Spatiotemporal Analysis of COVID-19 Tweet Trends in Subnational Areas of the United States

Presenter:

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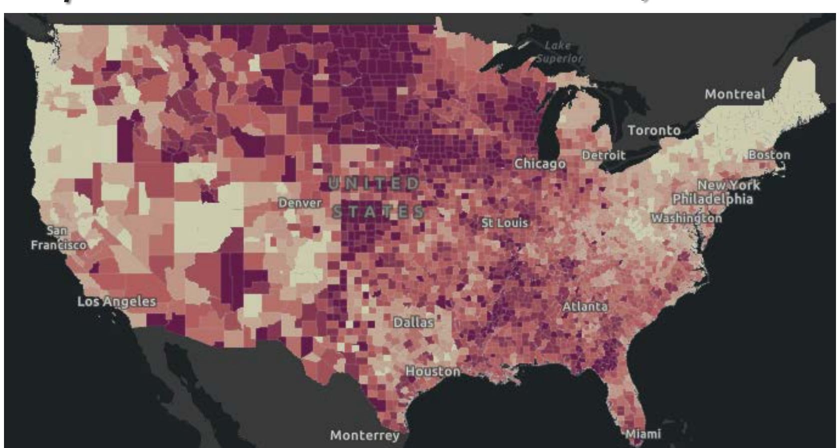
Background

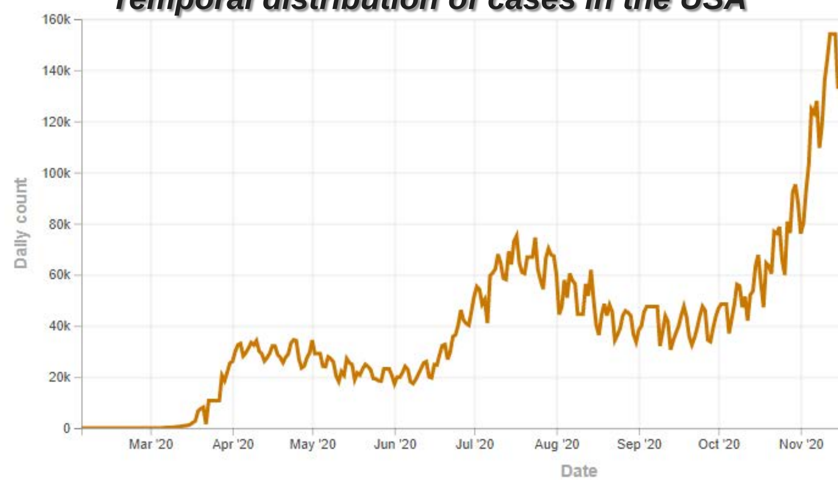
- COVID-19 infection is not evenly distributed across time and space
- At the population level, areas/times with high infection rates are likely to be preceeded by low levels of preventive behaviors, and low levels of preventive behaviors are likely to be preceeded by low concern relating to COVID-19
- The objective of this study was to describe the spatiotemporal distribution of COVID-19 tweets in the United States as a proxy for COVID-19 concern

Spatial distribution of cases in the USA, Nov 25th



From Johns Hopkins University

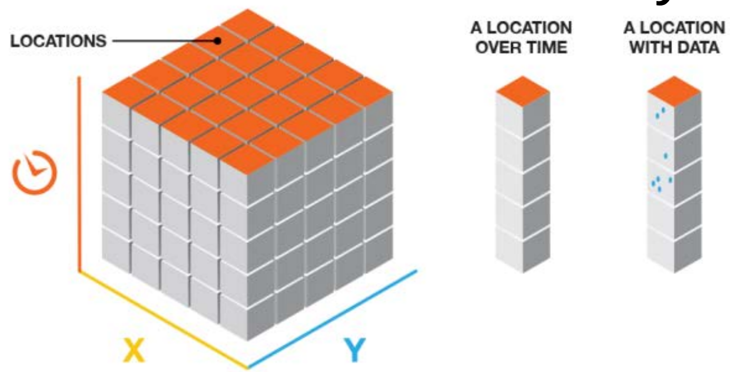
Temporal distribution of cases in the USA



From University of Washington

Methods

- Tweets with COVID-19 keywords and spatial coordinates from March 3rd to April 13th were collected using the Twitter API
  - corona outbreak, corona, anticorona, coronavirus, Wuhan virus, COVID, Wuhan pneumonia, and pneumonia of unknown cause
- A subset of tweets in a separate study manually coded for first-hand experience with COVID-19 was used to train a machine learning classifier (SVM), which was used to remove less relevant tweets
- The C3 algorithm of the Early Aberration Reporting System was used to detect statistically significant aberrations in tweets by state
- We created choropleth map of COVID-19 tweets in the study timeframe
- A space-time cube was computed to relay concurrent spatiotemporal distribution via Emerging Hot Spot Analysis



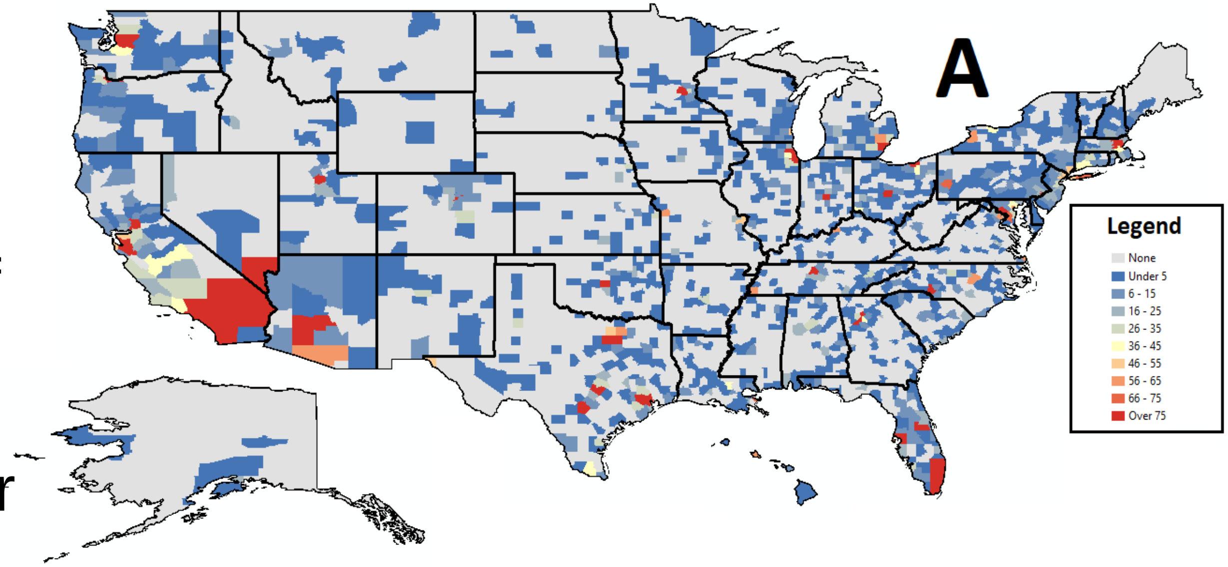
From ESRI

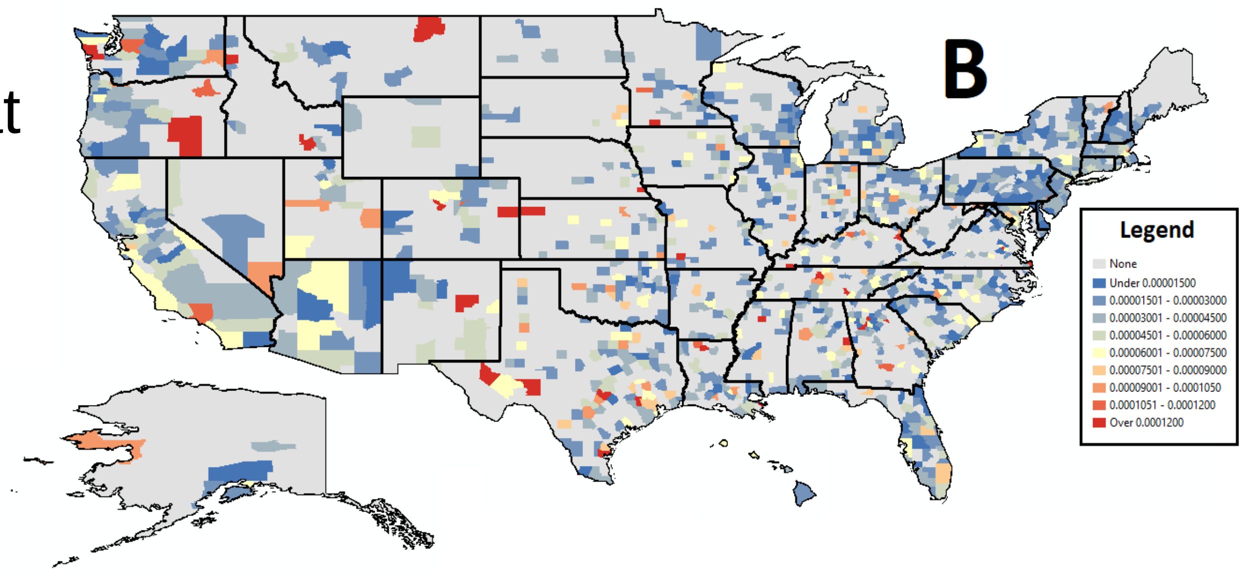
Results

State	Tweets per Day	Aberrant Dates
Alabama	147	27-Mar, 28-Mar
Alaska	31	
Arizona	357	
Arkansas	49	28-Mar, 29-Mar, 30-Mar, 31-Mar
California	2346	
Colorado	196	
Connecticut	140	
Delaware	47	
Florida	1101	
Georgia	515	30-Mar
Hawaii	69	
Idaho	49	29-Mar, 1-Apr, 2-Apr
Illinois	474	
Indiana	226	
Iowa	93	3-Apr, 4-Apr
Kansas	98	
Kentucky	173	
Louisiana	215	
Maine	42	
Maryland	336	
Massachusetts	334	
Michigan	314	
Minnesota	177	31-Mar, 1-Apr
Mississippi	72	29-Mar, 30-Mar
Missouri	215	29-Mar, 30-Mar
Montana	24	19-Mar, 23-Mar
Nebraska	70	7-Apr
Nevada	214	
New Hampshire	49	
New Jersey	351	
New Mexico	72	28-Mar
New York	1264	7-Apr
North Carolina	368	
North Dakota	15	
Ohio	450	1-Apr, 2-Apr, 3-Apr, 4-Apr
Oklahoma	106	25-Mar
Oregon	183	
Pennsylvania	513	
Rhode Island	47	3-Apr, 4-Apr
South Carolina	169	
South Dakota	17	
Tennessee	294	
Texas	1495	
Utah	106	
Vermont	19	
Virginia	399	19-Mar, 20-Mar, 23-Mar
Washington	380	
West Virginia	42	2-Apr
Wisconsin	146	
Wyoming	8	

Results (2/3)

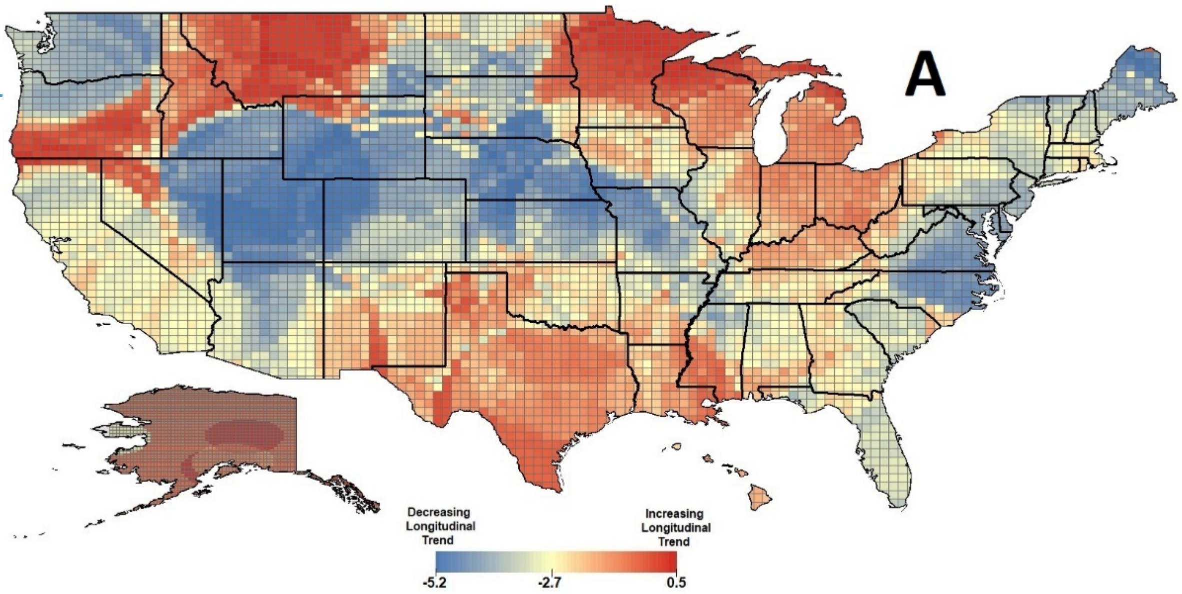
- This figure shows, at the county-level, the total number of tweets **(A)** and the population-normalized number of tweets **(B)**
- After population normalization, spatial clustering at the county level is unclear

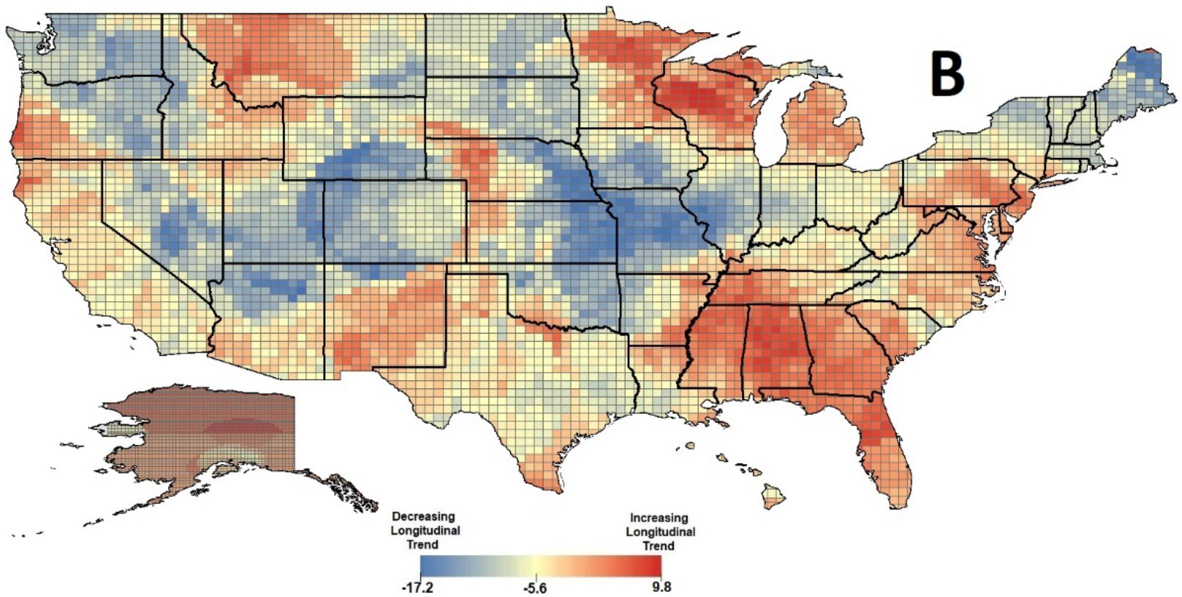




Results (3/3)

- This figure shows, at 2500 square-kilomerter intervals, *z* scores for the trend in hot/cold spot of total tweets **(A)** and *z* scores after population normalization **(B)**
- These figures suggest relatively consistency in tweets about COVID-19 from most major metropolitan areas





Discussion

- Tweet amounts:
  - 173,847,058 tweets with COVID-19 keywords globally
  - 1,244,478 of these had geospatial information
  - 698,794 were from the United States
  - 17,841 were chosen by machine learning classifier
- Longitudinal analysis uncovered a relative spike in tweets about COVID-19 around March 29th for predominantly rural areas within the United States.
- Normalized space-time cubes suggest that areas in the southeastern US had increasing trends, likely due to lower levels of engagement with the COVID-19 topic earlier in the study time period

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Conflict of Interest
The authors declare no conflicts of interest.

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