CPGIS Educational Webinars on Spatiotemporal Study of Urban Dynamics (2)

Co-sponsors:

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Journal of Computational Urban Science

"Computational Urban Science", Dr. Xinyue Ye, Texas A&M University

Chair: Qiusheng Wu, University of Tennessee, Knoxville

9:00 PM-10:00 PM, Thursday, March 11, 2021 (US EDT)

Computational Urban Science

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Communities in the 21st Century

- How can science improve forecasts and make predictions about the **future** states of rural, suburban, and urban systems?
- What **theories** explain the structure and function of communities in the 21st Century and what are the critical drivers of change?
- What aspects and intersections of social, built, and natural systems influence the resilience and sustainability of communities and the well-being of the **people** living in them?
- How can successful innovations in one community be **transferred** to others?
- How can integrative research along with **community engagement** improve the quality of life in communities?

https://www.nsf.gov/ere/ereweb/c21c/index.jsp

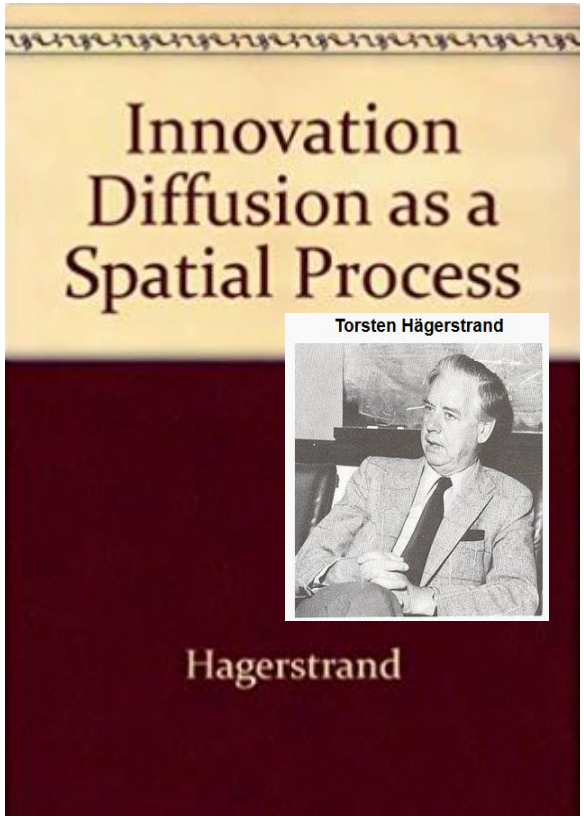
Computational Urban Science: Four Layers

- Human dynamics-centered Urban Science
- Platform-based Urban Science
- Action-oriented Urban Science
- Convergence-driven Urban Science
- Interpret, Manage, and Build

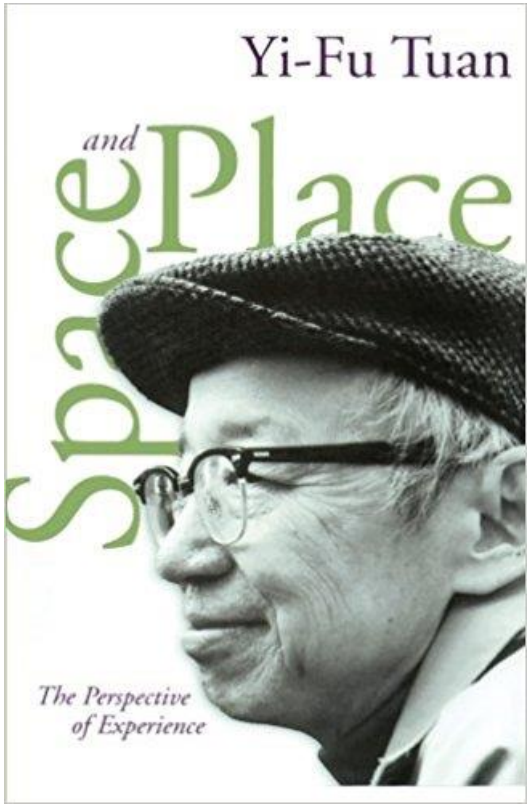
Computational Urban Science: Four Layers

- **Human dynamics-centered Urban Science (Geographical Perspective)**
- Platform-based Urban Science (Computer Science Perspective)
- Action-oriented Urban Science (Urban Planning Perspective)
- Convergence-driven Urban Science (Synthetic Perspective)

People, Place, and **Space**



Hägerstrand (1953)

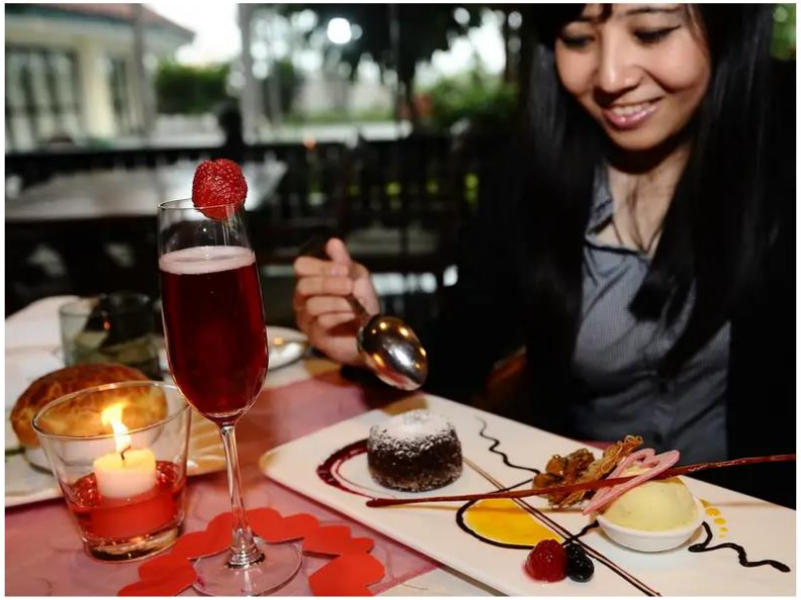


Tuan (1977)

You're now on the internet more than you aren't on the internet, instead of just using it for school or work.

The internet is currently a constant part of our lives. iStock/SolisImages

Eating at a restaurant has become a social experience.



It has to look good too. Robertus Pudyanto/Getty Images

You can no longer go on vacation and truly take a break from everything.

You can never really get off the grid these days. mihakonceptcorn/ iStock

You now take photos on your cell phone instead of a film camera.

Lots of pictures are taken on smartphones. REUTERS/Jason Reed

https://www.insider.com/how-life-has-changed-in-the-last-20-years-2018-12#youre-now-on-the-internet-more-than-you-arent-on-the-internet-instead-of-just-using-it-for-school-or-work-1

nature

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nature › letters › article

Published: 12 May 2005

The origin of bursts and heavy tails in human dynamics

Albert-László Barabási

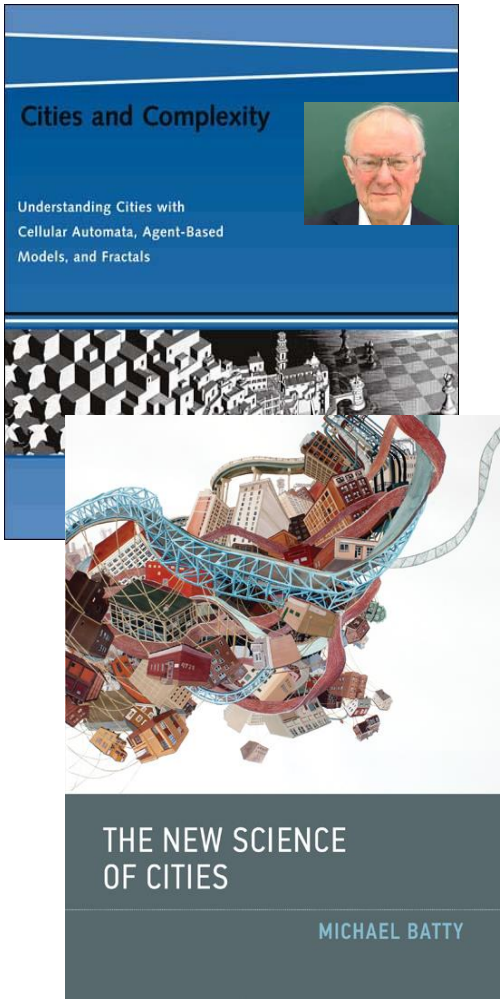
Nature **435**, 207–211(2005) | Cite this article

2366 Accesses | **1284** Citations | **49** Altmetric | Metrics

The dynamics of many social, technological and economic phenomena are driven by individual human actions, turning the quantitative understanding of human behaviour into a central question of modern science.

https://barabasi.com/about/contact-barabasi-lab

Network and Flow

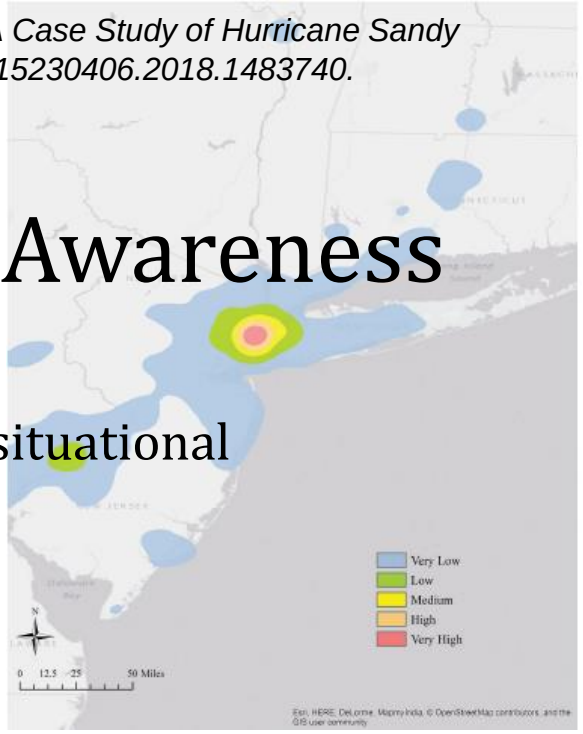


From a centralized, top-down approach to a **decentralized, bottom-up** perspective (Batty 2005).

To **understand cities** we must view them not simply as places in space but as **systems of networks and flows** (Batty 2013).

Wang, Z. & Ye, X. (2018) Space, Time, and Situational Awareness in Natural Hazards: A Case Study of Hurricane Sandy with Social Media Data. Cartography and Geographic Information Science. doi: 10.1080/15230406.2018.1483740.*

Space, Time, and Situational Awareness



New York

Social responses in social media data: damage reports, situational announcements, and help requests.

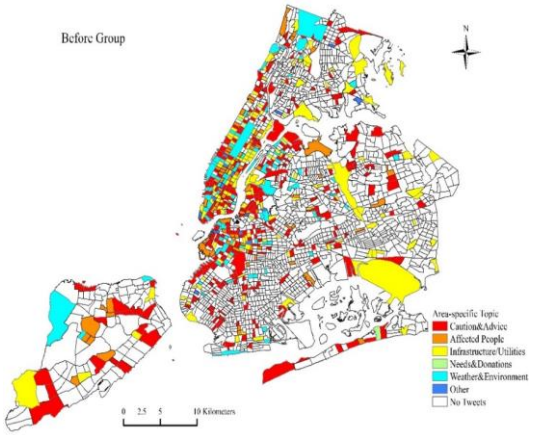
Goals:

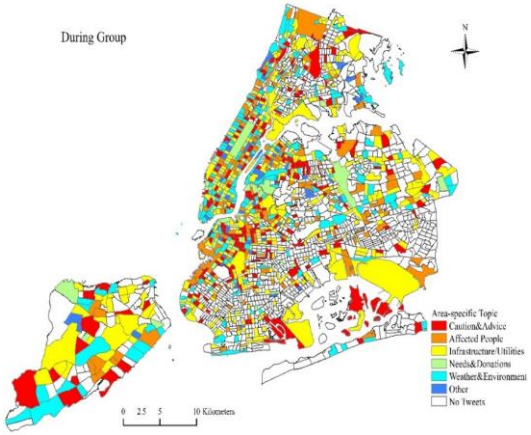
- Capture the spatial concentration and specialization of social responses to a disaster.
- investigate how the spatial concentration of topics changes before, during, and after a disaster.

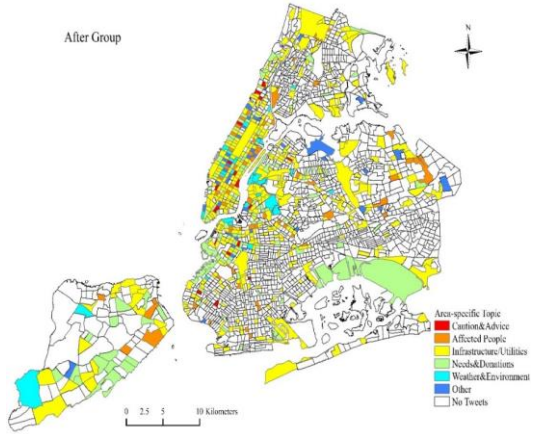
Category	Description
Caution and Advice	Tweets referring to warnings, preparation, advice, and tips (Imran et al. 2015).
Affected People	Tweets referring to people trapped, injured, missing, and killed (Imran et al. 2015).
Infrastructure/Utilities	Tweets referring to infrastructure damage, services closure, built environment, and collapsed structure (Imran et al. 2015).
Needs and Donations	Tweets referring to donations, volunteering, relief, and fundraising (Imran et al. 2015).
Weather and Environment	Tweets referring to weather conditions and environment.
Other	Tweets not referring to any of the previous categories (Imran et al. 2015).

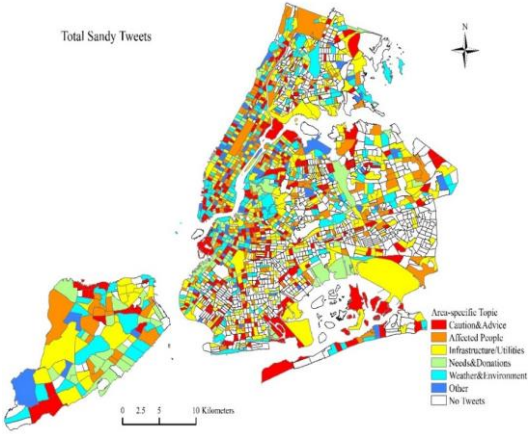
Results

Topics	Total Number	Total Percent	Before Number	Before Percent	During Number	During Percent	After Number	After Percent
Caution & advice (A)	1898	21.2%	1048	63%	833	15.1%	17	0.9%
Affected people (B)	582	6.5%	117	7%	386	7%	79	4.4%
Infrastructure/utilities (C)	4523	50.4%	368	22.1%	2819	51.2%	1336	74.1%
Needs & donations (D)	414	4.6%	8	0.5%	129	2.3%	277	15.4%
Weather & environment (E)	1395	15.5%	105	6.3%	1259	22.9%	31	1.7%
Other (F)	160	1.8%	18	1.1%	78	1.4%	64	3.5%









The transition probability matrix for area-specific topics from *Before* to *During*

Before \ *During*	A	B	C	D	E	F	G
A	*17.73%*	12.49%	16.90%	5.69%	19.97%	4.02%	**23.20%**
B	**18.63%**	7.64%	18.42%	20.67%	*17.38%*	5.70%	11.56%
C	13.36%	12.83%	**22.41%**	10.42%	*16.69%*	4.12%	20.16%
D	8.97%	*20.23%*	0.00%	6.95%	29.72%	0.00%	**34.14%**
E	11.81%	*17.39%*	**25.06%**	13.26%	17.95%	4.01%	10.52%
F	12.02%	11.12%	6.37%	**29.07%**	*13.15%*	25.67%	2.61%
G	*8.11%*	7.35%	16.09%	1.75%	7.85%	1.46%	**57.38%**
Total	10.59%	9.05%	17.05%	4.58%	*11.30%*	2.51%	**44.92%**

The transition probability matrix for area-specific topics from *During* to *After*

During \ *After*	A	B	C	D	E	F	G
A	1.03%	2.49%	27.51%	*13.04%*	2.22%	7.64%	**46.06%**
B	0.94%	*9.79%*	29.93%	8.55%	1.75%	2.05%	**46.98%**
C	1.02%	5.84%	26.10%	*6.66%*	1.54%	0.81%	**58.02%**
D	4.81%	4.45%	**39.41%**	10.17%	*5.96%*	4.35%	30.86%
E	1.22%	3.01%	29.00%	*9.70%*	3.60%	1.66%	**51.83%**
F	0.00%	7.64%	**37.99%**	5.93%	0.00%	*12.19%*	36.24%
G	0.03%	1.21%	9.76%	*3.07%*	0.17%	0.72%	**85.05%**
Total	0.74%	3.42%	20.49%	*6.38%*	1.41%	2.15%	**65.41%**

The transition probability matrix for area-specific topics from *Before* to *After*

Before \ *After*	A	B	C	D	E	F	G
A	1.60%	5.52%	29.76%	*10.30%*	1.45%	3.21%	**48.17%**
B	1.94%	6.55%	**36.58%**	*18.28%*	5.58%	6.14%	24.93%
C	2.68%	6.22%	28.58%	*9.88%*	5.40%	5.46%	**41.78%**
D	6.95%	29.72%	0.00%	0.00%	*20.23%*	8.97%	**34.14%**
E	0.00%	6.25%	**43.40%**	*14.74%*	1.78%	3.13%	30.71%
F	6.26%	0.00%	**29.54%**	1.07%	*13.15%*	29.38%	20.62%
G	0.21%	2.14%	15.03%	*3.88%*	0.42%	0.89%	**77.44%**
Total	0.74%	3.42%	20.49%	*6.38%*	1.41%	2.15%	**65.41%**

Computational Urban Science: Four Layers

- Human dynamics-centered Urban Science (Geographical Perspective)
- **Platform-based Urban Science (Computer Science Perspective)**
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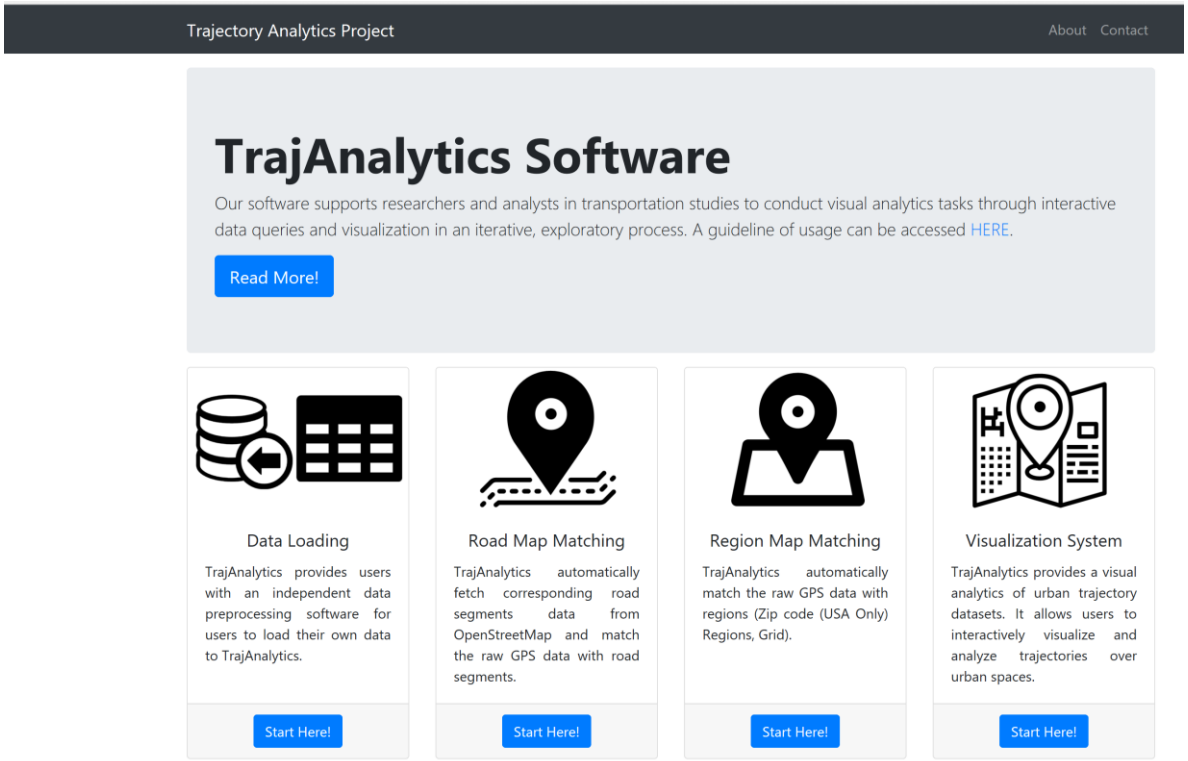
- Convergence-driven Urban Science (Synthetic Perspective)

Trajectory Visual Analytics Platform

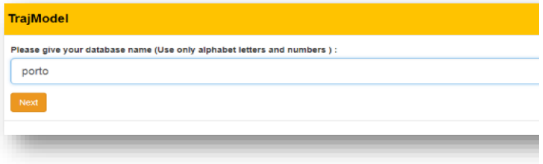


Procedure

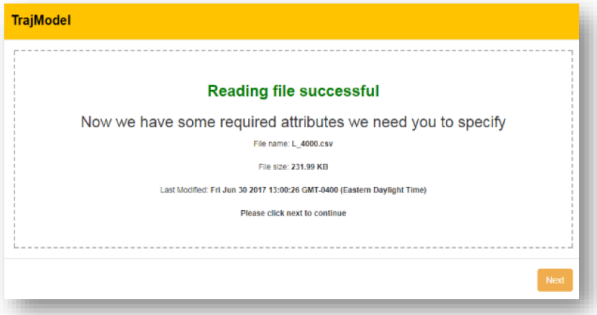
A. Data Loading

1. Input a user name.

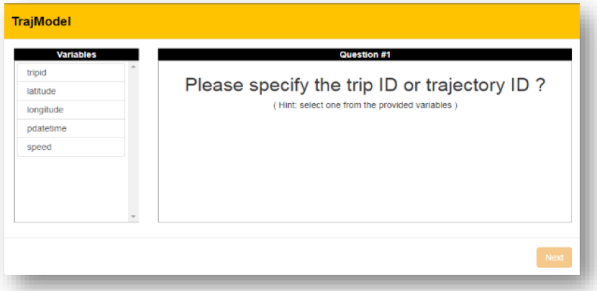
2. Input a database name.

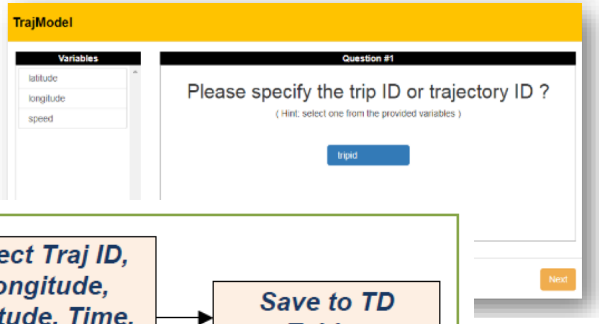


3. Raw CSV file uploading.

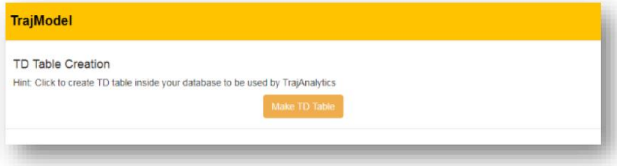


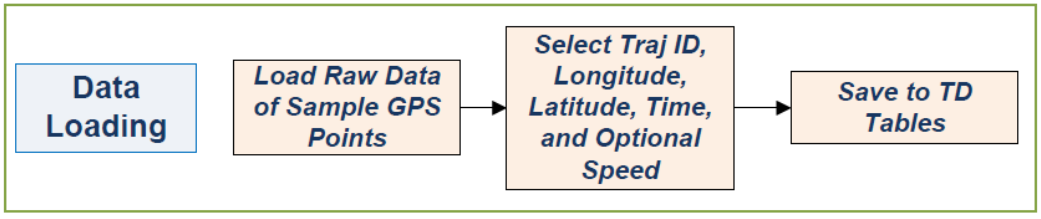
4. Select and match attributes.





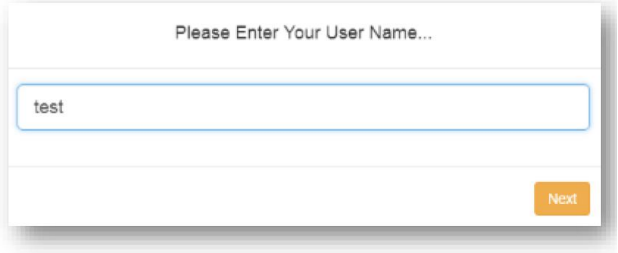
5. Save TD tables.



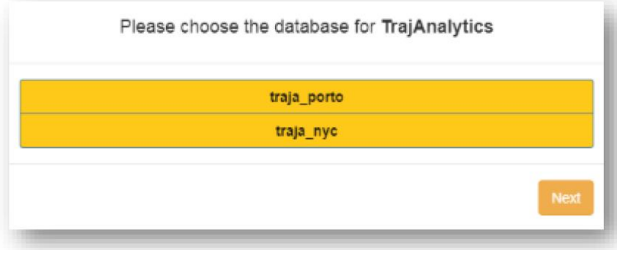


B. Street-Based Map Matching

1. Input a user name.

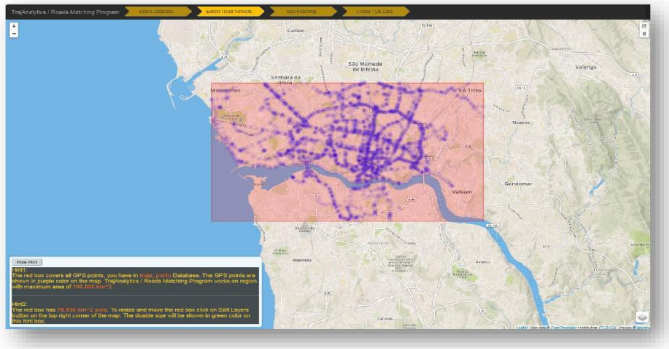


2. Select a database.

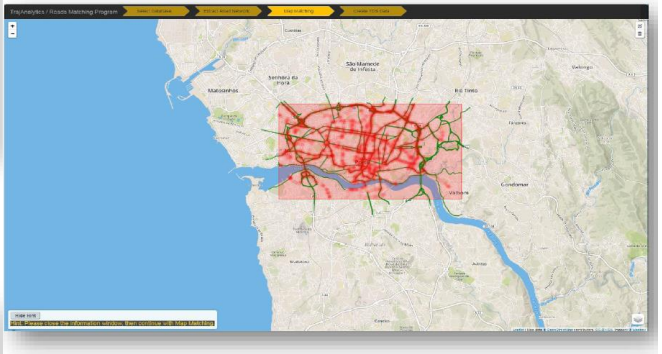


Procedure

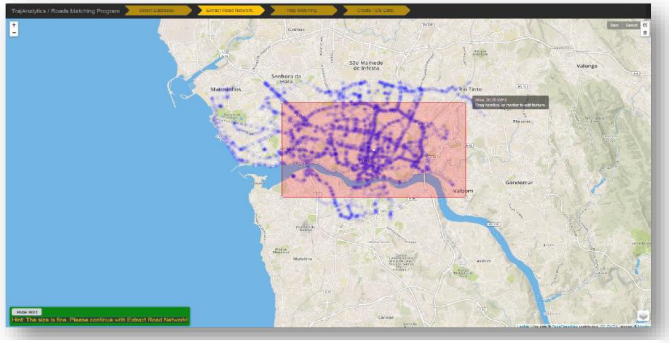
3. Display heatmap and bounding box of all sample points



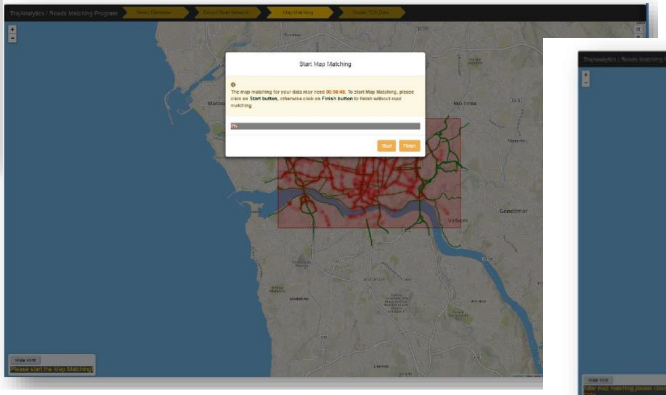
Download street network from OSM

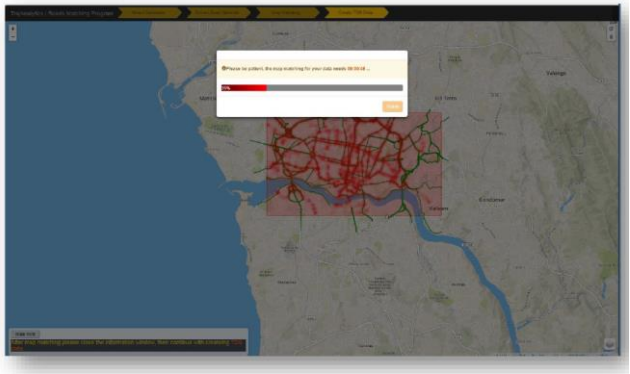


4. User edit and select of working region bounding box.

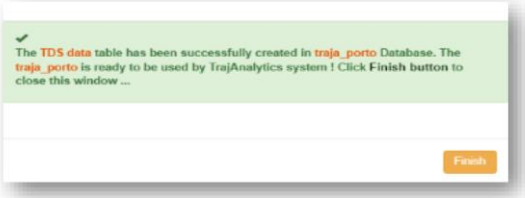


Do Map Matching.





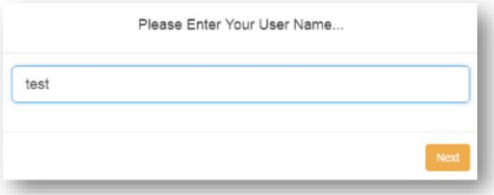
7. Create TDS table in TrajBase.



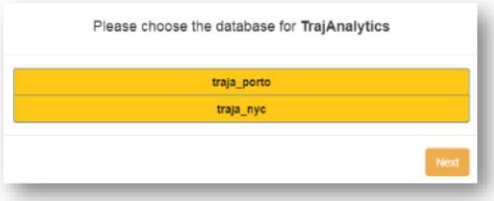
C. Region-Based Map Matching

Procedure

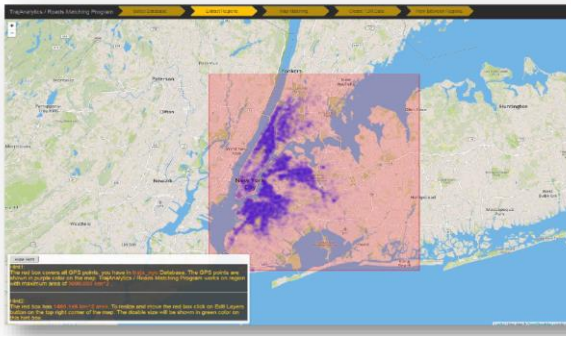
1. Input a user name.



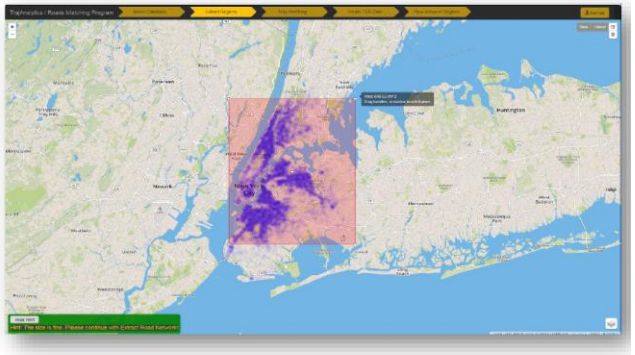
2. Select a database.



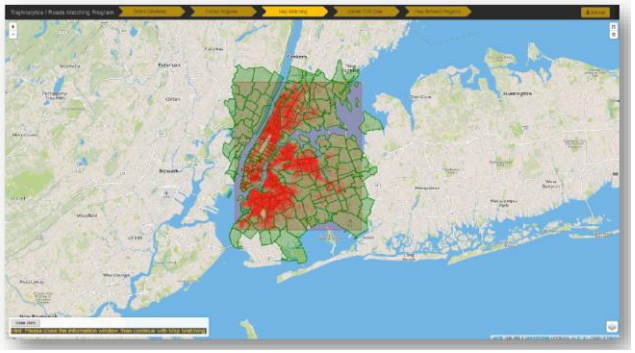
3. Display heatmap and bounding box of all sample points.



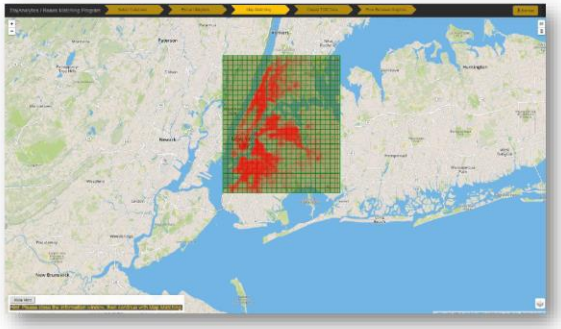
4. User edit and select of working region bounding box.



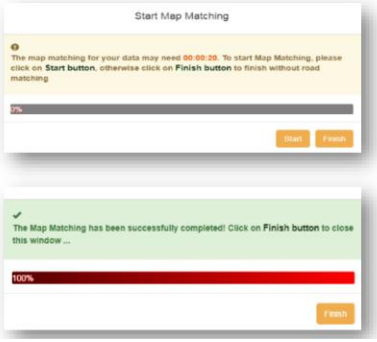
5. Zipcode based area division.



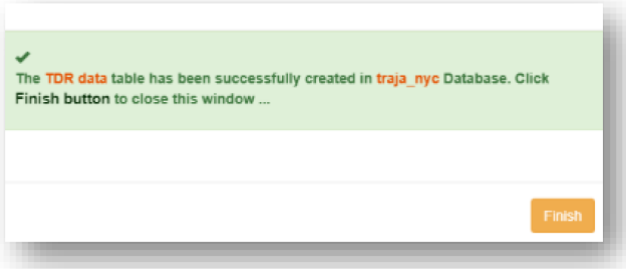
6. Grid based area division.



7. Do Map Matching.



8. Create TDR table in TrajBase.



Procedure

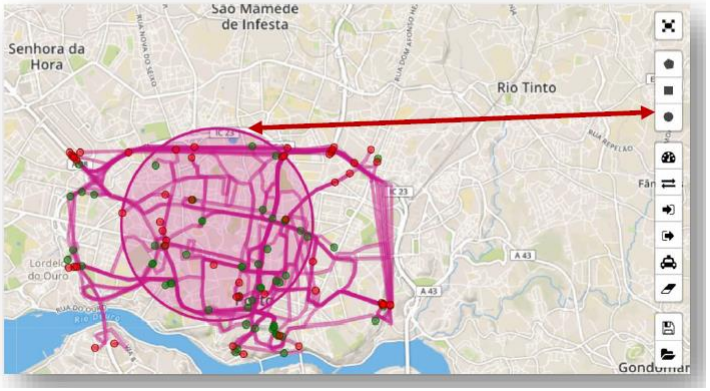
1. Input a user name.

2. Select a database and table

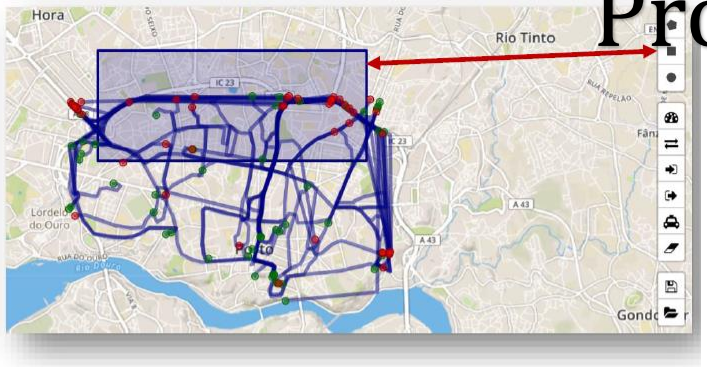
3. Prepare a set of visualization and interaction tools according to the types of data tables (TD, TDS, TDR)

Procedure

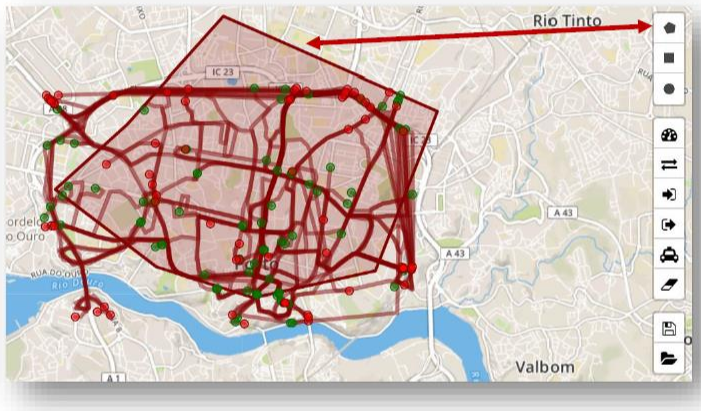
1. Specify query area
   a. Query by drawing circle on map



   b. Query by drawing rectangle on map



   c. Query by drawing arbitrary polygon on map



   d. Query by loading pre-defined shapes from file

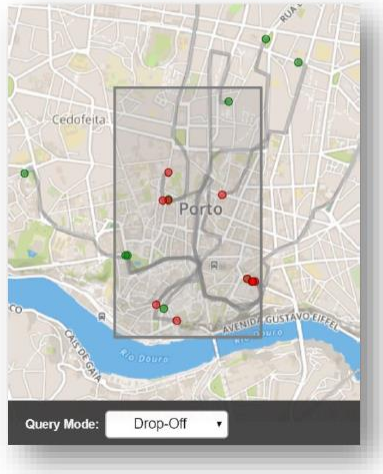
Procedure

2. Specify query time period

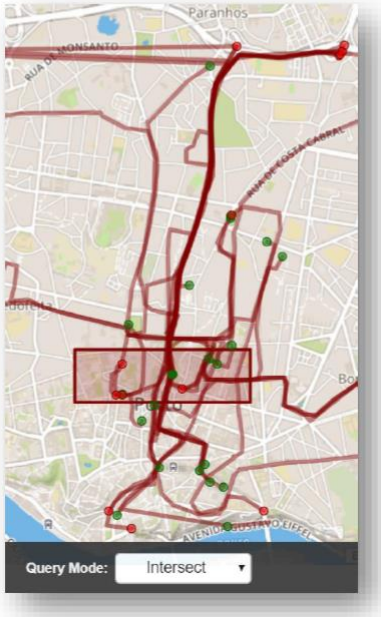
3. Specify query conditions

   a. Query trips starting from the region

   b. Query trips ending at the region



   c. Query trips traversing region



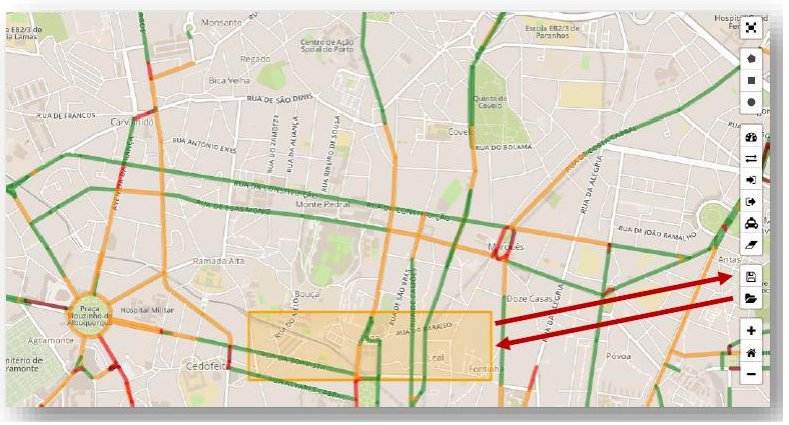
Kamw, F., AL-Dohuk, S., Zhao, Y., Eynon, T., Sheets, D., Yang, J., Ye, X., & Chen, W. (2018) Urban Structure Accessibility Modeling and Visualization for Joint Spatiotemporal Constraints. IEEE Transactions on Intelligent Transportation Systems. doi: 10.1109/TITS.2018.2888994

Ye, X., Du, J., Gong, X., Zhao, Y., AL-Dohuki, S., & Kamw, F. (2020) SparseTrajAnalytics: An Interactive Visual Analytics System for Sparse Trajectory Data. Journal of Geovisualization and Spatial Analysis. doi: 10.1007/s41651-020-00068-1

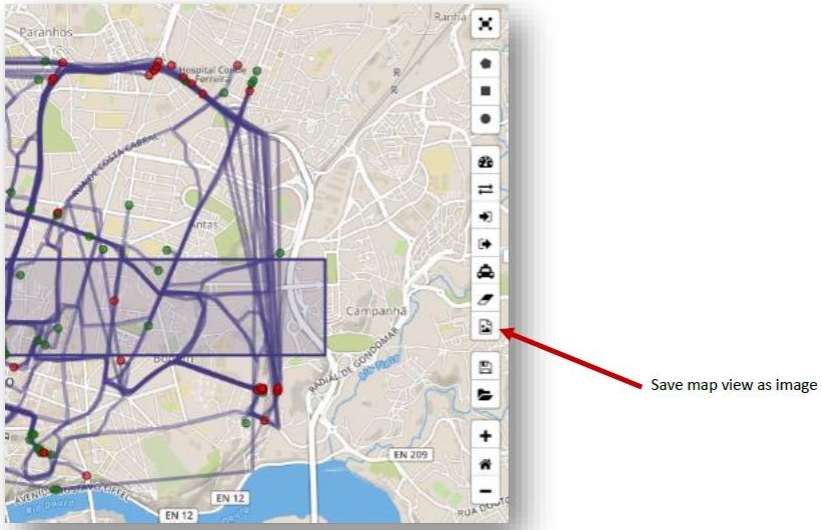
Procedure

2. Save lists as (.csv) file

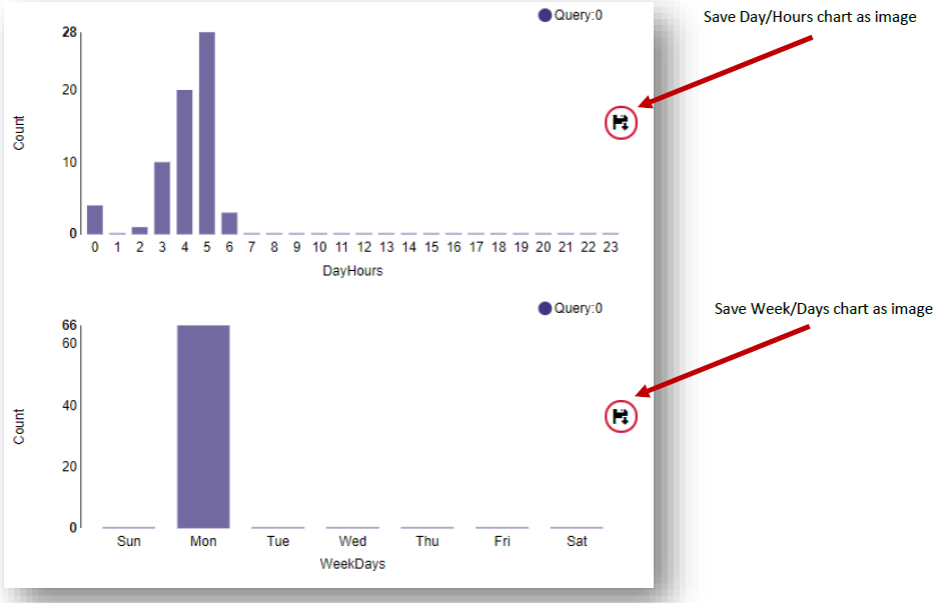
Save Query Results for Reuse and Sharing

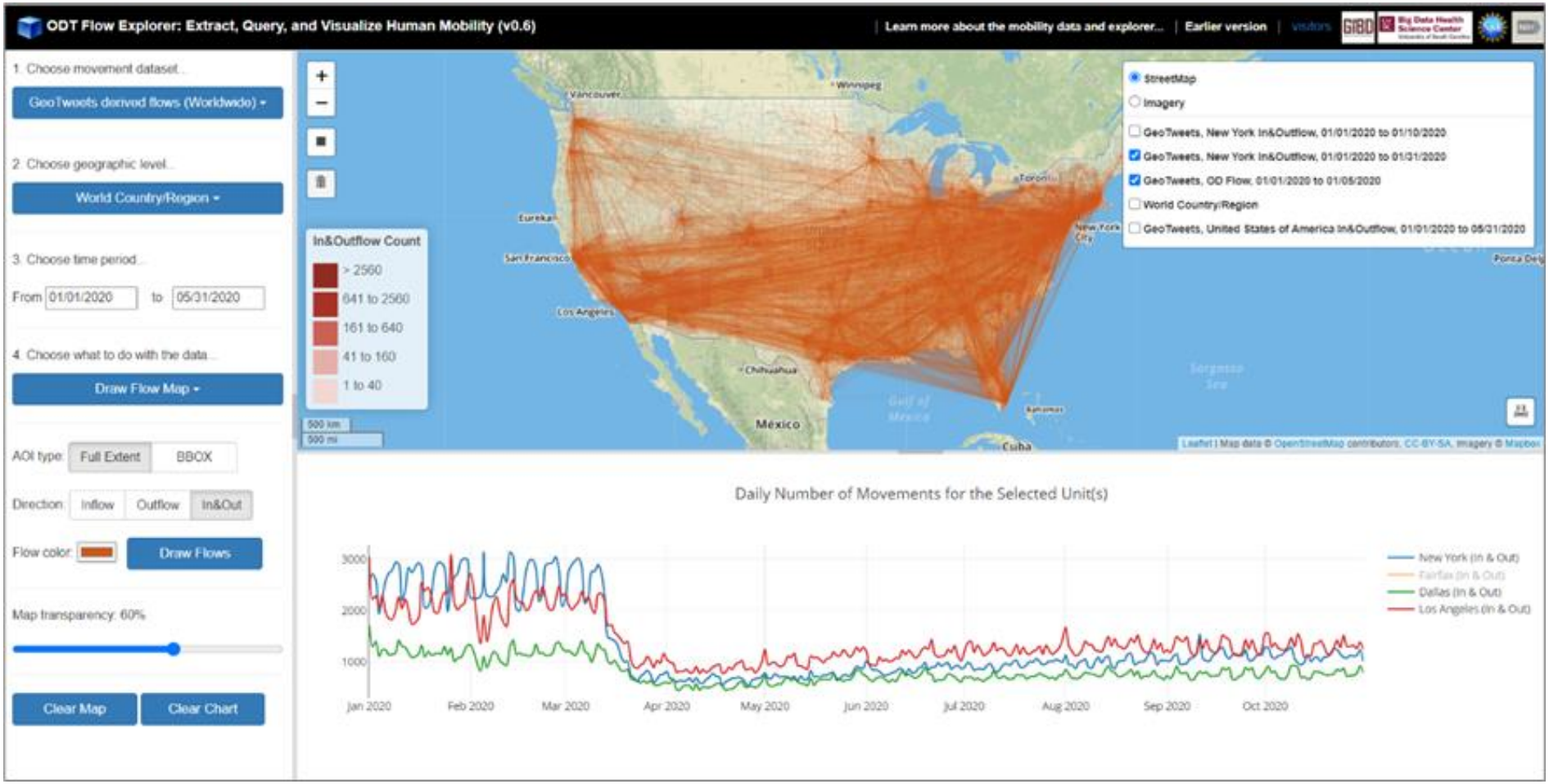


3. Save map view as image



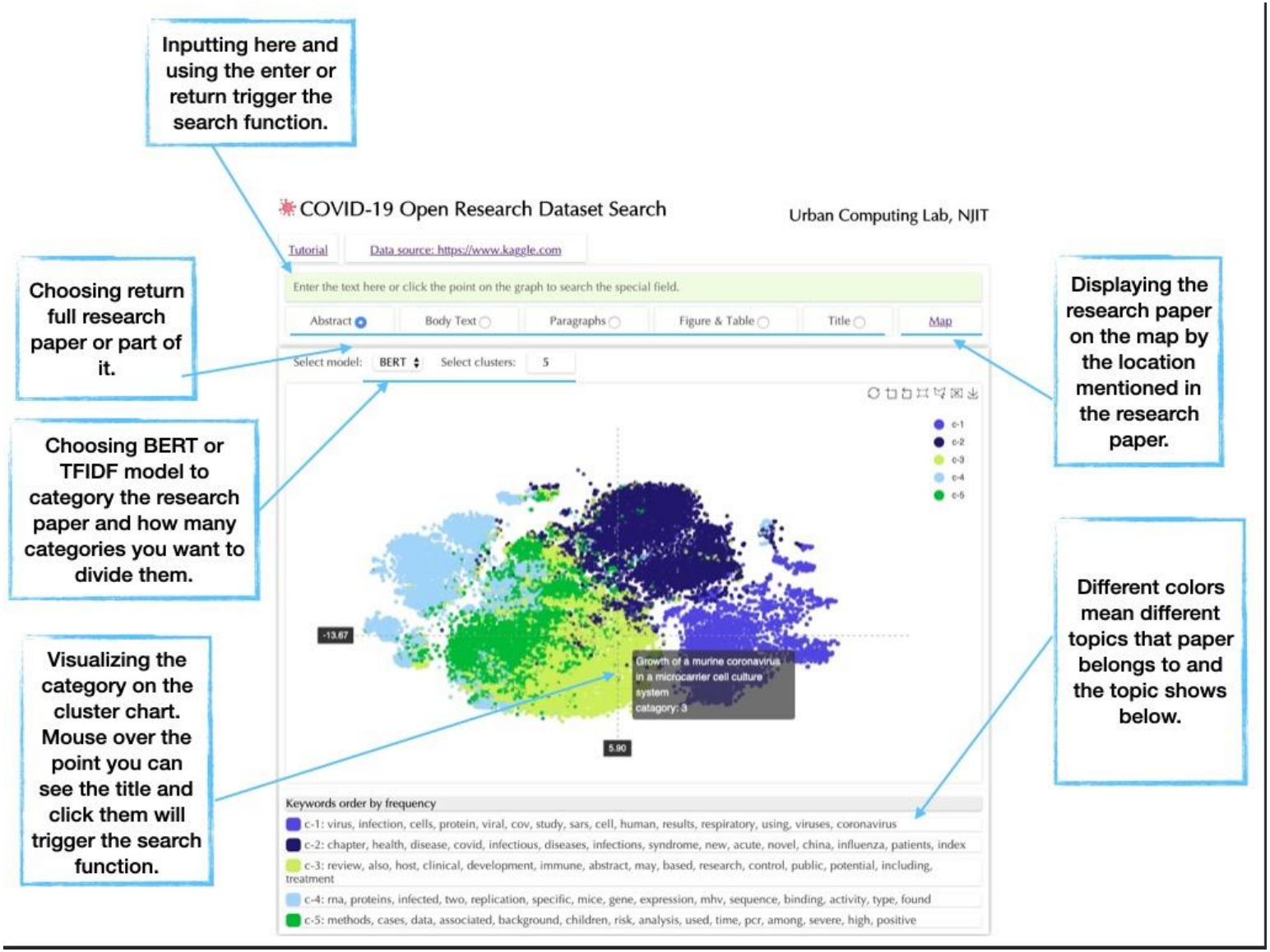
1. Save charts as image

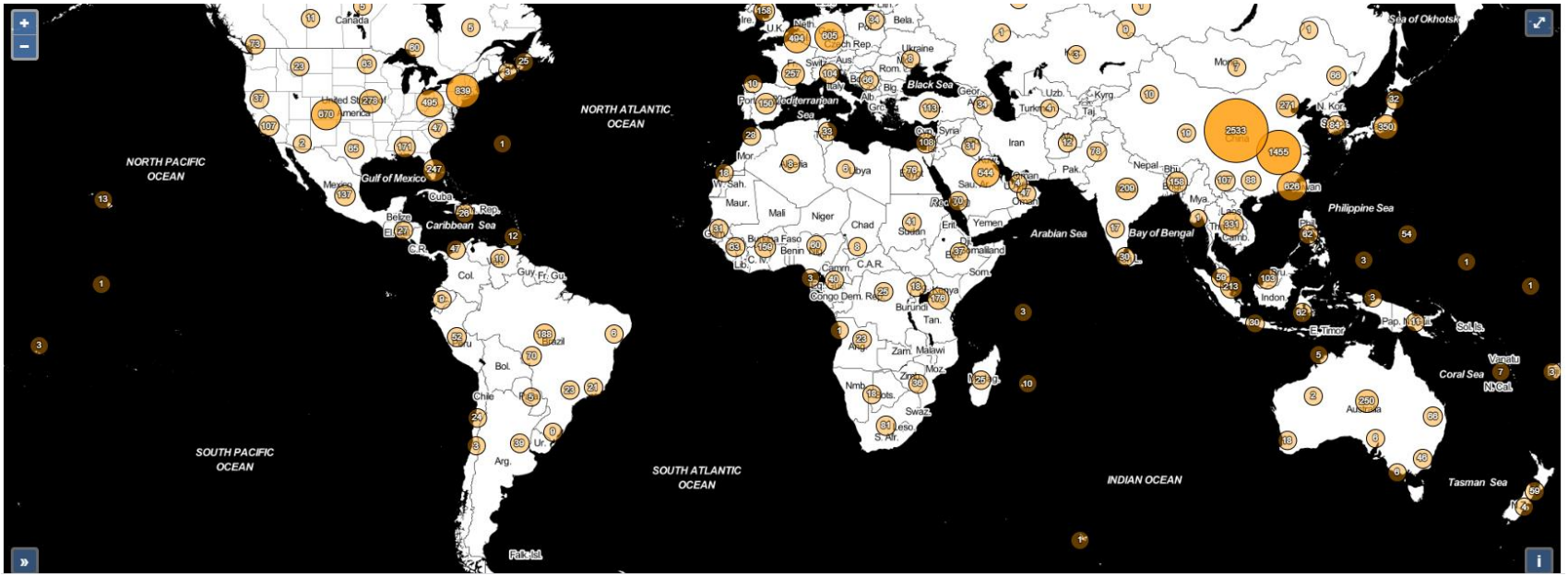


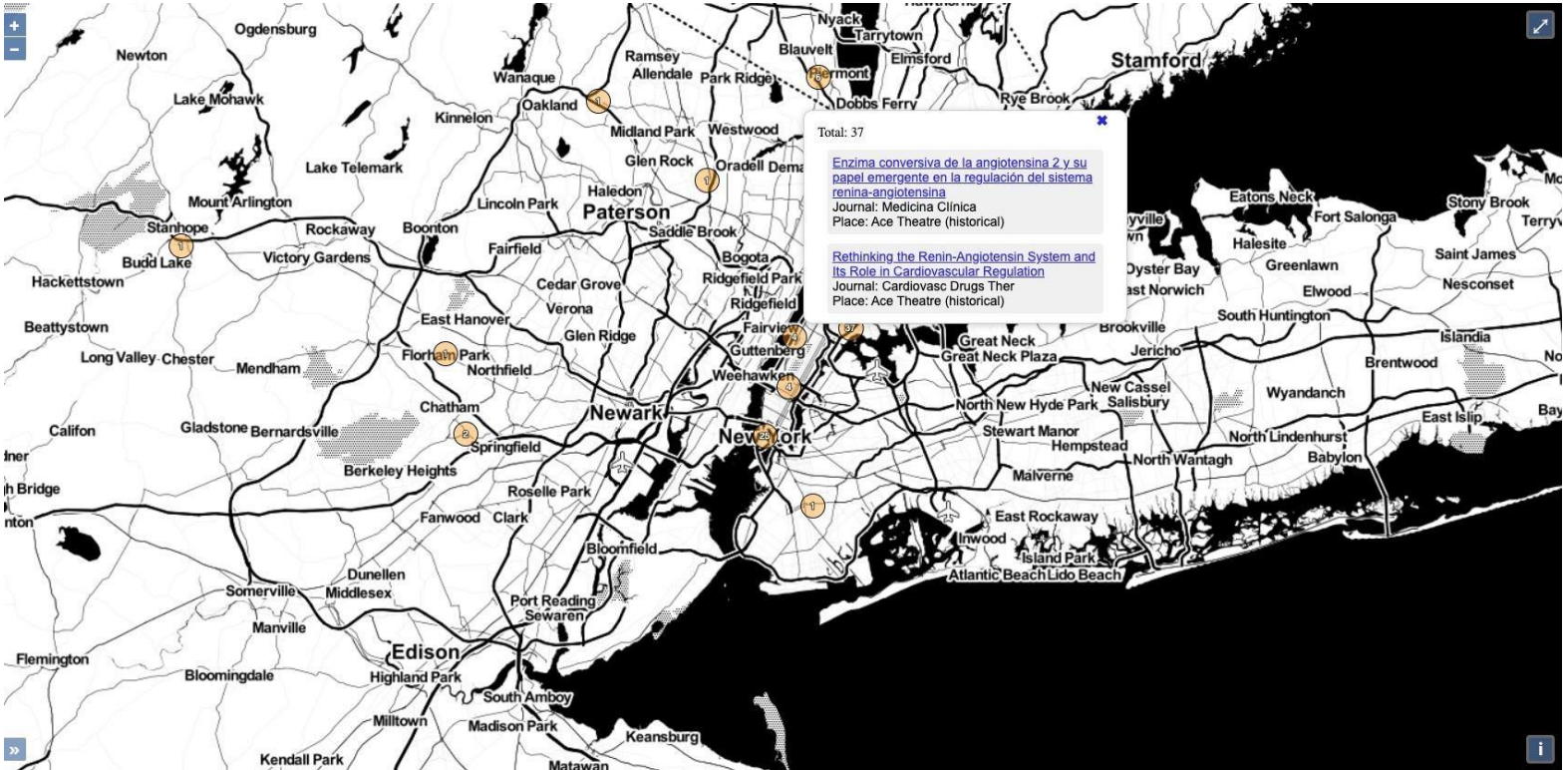


Li, Z., Huang, X., Ye, X., & Li, X. (2020). ODT flow explorer: Extract, query, and visualize human mobility. arXiv preprint arXiv:2011.12958.

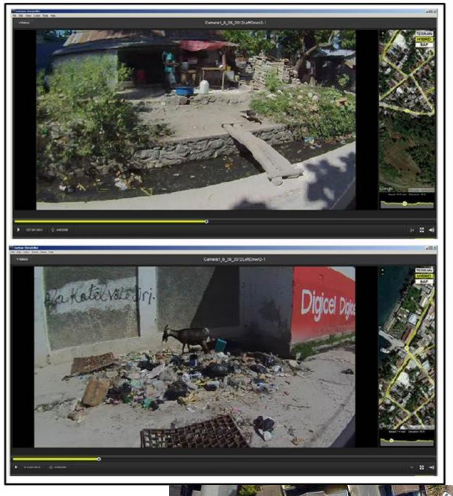
242,164 scholarly article on covid-19

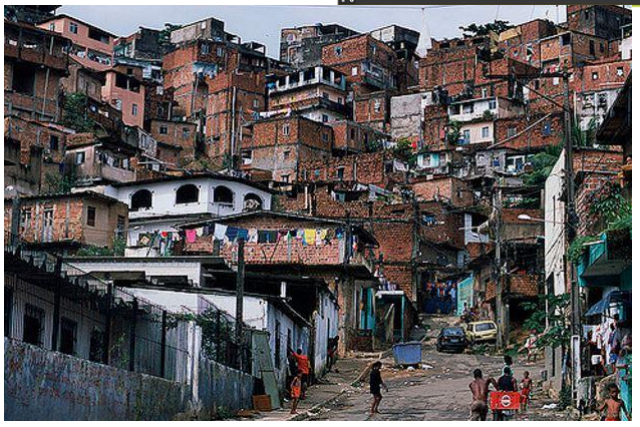



NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Gulf of Mexico
Caribbean Sea
Mediterranean Sea
Black Sea
Arabian Sea
Bay of Bengal
Philippine Sea
Coral Sea
Tasman Sea
Sea of Okhotsk
Canada
United States of America
Mexico
Cuba
Brazil
Chile
Arg.
Iran
Syria
Yemen
Nepal
Indon.
Australia
Fak. Isl.

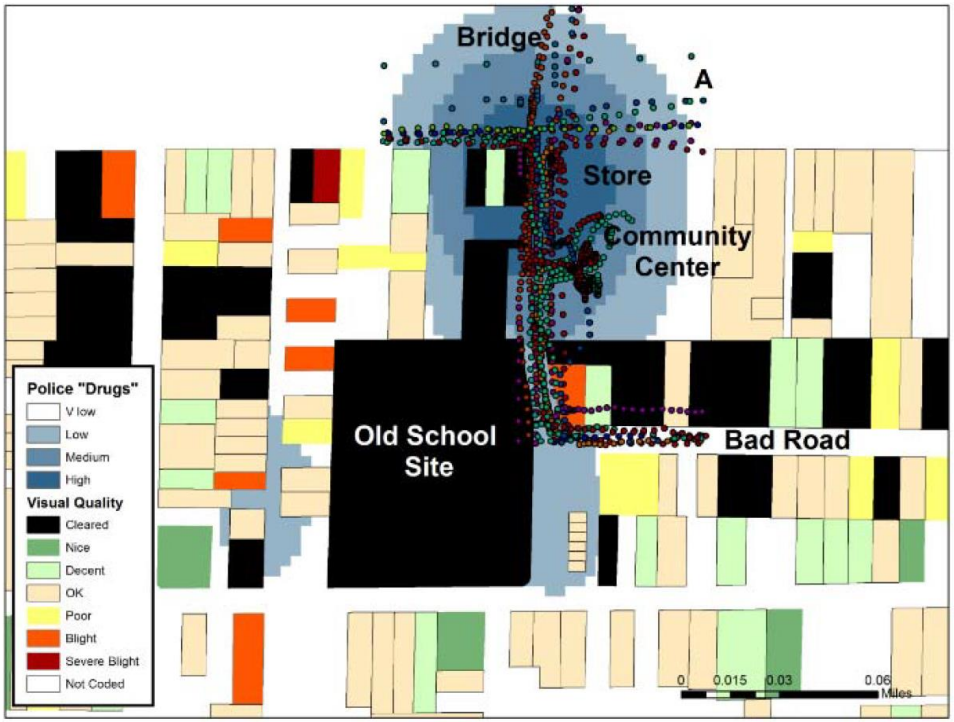

Total: 37
Enzima conversiva de la angiotensina 2 y su papel emergente en la regulación del sistema renina-angiotensina
Journal: Medicina Clínica
Place: Ace Theatre (historical)
Rethinking the Renin-Angiotensin System and Its Role in Cardiovascular Regulation
Journal: Cardiovasc Drugs Ther
Place: Ace Theatre (historical)
Ogdensburg
Newton
Lake Mohawk
Wanaque
Oakland
Kinnelon
Ramsey
Allendale
Park Ridge
Blauvelt
Nyack
Tarrytown
Elmsford
Stamford
Rye Brook
Dobbs Ferry
Midland Park
Westwood
Glen Rock
Oradell
Lake Telemark
Mount Arlington
Haledon
Lincoln Park
Paterson
Saddle Brook
Stanhope
Rockaway
Boonton
Budd Lake
Victory Gardens
Fairfield
Bogota
Ridgefield Park
Ridgefield
Hackettstown
Cedar Grove
Verona
East Hanover
Beattystown
Glen Ridge
Fairview
Guttenberg
Long Valley
Chester
Mendham
Florham Park
Northfield
Weehawken
Chatham
Newark
New York
Califon
Gladstone
Bernardsville
Springfield
Berkeley Heights
Roselle Park
Fanwood
Clark
Bloomfield
Dunellen
Somerville
Middlesex
Port Reading
Sewaren
Manville
Edison
Flemington
Bloomingdale
Highland Park
South Amboy
Milltown
Madison Park
Keansburg
Kendall Park
Matawan
Eatons Neck
Fort Salonga
Stony Brook
Halesite
Greenlawn
Saint James
Oyster Bay
Nesconset
Elwood
South Huntington
Brookville
Islandia
Great Neck
Great Neck Plaza
Jericho
Brentwood
New Cassel
Salisbury
Wyandanch
North New Hyde Park
East Islip
Stewart Manor
Hempstead
North Lindenhurst
North Wantagh
Babylon
Malverne
East Rockaway
Inwood
Island Park
Atlantic Beach
Lido Beach

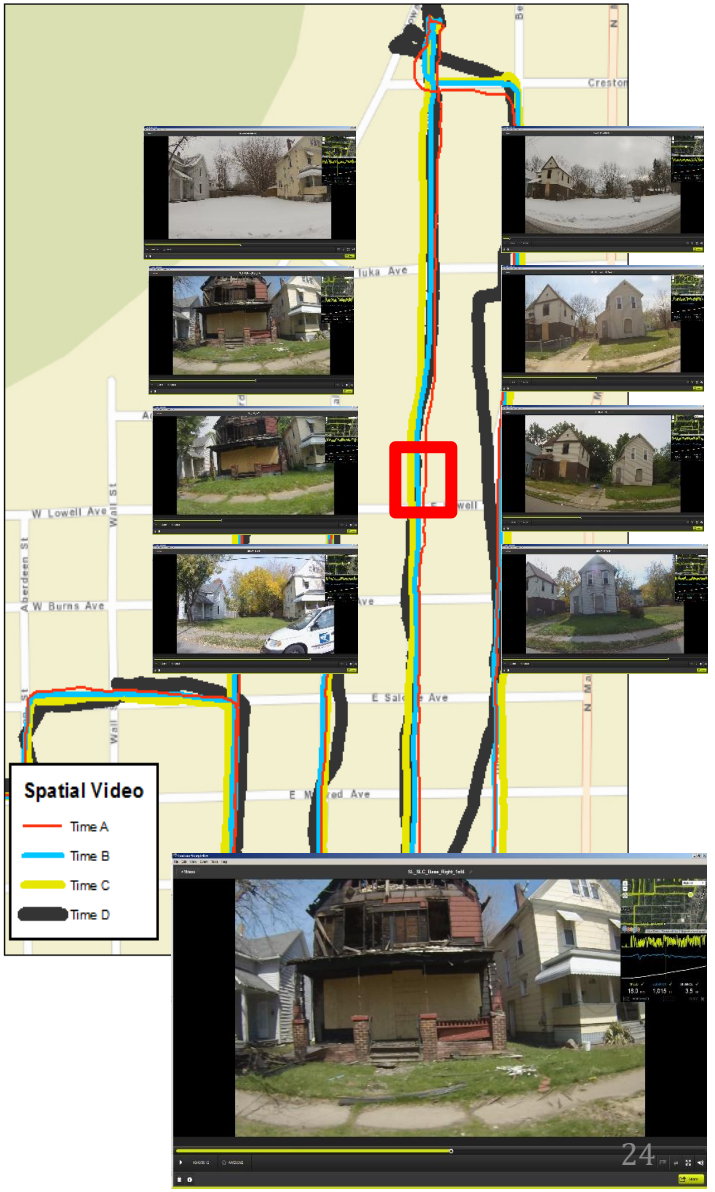
Data Challenging Communities



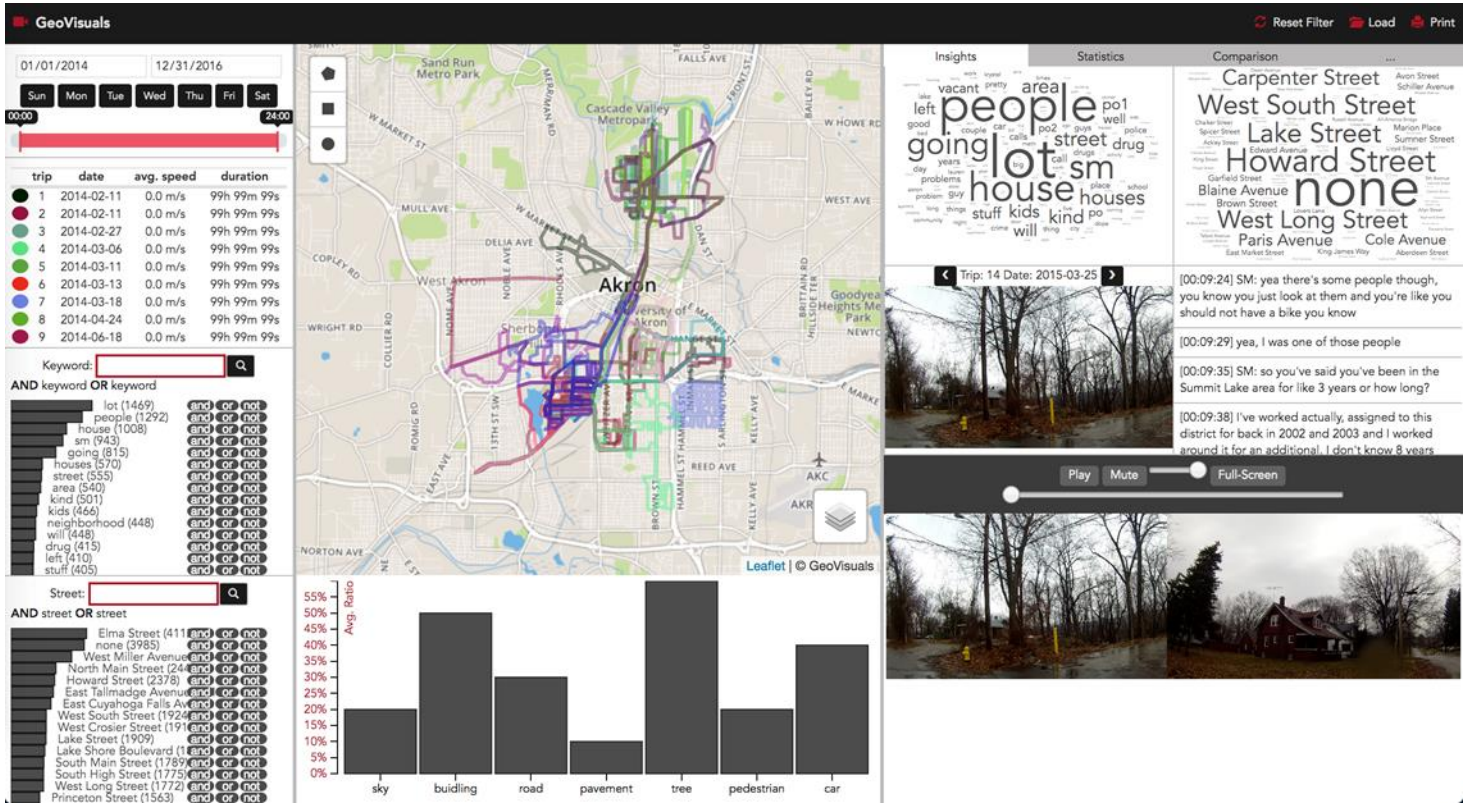


Data Challenging Communities

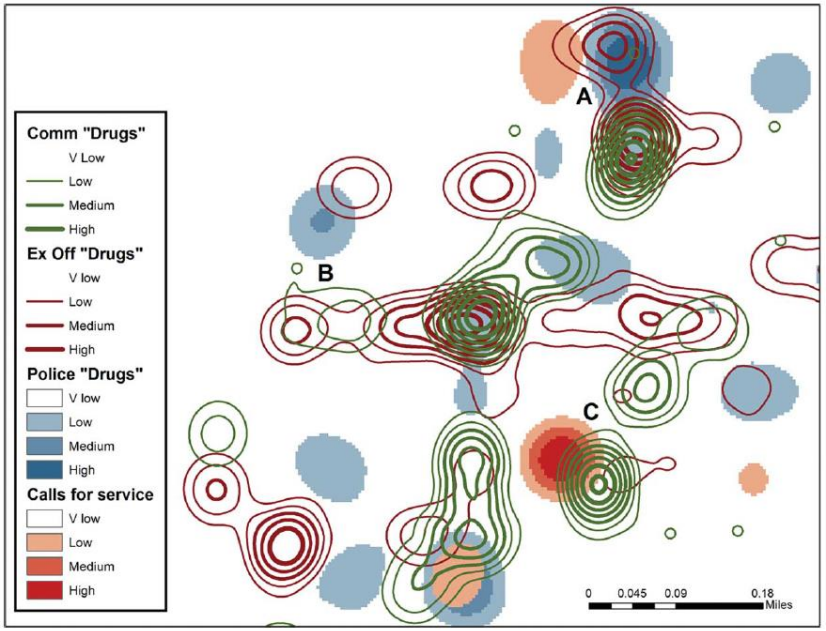




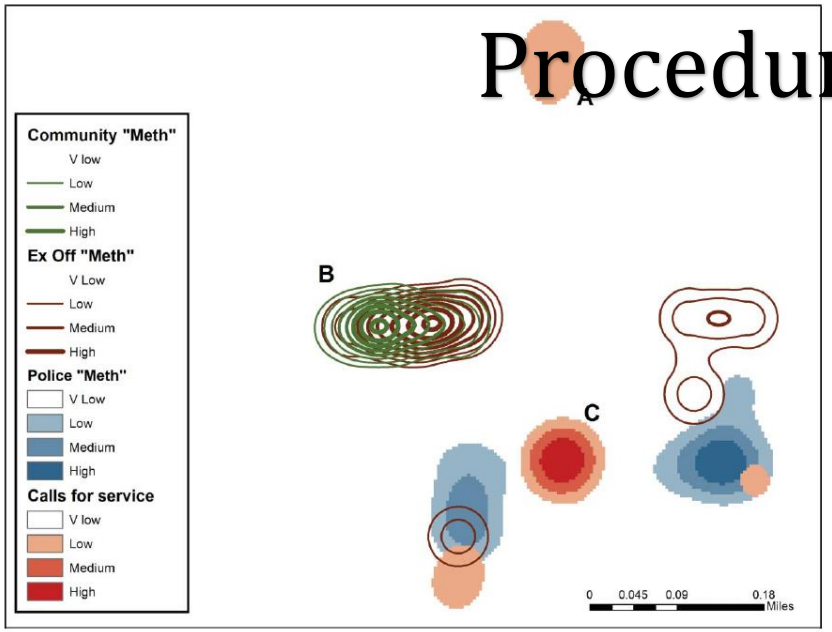
Urban Trips as Text and Image



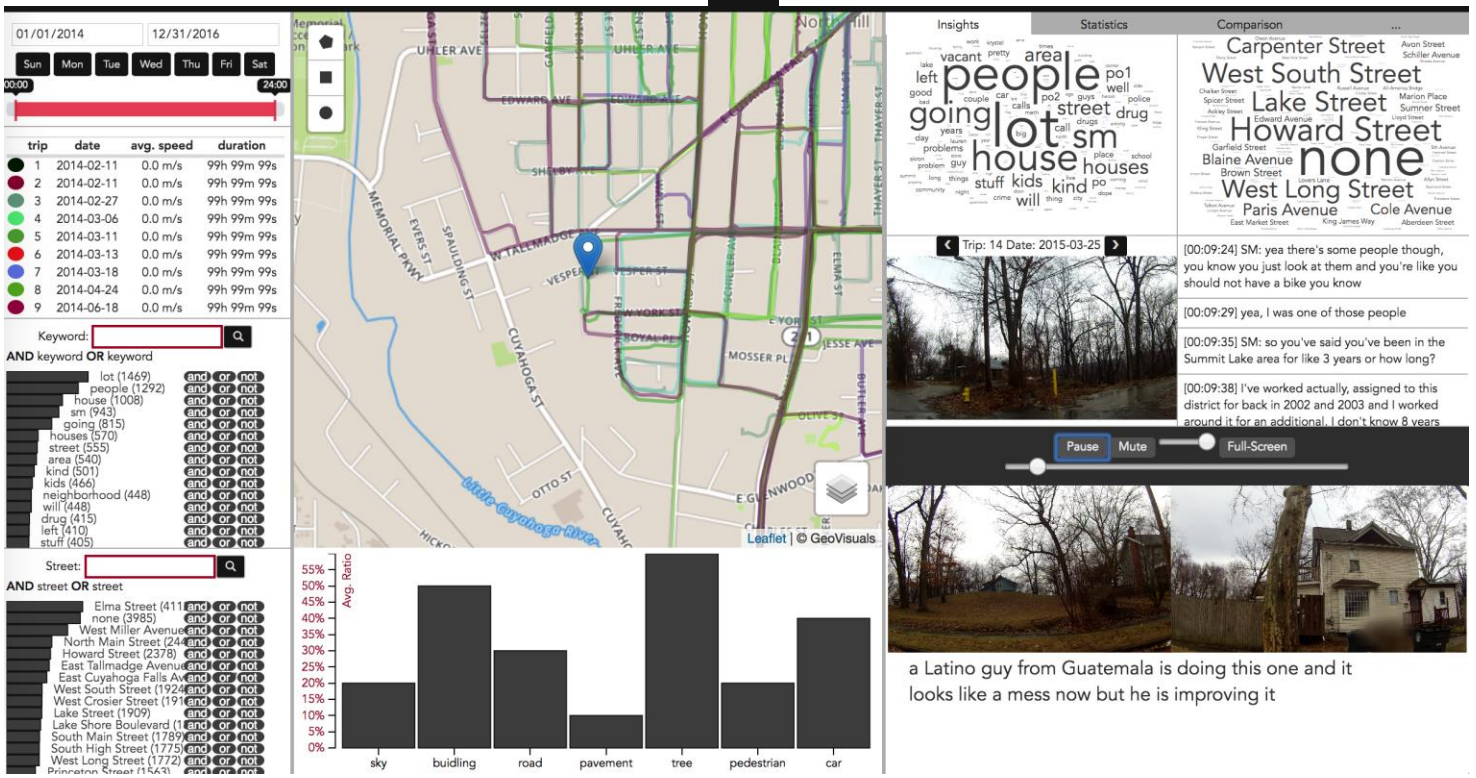
Procedure



Comm "Drugs"
V Low
Low
Medium
High
Ex Off "Drugs"
V low
Low
Medium
High
Police "Drugs"
V low
Low
Medium
High
Calls for service
V low
Low
Medium
High
A
B
C
0 0.045 0.09 0.18 Miles

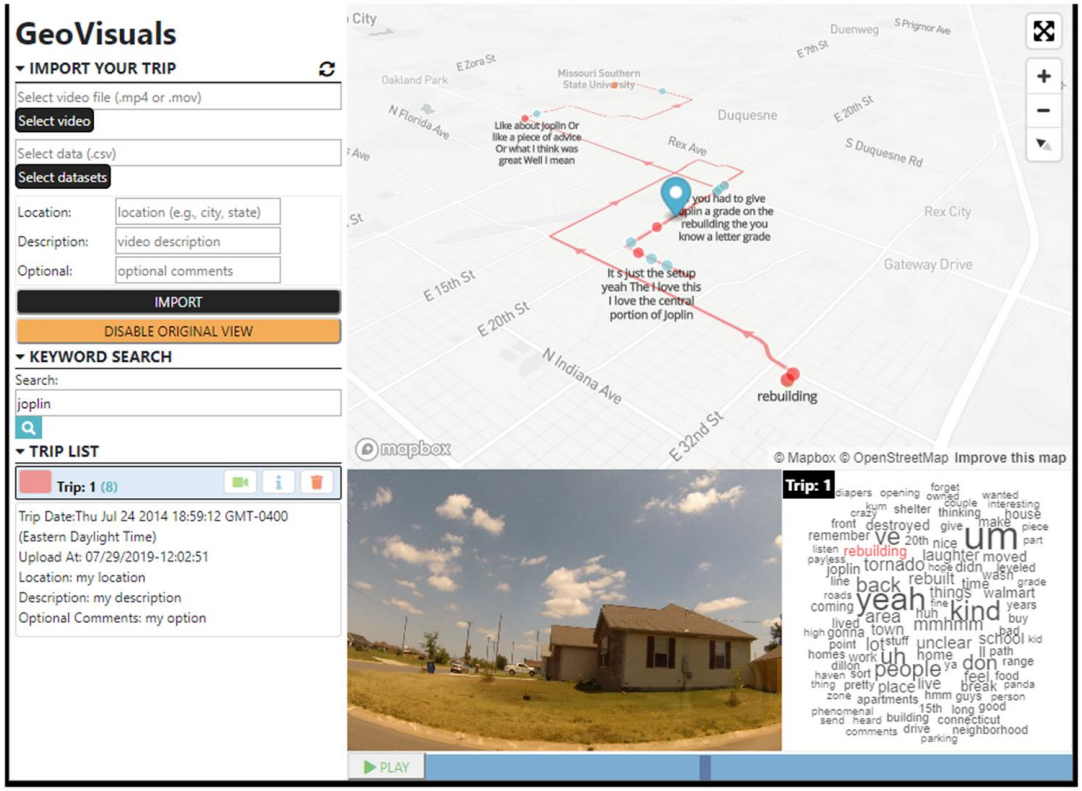


Community "Meth"
V low
Low
Medium
High
Ex Off "Meth"
V Low
Low
Medium
High
Police "Meth"
V Low
Low
Medium
High
Calls for service
V low
Low
Medium
High
A
B
C
0 0.045 0.09 0.18 Miles



01/01/2014
12/31/2016
Sun Mon Tue Wed Thu Fri Sat
00:00
24:00
trip date avg. speed duration
1 2014-02-11 0.0 m/s 99h 99m 99s
2 2014-02-11 0.0 m/s 99h 99m 99s
3 2014-02-27 0.0 m/s 99h 99m 99s
4 2014-03-06 0.0 m/s 99h 99m 99s
5 2014-03-11 0.0 m/s 99h 99m 99s
6 2014-03-13 0.0 m/s 99h 99m 99s
7 2014-03-18 0.0 m/s 99h 99m 99s
8 2014-04-24 0.0 m/s 99h 99m 99s
9 2014-06-18 0.0 m/s 99h 99m 99s
Keyword:
AND keyword OR keyword
lot (1469)
people (1292)
house (1008)
sm (943)
going (815)
houses (570)
street (555)
area (540)
kind (501)
kids (466)
neighborhood (448)
will (448)
drug (415)
left (410)
stuff (405)
Street:
AND street OR street
Elma Street (411
none (3985)
West Miller Avenue
North Main Street (244
Howard Street (2378)
East Tallmadge Avenue
East Cuyahoga Falls Av
West South Street (1924
West Crosier Street (191
Lake Street (1909)
Lake Shore Boulevard (1
South Main Street (1789)
South High Street (1775)
West Long Street (1772)
Princeton Street (1563)
UHLER AVE
EDWARD AVE
SHELBY AVE
W TALLMADGE
VESPER ST
W YORK ST
E YORK ST
MOSSER PL
JESSE AVE
OLIVE ST
E GLENWOOD
MEMORIAL PKWY
EVERS ST
SPAULDING ST
CUYAHOGA ST
OTTO ST
Little Cuyahoga River
Leaflet | © GeoVisuals
Avg. Ratio
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
sky
buidling
road
pavement
tree
pedestrian
car
Insights
Statistics
Comparison
people
going
lot
house
sm
houses
street
area
kids
kind
stuff
will
left
vacant
Carpenter Street
West South Street
Lake Street
Howard Street
none
Blaine Avenue
Brown Street
West Long Street
Paris Avenue
Cole Avenue
Trip: 14 Date: 2015-03-25
[00:09:24] SM: yea there's some people though, you know you just look at them and you're like you should not have a bike you know
[00:09:29] yea, I was one of those people
[00:09:35] SM: so you've said you've been in the Summit Lake area for like 3 years or how long?
[00:09:38] I've worked actually, assigned to this district for back in 2002 and 2003 and I worked around it for an additional, I don't know 8 years
Pause
Mute
Full-Screen
a Latino guy from Guatemala is doing this one and it looks like a mess now but he is improving it

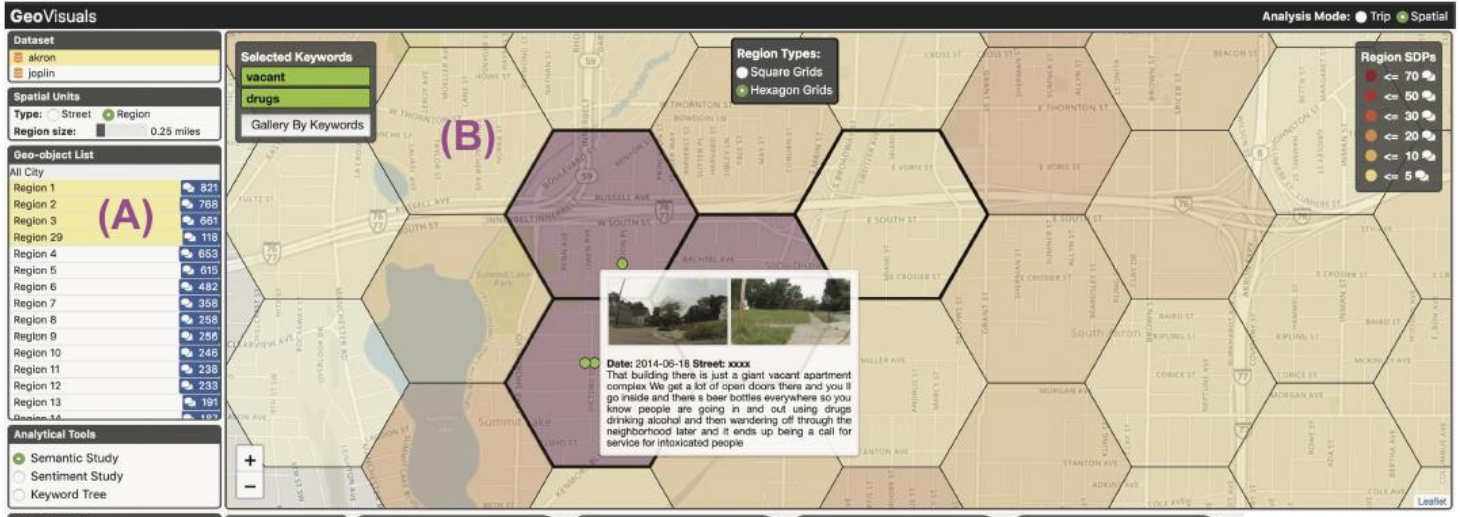
Urban Memory

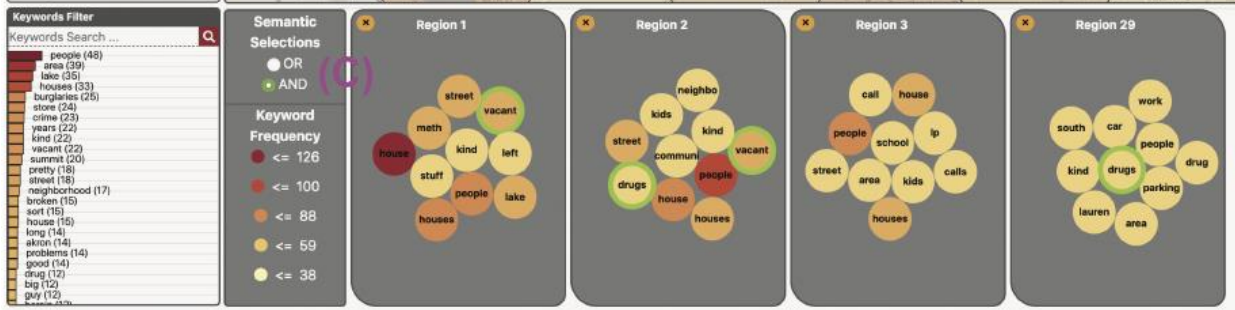


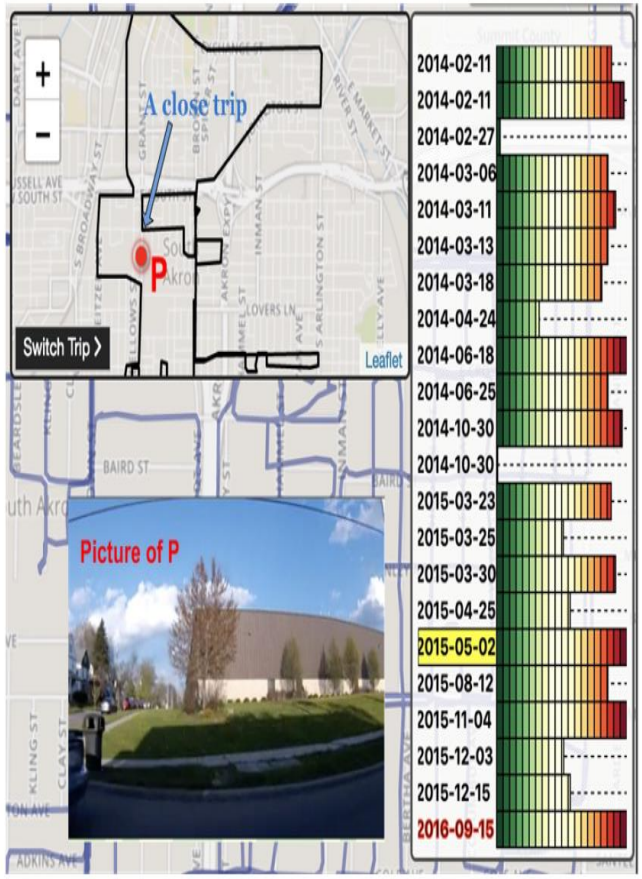
query, navigation, and comparison of video, photo, audio, and text over regions and locations

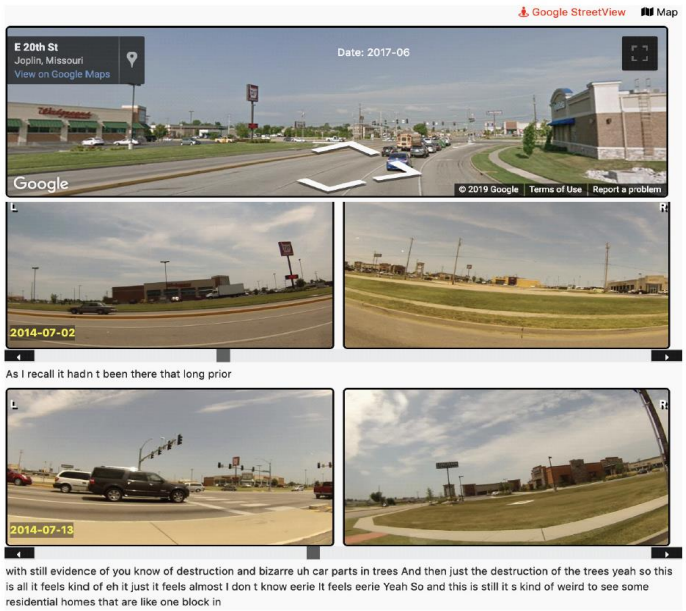
Urban Memory

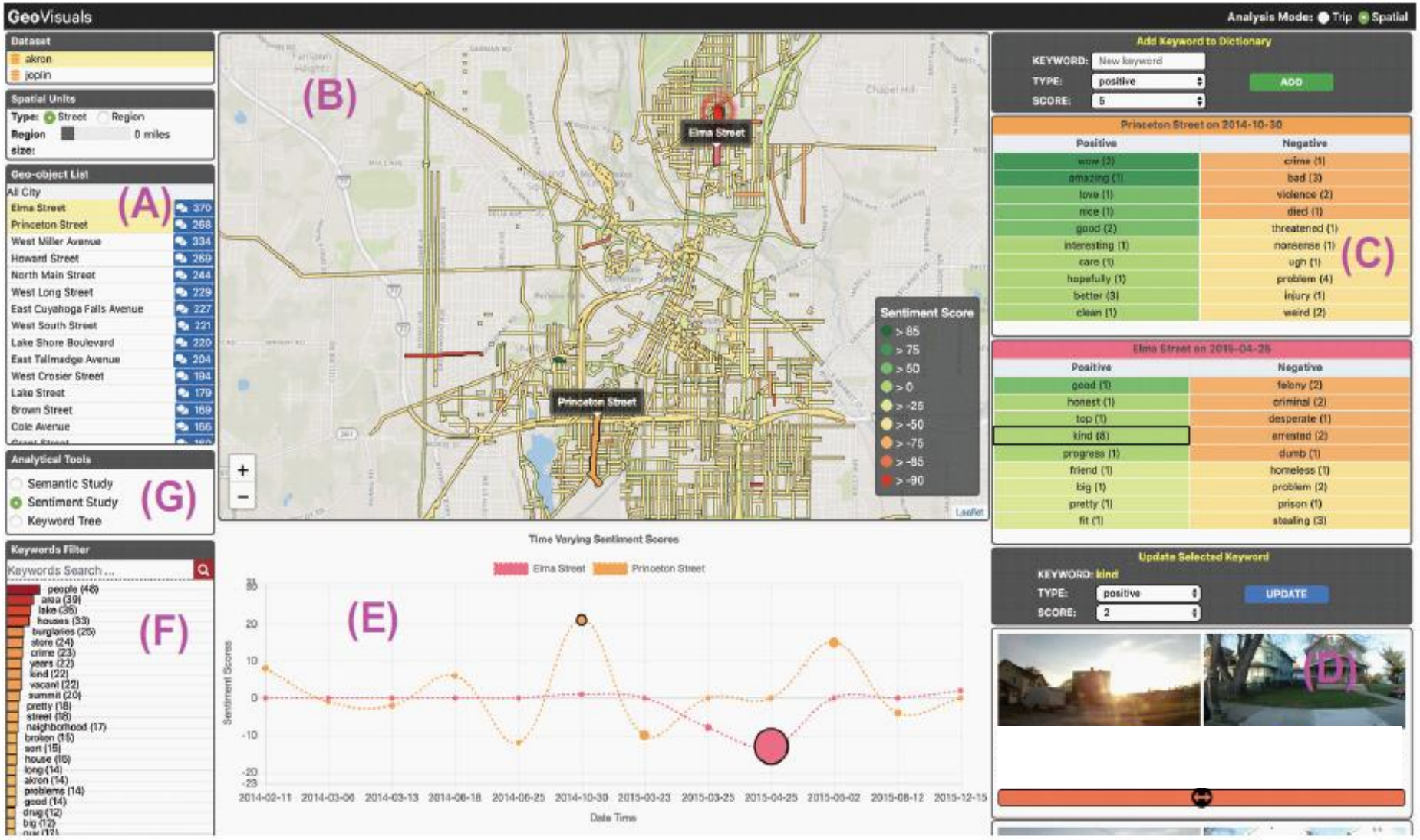
Procedure


GeoVisuals
Analysis Mode: Trip Spatial
Dataset
akron
joplin
Spatial Units
Type: Street Region
Region size: 0.25 miles
Geo-object List
All City
Region 1 821
Region 2 768
Region 3 661
Region 29 118
Region 4 653
Region 5 615
Region 6 482
Region 7 358
Region 8 258
Region 9 256
Region 10 246
Region 11 238
Region 12 233
Region 13 191
(A)
Analytical Tools
Semantic Study
Sentiment Study
Keyword Tree
Selected Keywords
vacant
drugs
Gallery By Keywords
(B)
Region Types:
Square Grids
Hexagon Grids
Region SDPs
<= 70
<= 50
<= 30
<= 20
<= 10
<= 5
Date: 2014-06-18 Street: xxxx
That building there is just a giant vacant apartment complex We get a lot of open doors there and you ll go inside and there s beer bottles everywhere so you know people are going in and out using drugs drinking alcohol and then wandering off through the neighborhood later and it ends up being a call for service for intoxicated peopie
Leaflet

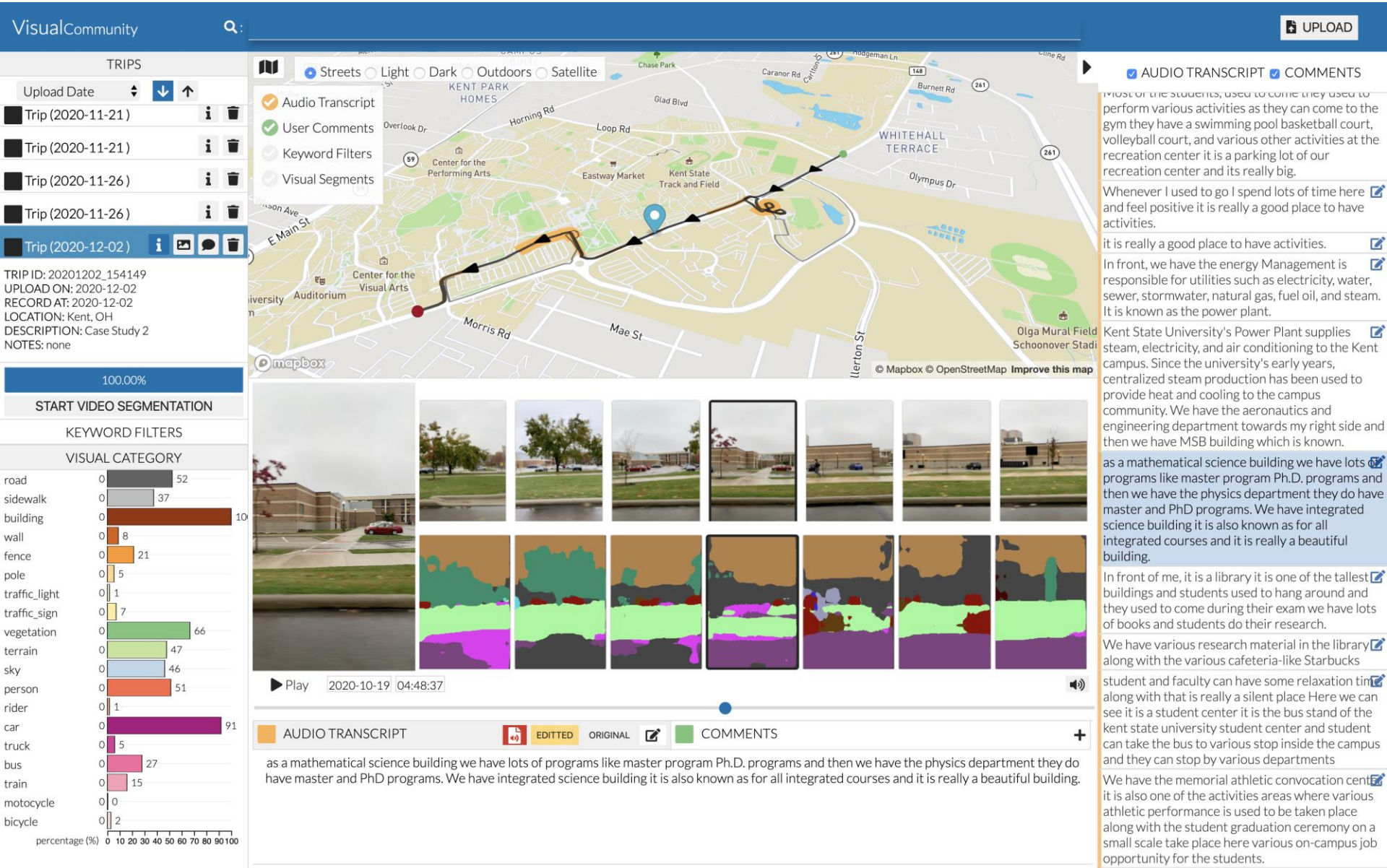

Keywords Filter
Keywords Search ...
people (48)
area (39)
lake (35)
houses (33)
burglaries (25)
store (24)
crime (23)
years (22)
kind (22)
vacant (22)
summit (20)
pretty (18)
street (18)
neighborhood (17)
broken (15)
sort (15)
house (15)
long (14)
akron (14)
problems (14)
good (14)
drug (12)
big (12)
guy (12)
Semantic Selections
OR
AND
(C)
Keyword Frequency
<= 126
<= 100
<= 88
<= 59
<= 38
Region 1
street
vacant
meth
house
kind
left
stuff
people
lake
houses
Region 2
neighbo
kids
street
kind
communi
vacant
drugs
people
house
houses
Region 3
call
house
people
school
ip
street
area
kids
calls
houses
Region 29
work
south
car
people
drug
kind
drugs
parking
lauren
area


A close trip
P
Switch Trip
Leaflet
BAIRD ST
Picture of P
2014-02-11
2014-02-11
2014-02-27
2014-03-06
2014-03-11
2014-03-13
2014-03-18
2014-04-24
2014-06-18
2014-06-25
2014-10-30
2014-10-30
2015-03-23
2015-03-25
2015-03-30
2015-04-25
2015-05-02
2015-08-12
2015-11-04
2015-12-03
2015-12-15
2016-09-15


Google StreetView
Map
E 20th St
Joplin, Missouri
View on Google Maps
Date: 2017-06
Google
© 2019 Google
Terms of Use
Report a problem
2014-07-02
As I recall it hadn t been there that long prior
2014-07-13
with still evidence of you know of destruction and bizarre uh car parts in trees And then just the destruction of the trees yeah so this is all it feels kind of eh it just it feels almost I don t know eerie It feels eerie Yeah So and this is still it s kind of weird to see some residential homes that are like one block in


GeoVisuals
Analysis Mode: Trip Spatial
Dataset
akron
joplin
Spatial Units
Type: Street Region
Region size: 0 miles
Geo-object List
All City
Elma Street 370
Princeton Street 288
West Miller Avenue 334
Howard Street 269
North Main Street 244
West Long Street 229
East Cuyahoga Falls Avenue 227
West South Street 221
Lake Shore Boulevard 220
East Tallmadge Avenue 204
West Crosier Street 194
Lake Street 179
Brown Street 169
Cole Avenue 166
(A)
(B)
Elma Street
Princeton Street
Sentiment Score
> 85
> 75
> 50
> 0
> -25
> -50
> -75
> -85
> -90
Leaflet
Add Keyword to Dictionary
KEYWORD: New keyword
TYPE: positive
SCORE: 5
ADD
Princeton Street on 2014-10-30
Positive
wow (2)
amazing (1)
love (1)
nice (1)
good (2)
interesting (1)
care (1)
hopefully (1)
better (3)
clean (1)
Negative
crime (1)
bad (3)
violence (2)
died (1)
threatened (1)
nonsense (1)
ugh (1)
problem (4)
injury (1)
weird (2)
(C)
Elma Street on 2015-04-25
Positive
good (1)
honest (1)
top (1)
kind (8)
progress (1)
friend (1)
big (1)
pretty (1)
fit (1)
Negative
felony (2)
criminal (2)
desperate (1)
arrested (2)
dumb (1)
homeless (1)
problem (2)
prison (1)
stealing (3)
Analytical Tools
Semantic Study
Sentiment Study
Keywords Tree
(G)
Keywords Filter
Keywords Search ...
people (48)
area (39)
lake (36)
houses (33)
burglaries (26)
store (24)
crime (23)
years (22)
kind (22)
vacant (22)
summit (20)
pretty (18)
street (18)
neighborhood (17)
broken (15)
sort (15)
house (15)
long (14)
akron (14)
problems (14)
good (14)
drug (12)
big (12)
(F)
Time Varying Sentiment Scores
Elma Street
Princeton Street
(E)
Sentiment Scores
30
20
10
0
-10
-20
-23
2014-02-11
2014-03-06
2014-03-13
2014-06-18
2014-06-25
2014-10-30
2015-03-23
2015-03-25
2015-04-25
2015-05-02
2015-08-12
2015-12-15
Date Time
Update Selected Keyword
KEYWORD: kind
TYPE: positive
SCORE: 2
UPDATE
(D)

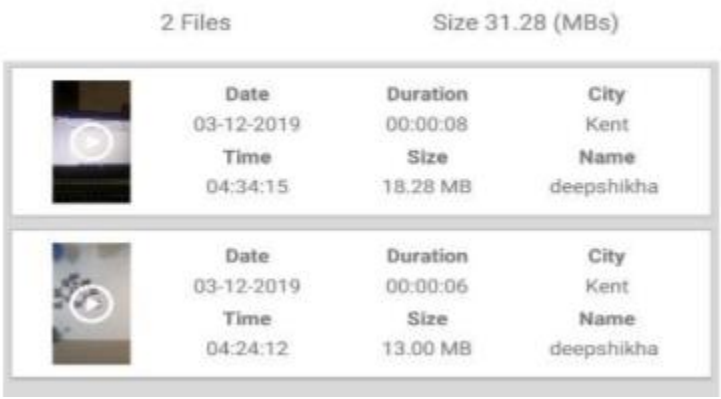
Procedure


VisualCommunity
UPLOAD
TRIPS
Upload Date
Trip (2020-11-21)
Trip (2020-11-21)
Trip (2020-11-26)
Trip (2020-11-26)
Trip (2020-12-02)
TRIP ID: 20201202_154149
UPLOAD ON: 2020-12-02
RECORD AT: 2020-12-02
LOCATION: Kent, OH
DESCRIPTION: Case Study 2
NOTES: none
100.00%
START VIDEO SEGMENTATION
KEYWORD FILTERS
VISUAL CATEGORY
road 0 52
sidewalk 0 37
building 0 10
wall 0 8
fence 0 21
pole 0 5
traffic_light 0 1
traffic_sign 0 7
vegetation 0 66
terrain 0 47
sky 0 46
person 0 51
rider 0 1
car 0 91
truck 0 5
bus 0 27
train 0 15
motocycle 0 0
bicycle 0 2
percentage (%) 0 10 20 30 40 50 60 70 80 90 100
Streets Light Dark Outdoors Satellite
Audio Transcript
User Comments
Keyword Filters
Visual Segments
KENT PARK HOMES
Chase Park
Horning Rd
Glad Blvd
Loop Rd
Overlook Dr
Center for the Performing Arts
Eastway Market
Kent State Track and Field
WHITEHALL TERRACE
Olympus Dr
Burnett Rd
Caranor Rd
Hodgeman Ln
E Main St
Center for the Visual Arts
Auditorium
Morris Rd
Mae St
Olga Mural Field
Schoonover Stadi
© Mapbox © OpenStreetMap Improve this map
Play
2020-10-19 04:48:37
AUDIO TRANSCRIPT
EDITTED
ORIGINAL
COMMENTS
as a mathematical science building we have lots of programs like master program Ph.D. programs and then we have the physics department they do have master and PhD programs. We have integrated science building it is also known as for all integrated courses and it is really a beautiful building.
AUDIO TRANSCRIPT
COMMENTS
perform various activities as they can come to the gym they have a swimming pool basketball court, volleyball court, and various other activities at the recreation center it is a parking lot of our recreation center and its really big.
Whenever I used to go I spend lots of time here and feel positive it is really a good place to have activities.
it is really a good place to have activities.
In front, we have the energy Management is responsible for utilities such as electricity, water, sewer, stormwater, natural gas, fuel oil, and steam. It is known as the power plant.
Kent State University's Power Plant supplies steam, electricity, and air conditioning to the Kent campus. Since the university's early years, centralized steam production has been used to provide heat and cooling to the campus community. We have the aeronautics and engineering department towards my right side and then we have MSB building which is known.
as a mathematical science building we have lots of programs like master program Ph.D. programs and then we have the physics department they do have master and PhD programs. We have integrated science building it is also known as for all integrated courses and it is really a beautiful building.
In front of me, it is a library it is one of the tallest buildings and students used to hang around and they used to come during their exam we have lots of books and students do their research.
We have various research material in the library along with the various cafeteria-like Starbucks
student and faculty can have some relaxation tim along with that is really a silent place Here we can see it is a student center it is the bus stand of the kent state university student center and student can take the bus to various stop inside the campus and they can stop by various departments
We have the memorial athletic convocation cent it is also one of the activities areas where various athletic performance is used to be taken place along with the student graduation ceremony on a small scale take place here various on-campus job opportunity for the students.

Apps

ROUTE APPLICATION

KENT PARK HOMES
HOLLY PARK APARTMENTS
CAPTURE
FILES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Duration
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Kent
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Size
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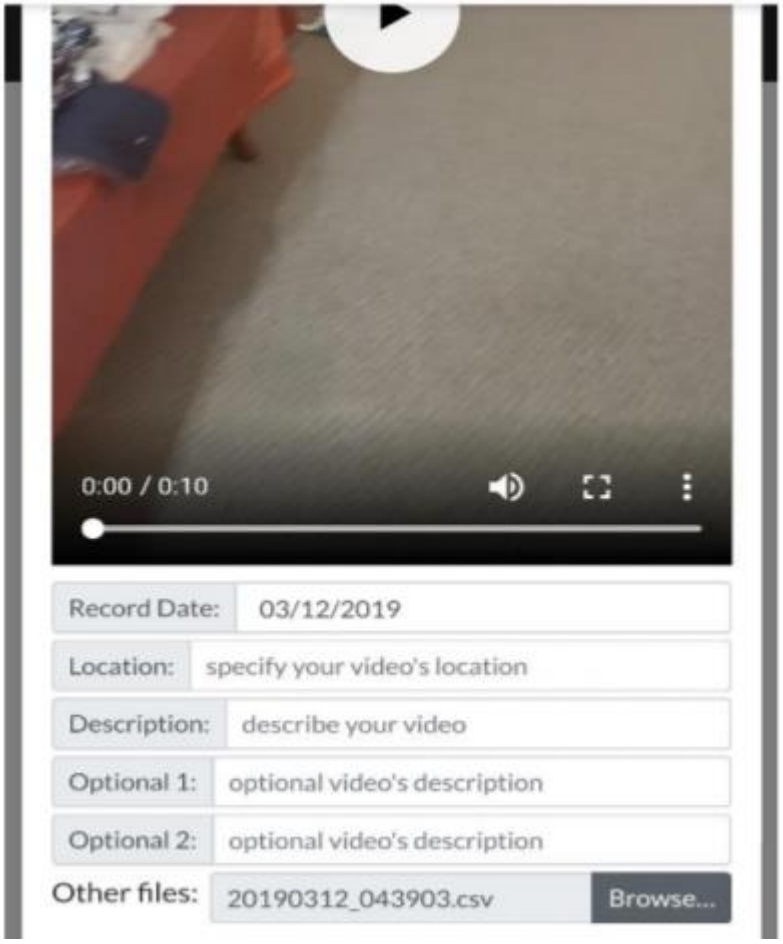
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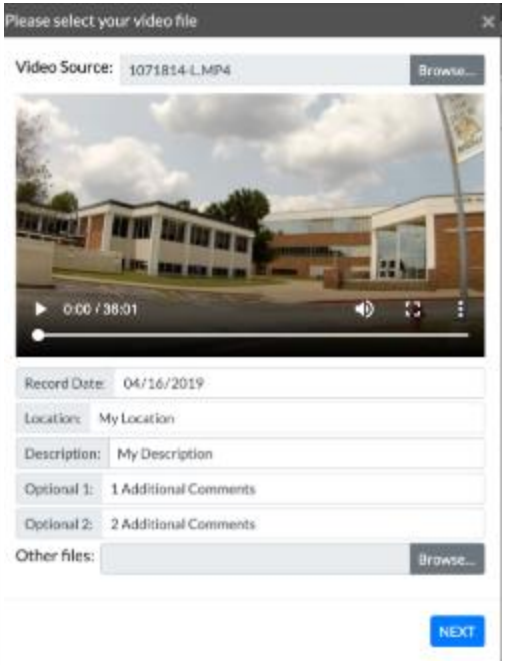
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Optional 1: 1 Additional Comments
Optional 2: 2 Additional Comments
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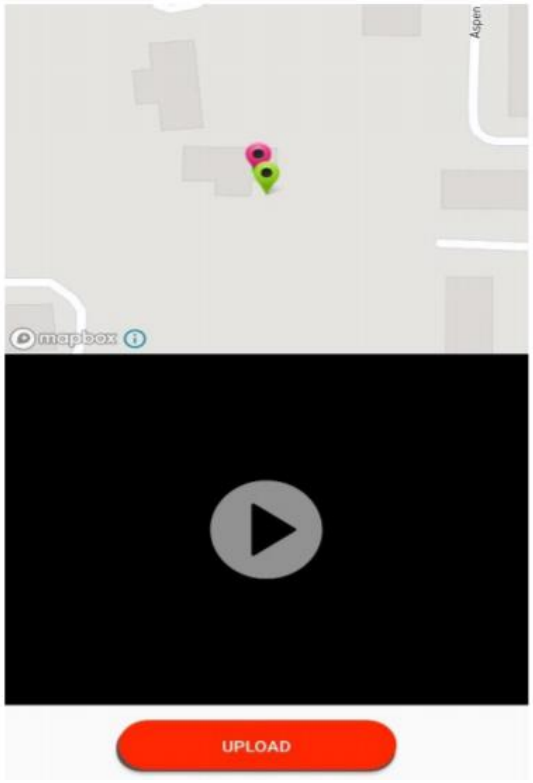
mapbox
UPLOAD

Computational Urban Science: Four Layers

- Human dynamics-centered Urban Science (Geographical Perspective)
- Platform-based Urban Science (Computer Science Perspective)
- **Action-oriented Urban Science (Urban Planning Perspective)**
- Convergence-driven Urban Science (Synthetic Perspective)

Urban Economics and Management

https://scholar.harvard.edu/glaeser

CROWDSOURCING CITY GOVERNMENT:
USING TOURNAMENTS TO IMPROVE INSPECTION ACCURACY

Edward L. Glaeser
Andrew Hillis
Scott Duke Kominers
Michael Luca

Working Paper 22124
http://www.nber.org/papers/w22124

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 2016

prediction tournaments to improve city operations and translate data science insights into practice

BIG DATA AND BIG CITIES:
THE PROMISES AND LIMITATIONS OF IMPROVED MEASURES OF URBAN LIFE

Edward L. Glaeser
Scott Duke Kominers
Michael Luca
Nikhil Naik

Working Paper 21778
http://www.nber.org/papers/w21778

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
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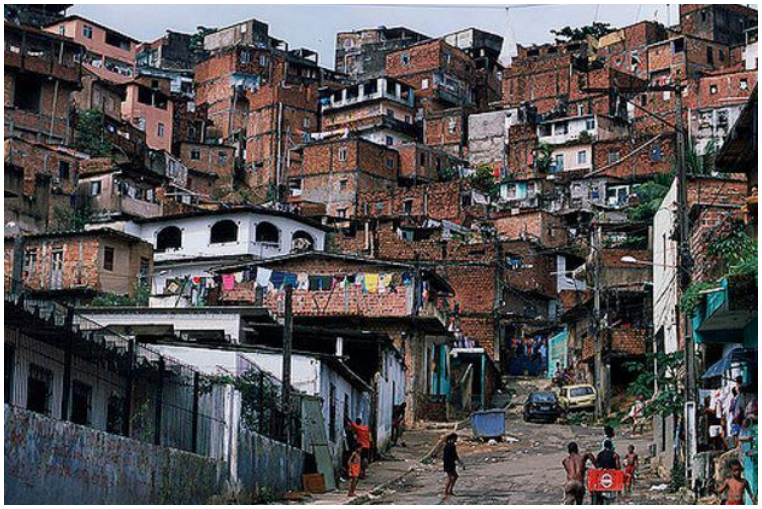
December 2015

Measure <u>unmeasurable</u>

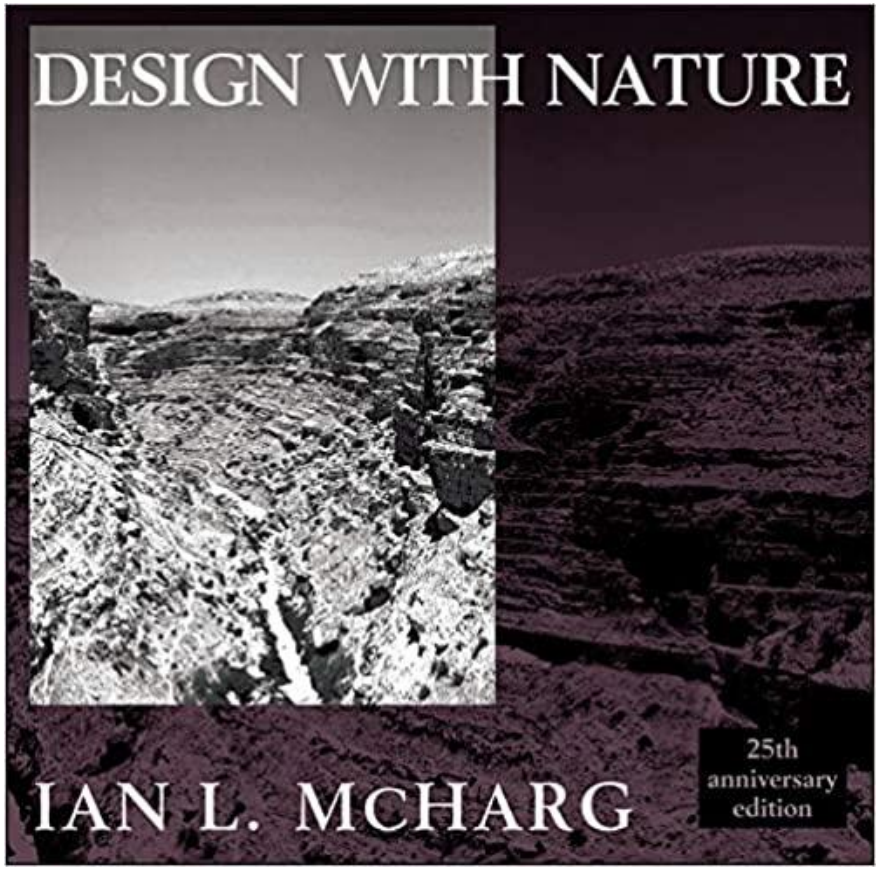
What makes cities vulnerable to COVID-19? Concentrated poverty, says econ professor - Edward Glaeser

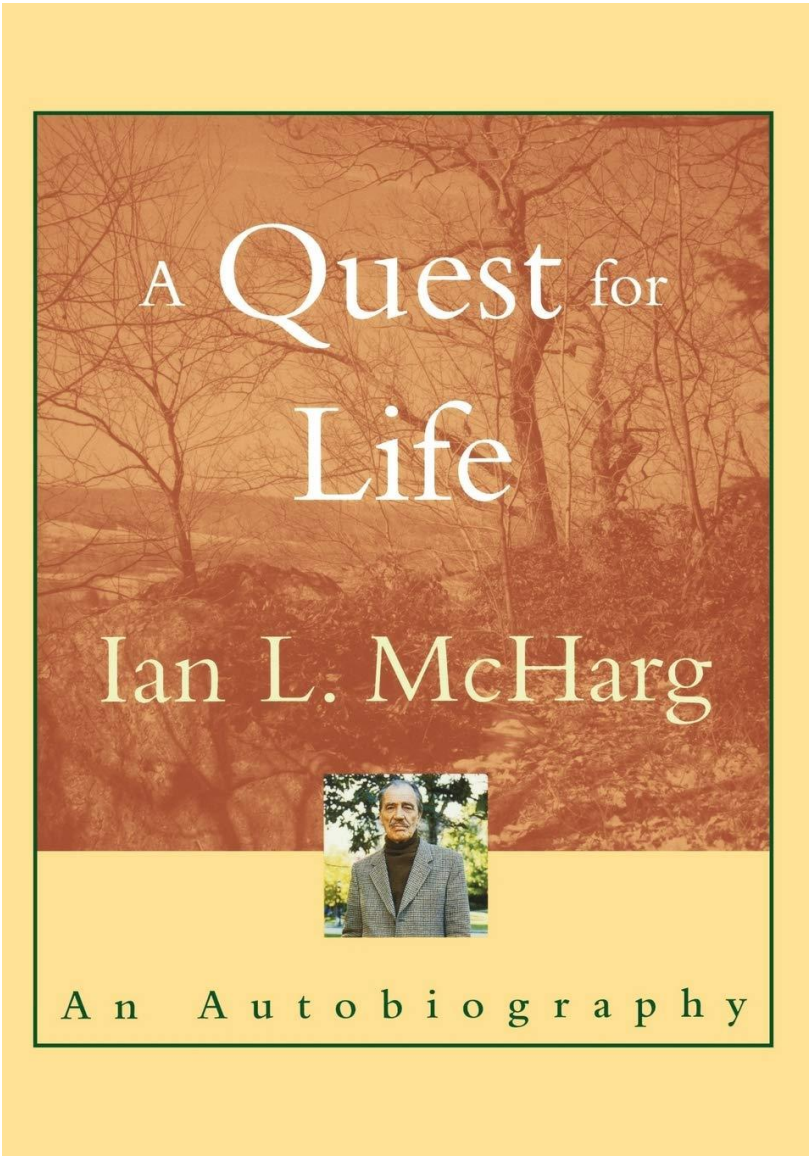
Excerpt

May 28, 2020, Audio, "Disease has thrived among dense populations since cities began. But COVID-19 is the worst example since 1918, and New York City is America's primary victim, with empty streets and skyscrapers. Can New York and other cities survive this pandemic?"
Listen on KCRW

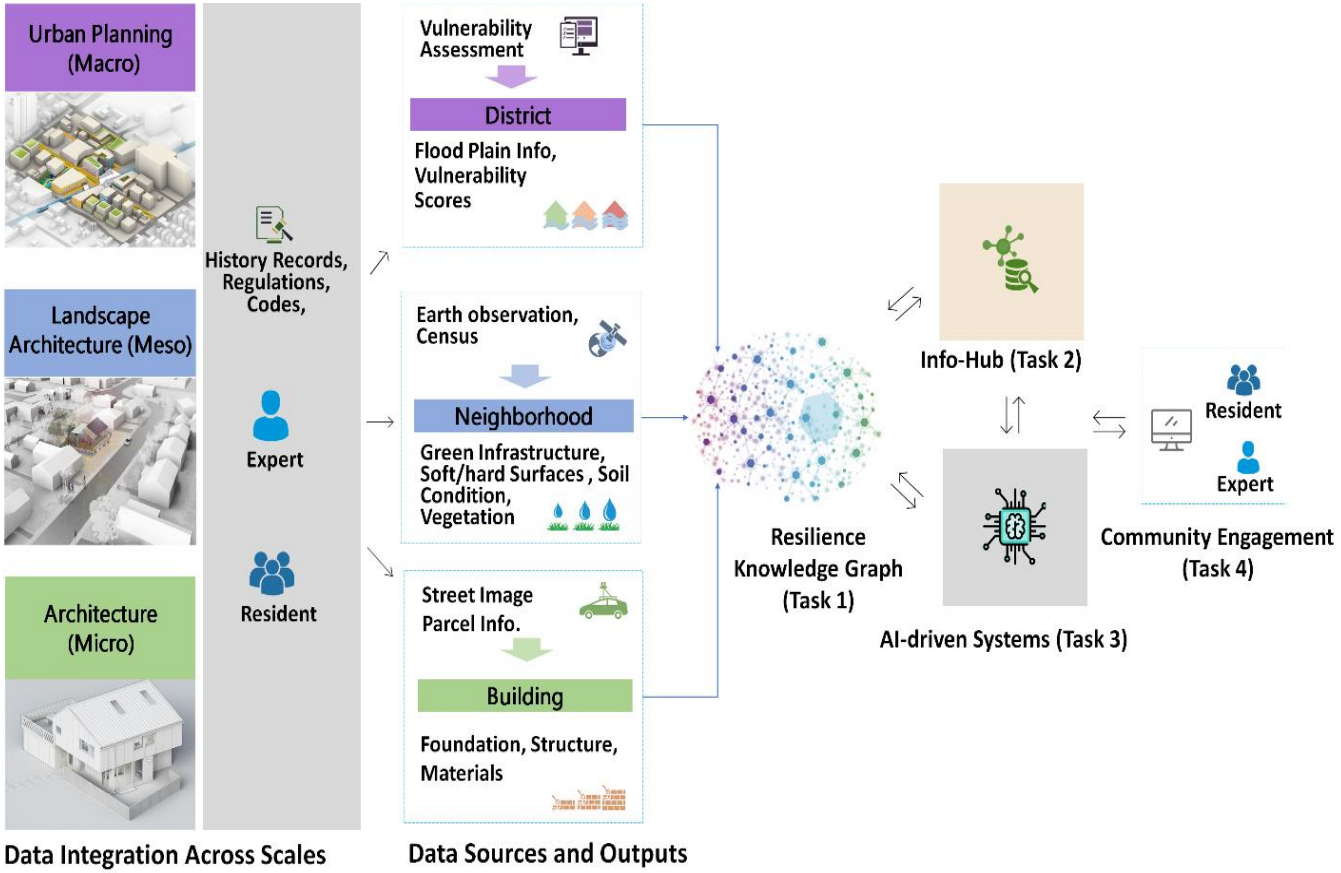


GeoDesign

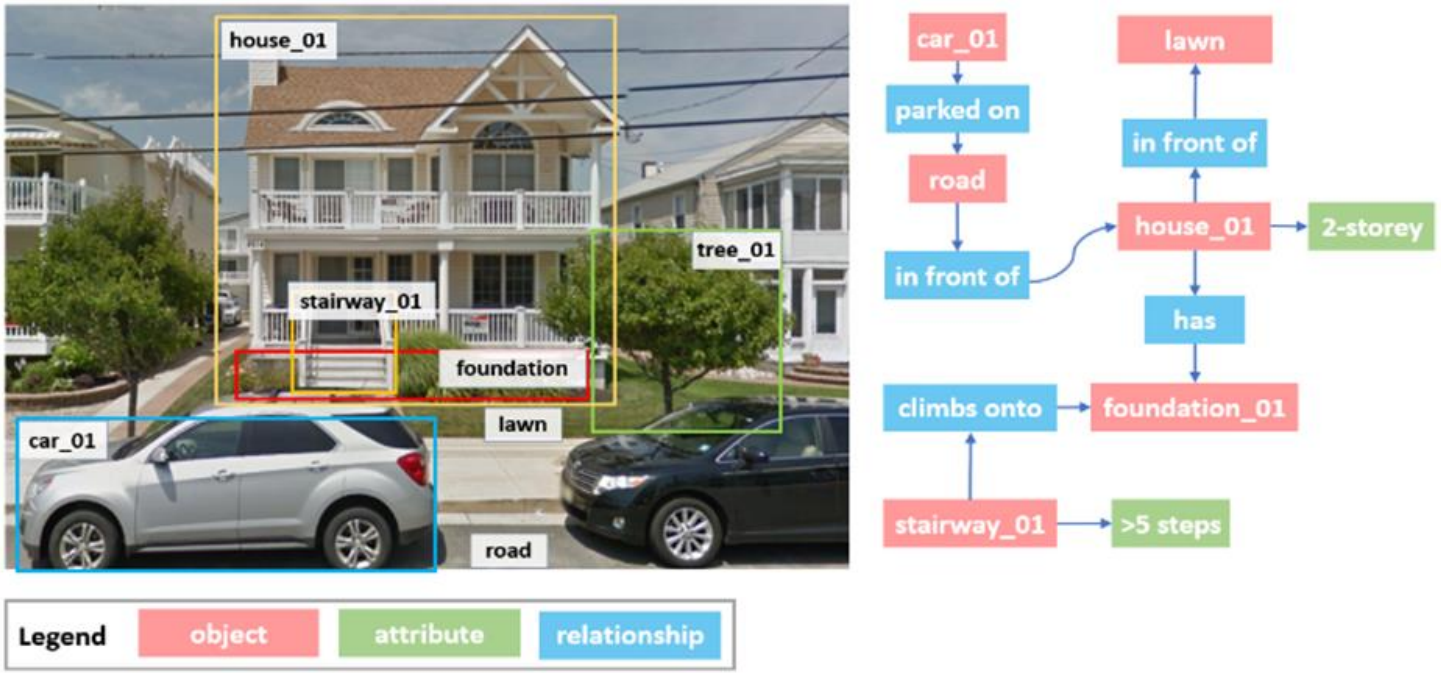

DESIGN WITH NATURE
IAN L. MCHARG
25th anniversary edition


A Quest for Life
Ian L. McHarg
An Autobiography

AI-driven Framework for GeoDesign

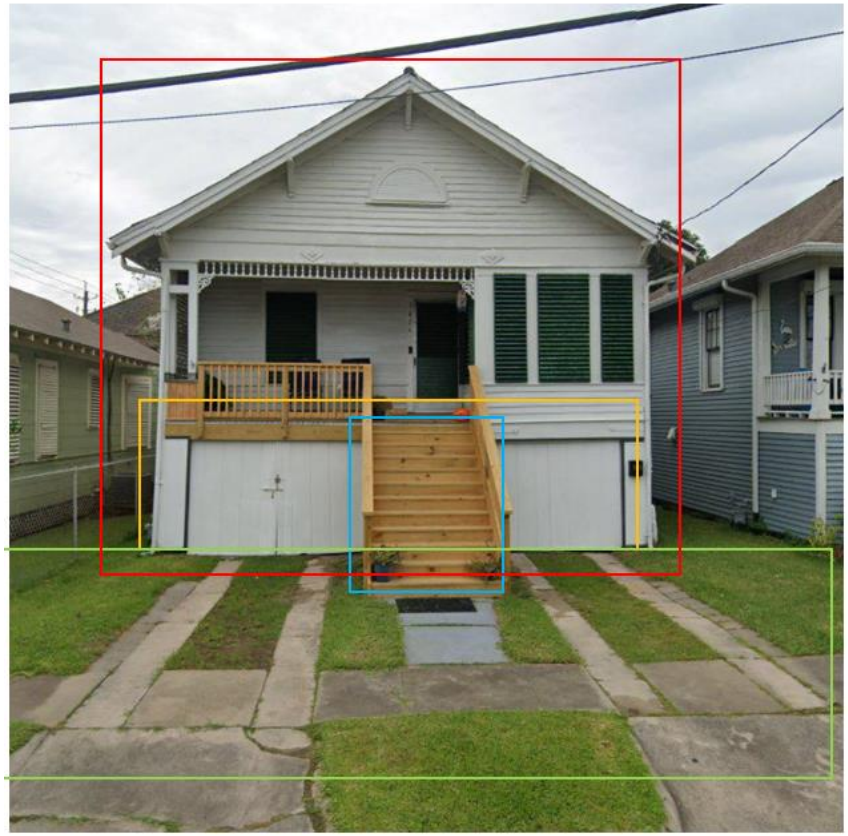


Scene Graph


house_01
tree_01
stairway_01
foundation
lawn
car_01
road
car_01
parked on
road
in front of
lawn
in front of
house_01
2-storey
has
climbs onto
foundation_01
stairway_01
>5 steps
Legend
object
attribute
relationship

Resilient elements of residential buildings

resilient



1.High Elevated on Fill

2.High Solid foundation (high access , space cannot be used)

3.High Open foundation (high access, space cannot be used)

4.High elevated foundation (not open)

5.Wet floodproofed (hydrostatic opening)

6.High-raised basement foundation (maybe in downtown)

7.Scarified first floor: first-floor access

8.Scarified first floor: second-floor access

9.Second-floor access (occupiable first floor)

10.Stilt house (one floor high, the space can be used)

11.Carport under stilt house

12.Enclosed area under stilt house

13.garage room under stilt house

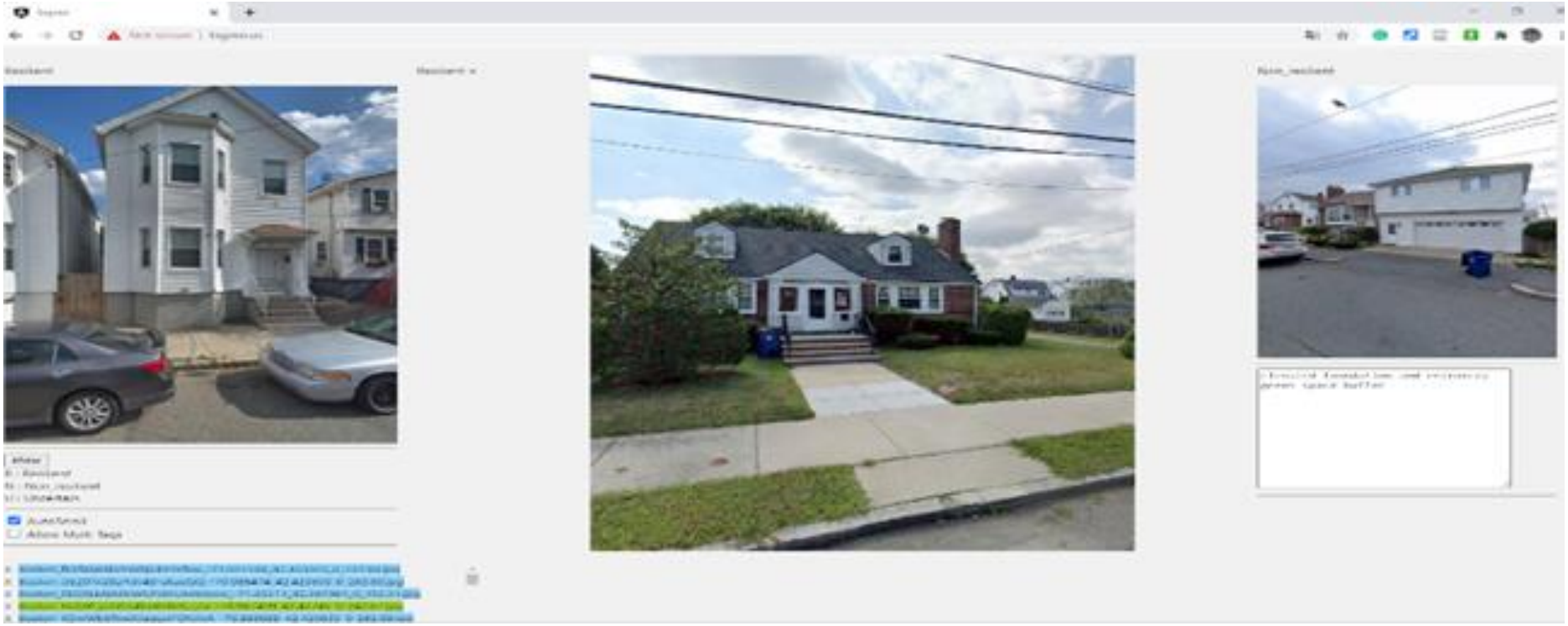
14.Residential room under stilt house

15.Green space

16.Elevate critical system

17.Independent concrete slabs

Annotation Systems



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Query image

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18,000

cities/towns with <50,000 population

ENDEAVR Institute (501 © 3)

ENDEAVR Institute: Futureproofing Small-Town America!

www.endeavr.city

News Coverage: https://bit.ly/ENDEAVR_NEWS

By 2022, we will complete the world's first non-profit autonomous bus system in Bell County, Texas. We will expand our capacity to bring free taxi rides and telemedicine services to low-income people with mobility challenges.

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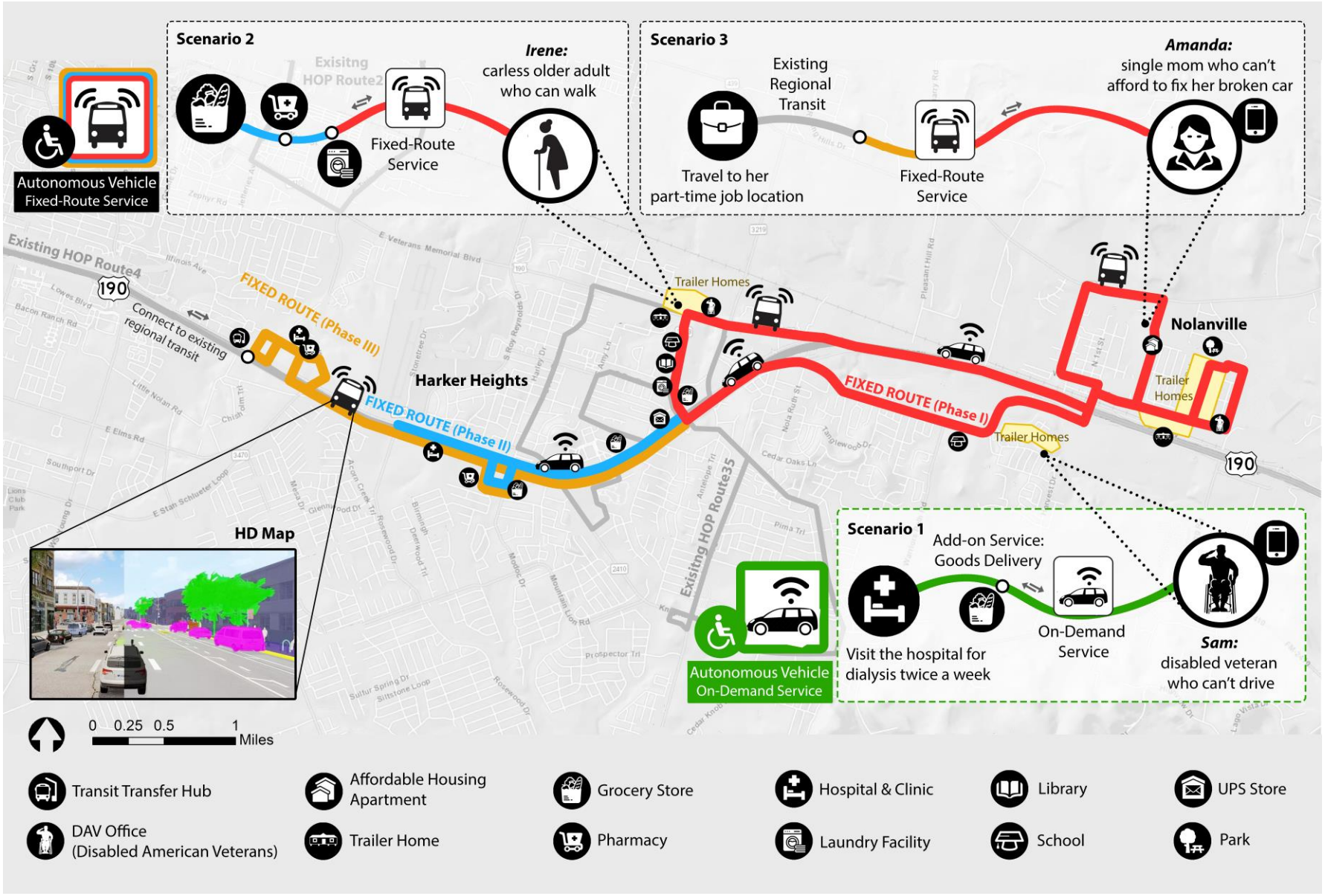
https://charity.gofundme.com/o/en/campaign/mobilityhealth21

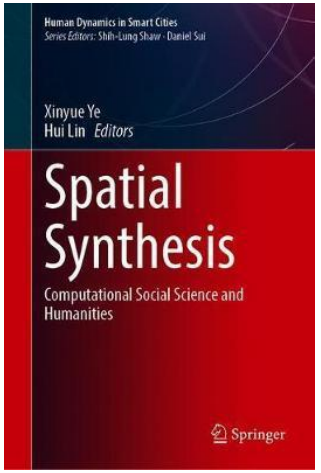

Scenario 2
Irene:
carless older adult who can walk
Exisitng HOP Route2
Fixed-Route Service
Autonomous Vehicle Fixed-Route Service
Scenario 3
Existing Regional Transit
Amanda:
single mom who can't afford to fix her broken car
Travel to her part-time job location
Fixed-Route Service
Existing HOP Route4
190
Connect to existing regional transit
FIXED ROUTE (Phase III)
FIXED ROUTE (Phase II)
Harker Heights
Trailer Homes
FIXED ROUTE (Phase I)
Nolanville
Trailer Homes
Trailer Homes
190
HD Map
Exisitng HOP Route35
Autonomous Vehicle On-Demand Service
Scenario 1
Add-on Service: Goods Delivery
Visit the hospital for dialysis twice a week
On-Demand Service
Sam:
disabled veteran who can't drive
0 0.25 0.5 1 Miles
Transit Transfer Hub
Affordable Housing Apartment
Grocery Store
Hospital & Clinic
Library
UPS Store
DAV Office (Disabled American Veterans)
Trailer Home
Pharmacy
Laundry Facility
School
Park

Computational Urban Science: Four Layers

- Human dynamics-centered Urban Science (Geographical Perspective)
- Platform-based Urban Science (Computer Science Perspective)
- Action-oriented Urban Science (Urban Planning Perspective)
- **Convergence-driven Urban Science (Synthetic Perspective)**

Convergence and Synthesis (Goodchild 2020)

- problems faced by humanity are arguably more challenging than they have ever been;
- science today is by nature collaborative;
- beyond centripetal academic practice: reward broader perspectives.



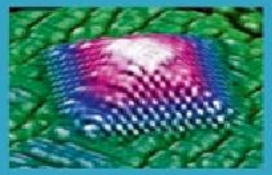
Successive levels of convergence for added value

Mihail C. Roco

Nanotechnology

Nanoscale science, engng.& technology

1999 NNI Report

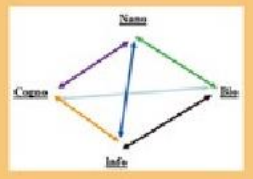


Integrate disciplines: for all sectors of the material world

NBIC

Nano, Bio, Info & Cogno

2003 Report



Integrate foundational technologies: Nanotechnology, Biotech, IT, Cogno

CKTS

Converg. Knowledge, Technology & Society

2013 Report

Integrate essential convergence platforms: NBIC, Human-scale, Earth-scale, Societal-scale

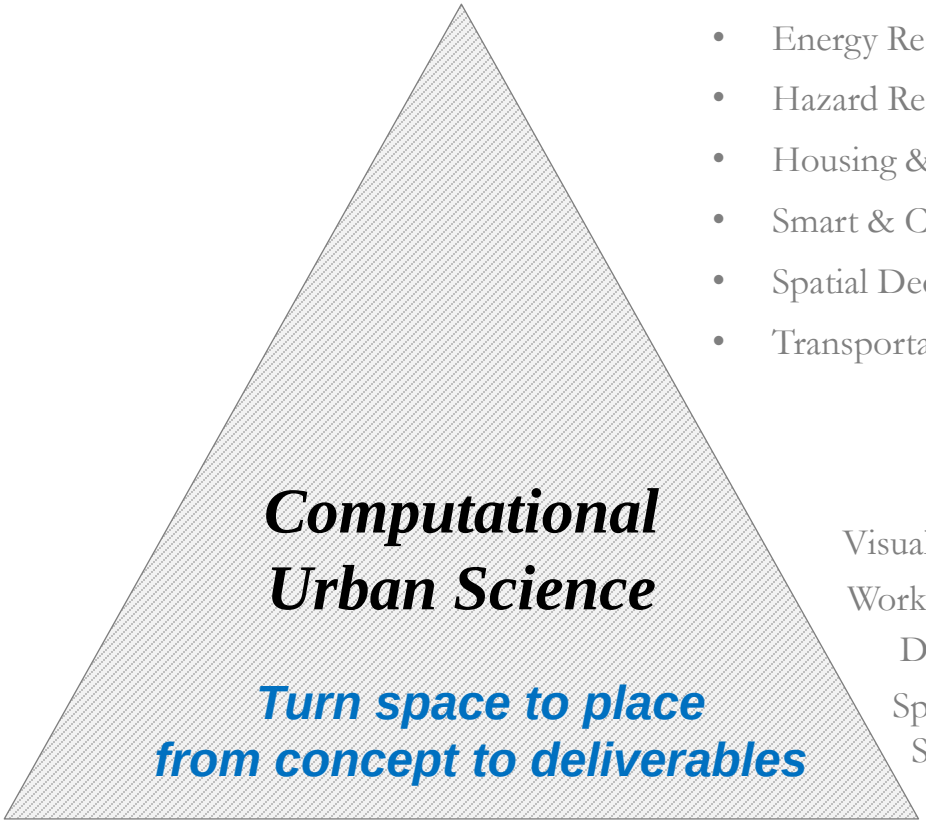
https://www.semanticscholar.org/paper/Convergence-of-Knowledge%2C-Technology-and-Society%3A-Roco-Bainbridge/395ba79760e73ee0391ba1ea3b8f02287903dbd9

https://nsf.gov/staff/staff_bio.jsp?lan=mroco

Research Agenda

Transformative Outcome

- Energy Research
- Hazard Reduction & Recovery
- Housing & Land Use
- Smart & Connected Cities/Health
- Spatial Decision Support System
- Transportation & Travel Behavior



Visual Analytics
Urban Computing
Workflow Automation
Text as Data
Data Fusion
Image and Video Analytics
Space-time Analysis
Real-time System
Spatial Econometrics

Human Dynamics

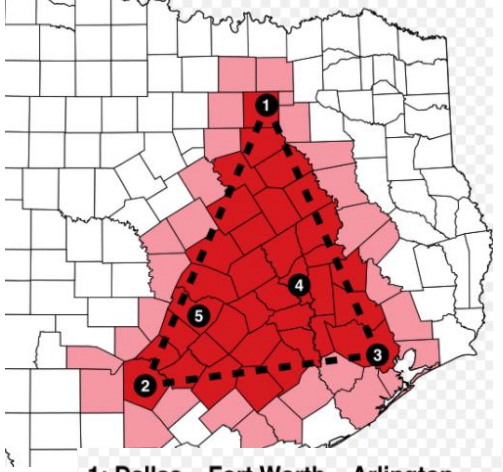
Conceptual

Urban Systems and Communities in the 21st Century

Methodological

Emerging AI, ICT, and location-aware technologies

Texas Triangle 2100



1: Dallas – Fort Worth – Arlington
2: San Antonio – New Braunfels
3: Houston – Sugar Land – Baytown
4: College Station
5: Austin – Round Rock – San Marcos

Modeling and Predicting Climate Change and Urban Sustainability by Integrating **High-Resolution Climate Simulation, Artificial Intelligence, and GeoDesign**

Faculty members from (9 colleges/15 departments, 4 TAMU system-level agencies)

- College of Architecture (Architecture, Construction Science, Landscape Architecture & Urban Planning)
- College of Geosciences (Atmospheric Sciences, Geography, Oceanography)
- College of Engineering (Computer Science, Electrical and Computer Engineering)
- College of Agriculture and Life Sciences (Horticultural Sciences)
- College of Liberal Arts (Communication, Sociology)
- Bush School of Government and Public Service (Public Service and Administration)
- Mays Business School (Finance)
- School of Public Health (Environmental and Occupational Health)
- Marine Science (TAMU-Galveston)
- Texas Federal Statistical Research Data Center
- Texas A&M High Performance Computing Center
- Texas A&M Institute of Data Science
- Texas A&M Engineering Experiment Station

Clockwise: Houston, Austin, San Antonio, Dallas-Fort Worth

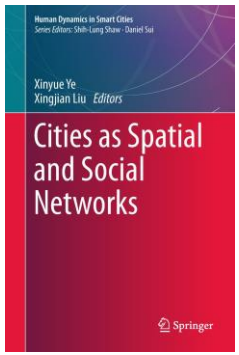
The 7th Symposium on Human Dynamics Research

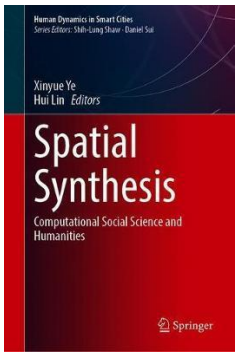
2021 AAG Annual Meeting, Seattle, WA
April 7-11, 2021

Call for Paper/Panel Sessions

Sponsored by the following AAG Specialty Groups:

- Applied Geography
- Cartography
- Cyberinfrastructure
- Geographic Information Science and Systems
- Regional Development and Planning
- Spatial Analysis and Modeling
- Transportation Geography
- Urban Geography





As a framework promoting human-centered convergence research, human dynamics has the potential to enable more effective and symbiotic collaboration across disciplines to improve human societies. We are particularly interested in topics related to the actionable human dynamics during the Seattle AAG meeting.

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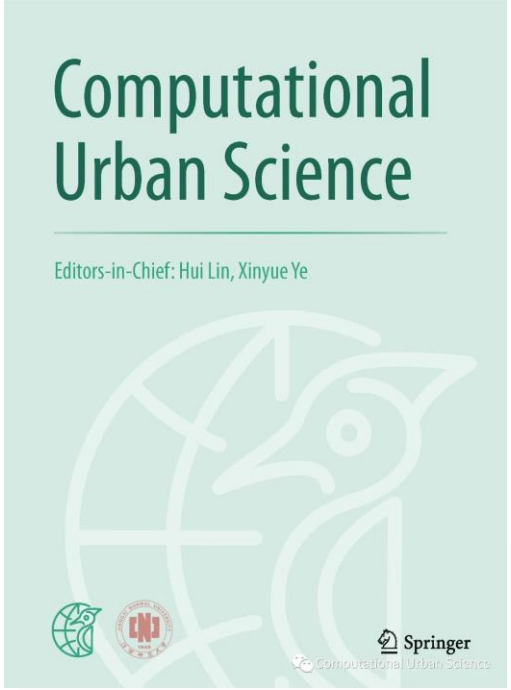

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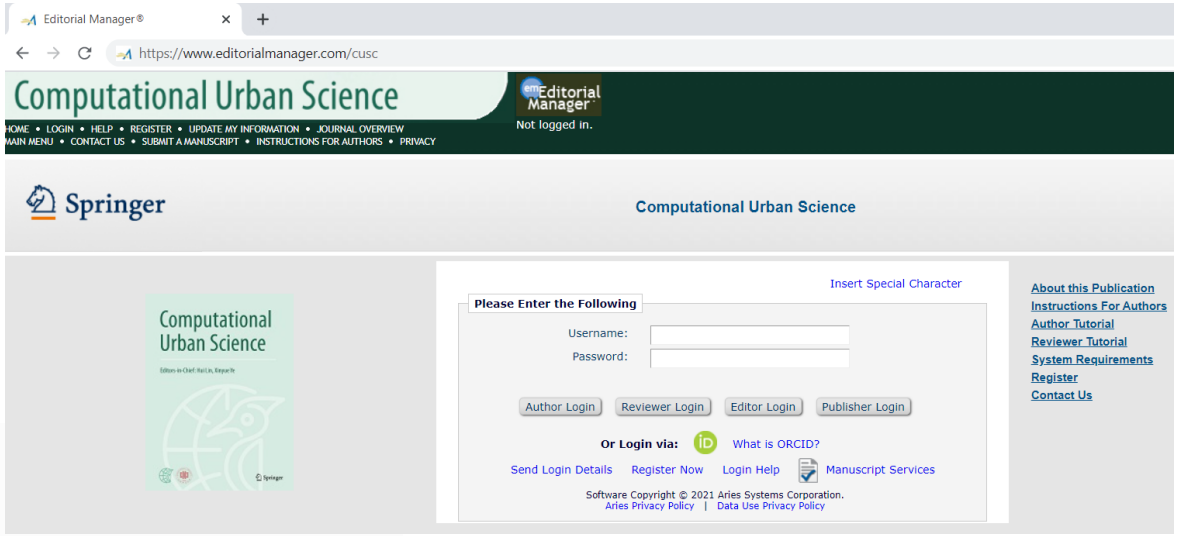

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