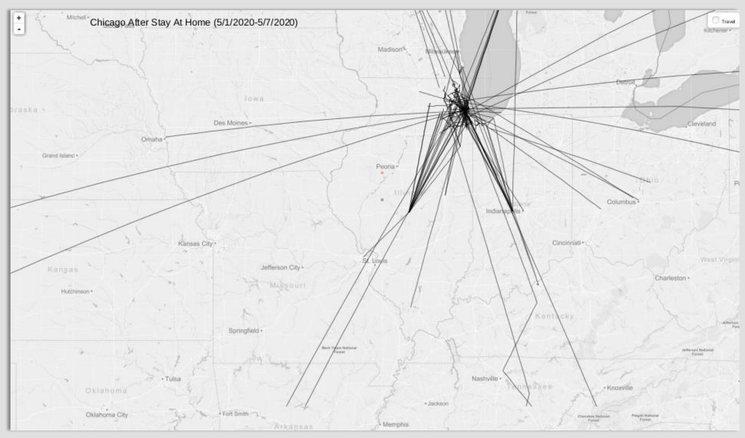
Reproducable Layers

- USA county map
- Histogram of cases
- Output from Python code is stored as a .js file
- Output is visualized on client side
- Docker Hub manages environments for data collection, processing

Geovisualization With D3.js

- D3 renders responsive and interactive maps in web browsers
- A user's points are plotted, and a line connects these points so that the destinations are connected to an origin
- D3 Example: Comparing one week's worth of Twitter API data from Chicago.





Twitter User Trajectories In The Week Before and The Week After The Stay-At-Home Order Goes Into Effect (May 1, 2020)
Left: Before, 4/24/2020 - 4/31/2020 Right: After, 5/1/2020 – 5/7/2020

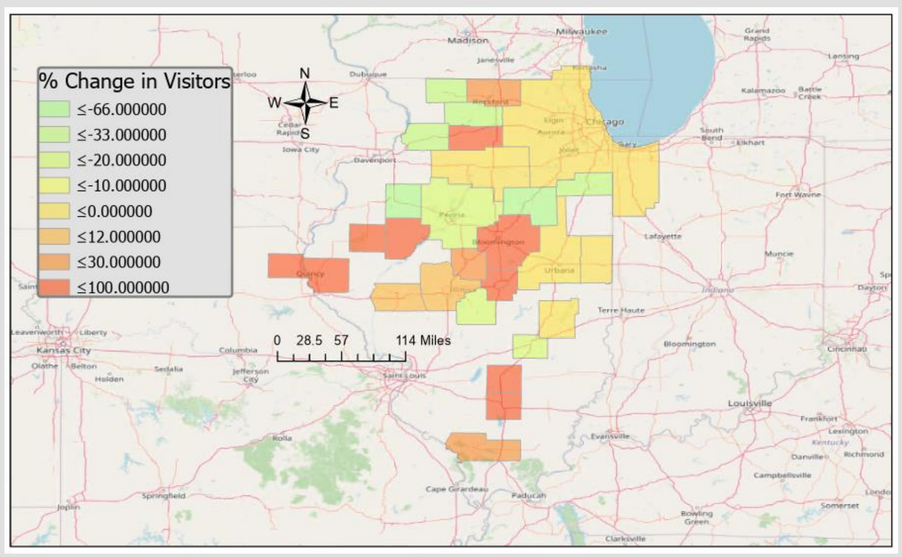
Covid-19 Case Study in Illinois and Results

Illinois Stay-At-Home Order: May 1st 2020

- Illinois Governor J.B. Pritzker effected a stay-at-home order in response to an alarming rise in the case numbers in Illinois.
- Analysis of the data provided by the Twitter API revealed **varying degrees of compliance** throughout Illinois by Twitter users who chose to either stay home or continue to travel throughout Illinois.
- Aggregating the weekly travel records in Illinois to the Metro Statistical Area (MSA) reveals the varying degrees of compliance in different regions of Illinois by **visitors** (visitors are Twitter users who mostly post Tweets from another MSA).
  - **Chicago-Naperville-Elgin MSA** and **Champaign-Urbana** MSA both saw a slight increase in visitors, increasing **+7.92% and +6.25%** respectively in the week after May 1, 2020, compared to the previous week.
- **Download the aggregated data and explore** regional, national and global patterns in Twitter users between April 24, 2020 and May 7, 2020; Search "Percent Change in Visitors by MSA, Spring 2020" on ArcGIS Cloud or go to https://arcg.is/nbKab0 (available only to University of Illinois users, or upon request)

Illinois State Area MSA Changes in Mobility, Spring 2020

- Some of the rural areas of Illinois did not see a decrease in visitors, and alarmingly, some saw a large increase.
- The percentage change in visitors who posted geotagged Tweets to Twitter continued in the Chicago-area MSA, even after the stay-at-home order went into effect on May 1, 2020.



Conclusion

- Mapping the origin and destinations, we can see clear changes in the range of mobility, with an overall decrease in range of mobility among all users in the Chicago area.
- The spread of Covid-19 through travelling visitors may have been slowed by the stay-at-home order.
- Compared with the previous week, some MSAs in Illinois saw up to 66% decreases in visitors, while others experienced up to 100% increases after May 1, 2020.
- The unknown representative-ness of Twitter users is a challenge for generalizability.

Acknowledgements: This poster layout was created with the help of the CyberGIS Center. We greatly appreciate the support from Kennith Patten and the entire SESE IT Support Team, and from Dr. Anand Padmanabhan from the CyberGIS Center for Advanced Digital and Spatial Studies, and the School of Earth, Society and Environment at the University of Illinois. Data was gathered from the Twitter API with their support. Additionally we thank Dr. Shaowen Wang and the entire CyberGIS Center for their support, which has made this research possible.

Contact: Ben Liebersohn • University of Illinois at Urbana-Champaign • bliebe3@illinois.edu • http://cybergis.illinois.edu