The Geospatial Triade & C19

Case Geocoding, contact/proximity tracing, & spatial diffusion

GISMO June 9, 2020

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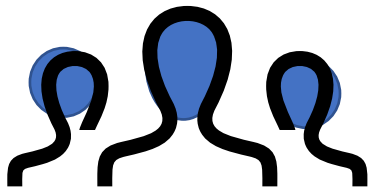
Dept. of Geography and Environmental Science
Hunter College - CUNY

Conceptual Model (SIR)

Origin

Ro

Susceptible Individual



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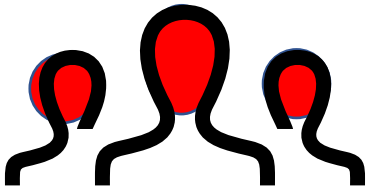

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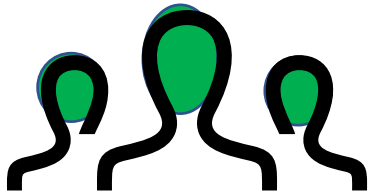
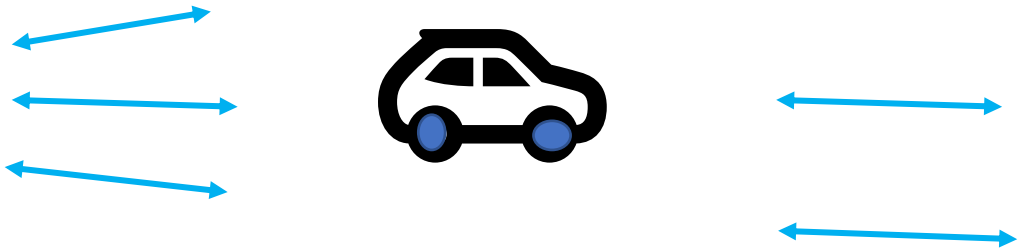
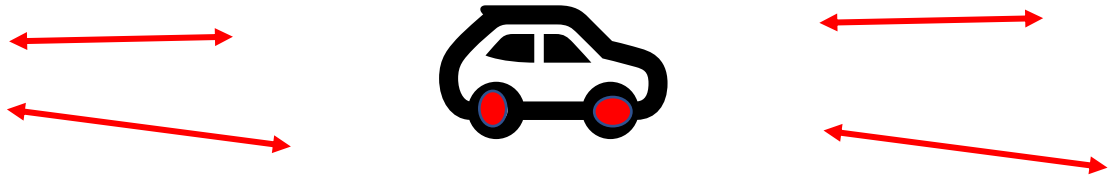


Transportation

Ro & diffusion

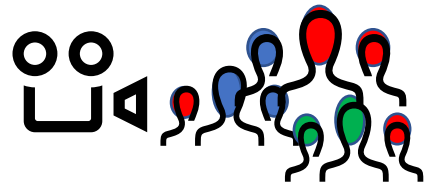




Destination

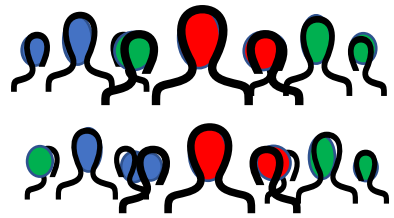
Ro

entertainment



work

Demonstration



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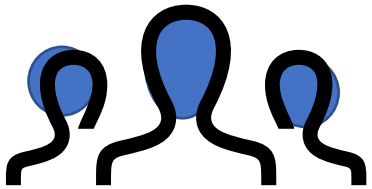

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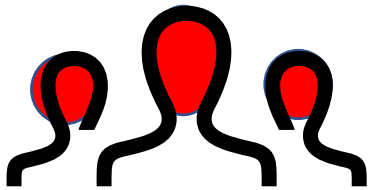

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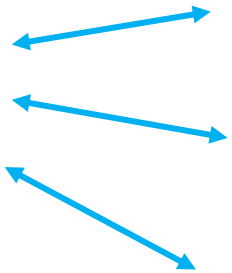

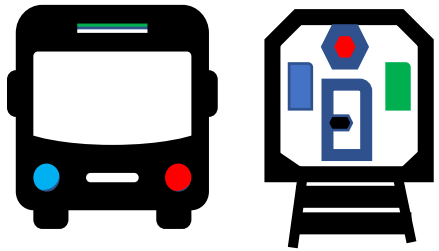

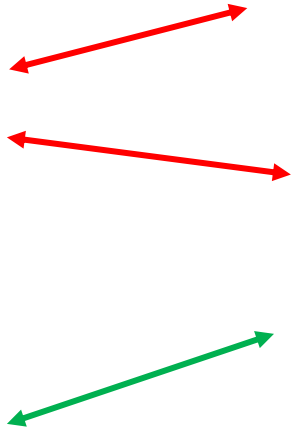

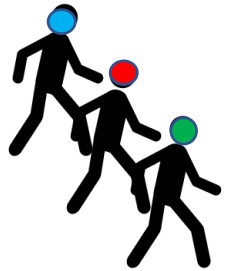

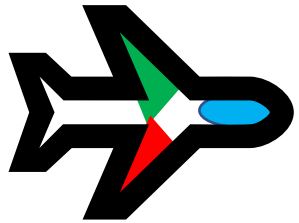

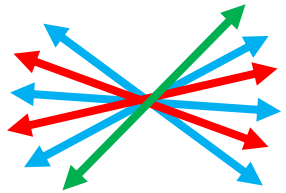

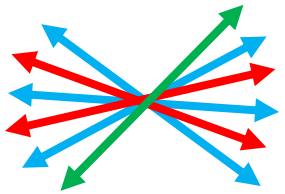

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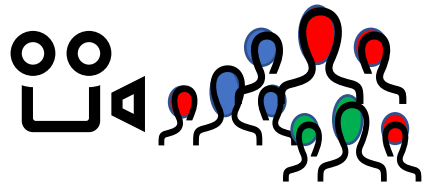

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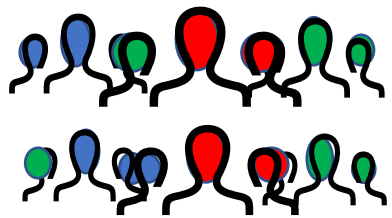


Goal: Understand and reduce transmission

Reducing transmission

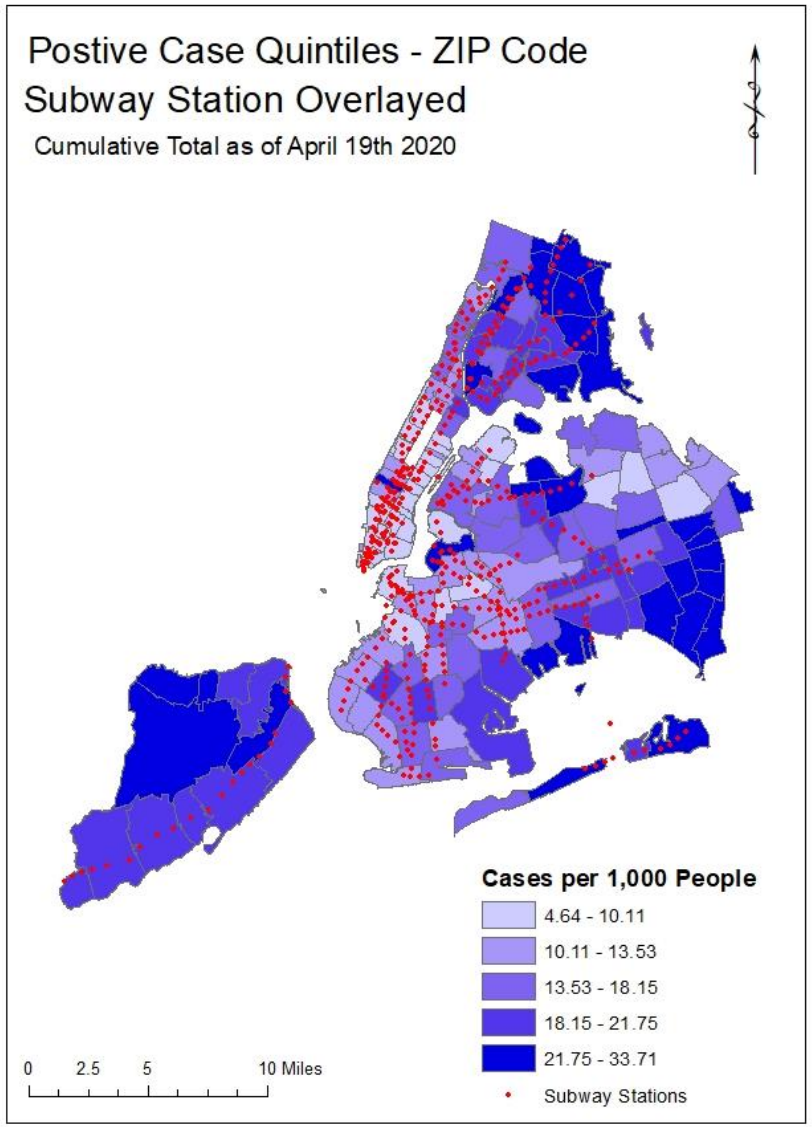
Modeling and prediction

- Where is the origin of infected individuals? Geocoding
- What individuals have they come into contact? Contact tracing
- What is the transmission rate of individuals? Ro
- How dispersed is the interaction of individuals? Diffusion

Challenge of Geo-Coding: get “clean” data at the source.

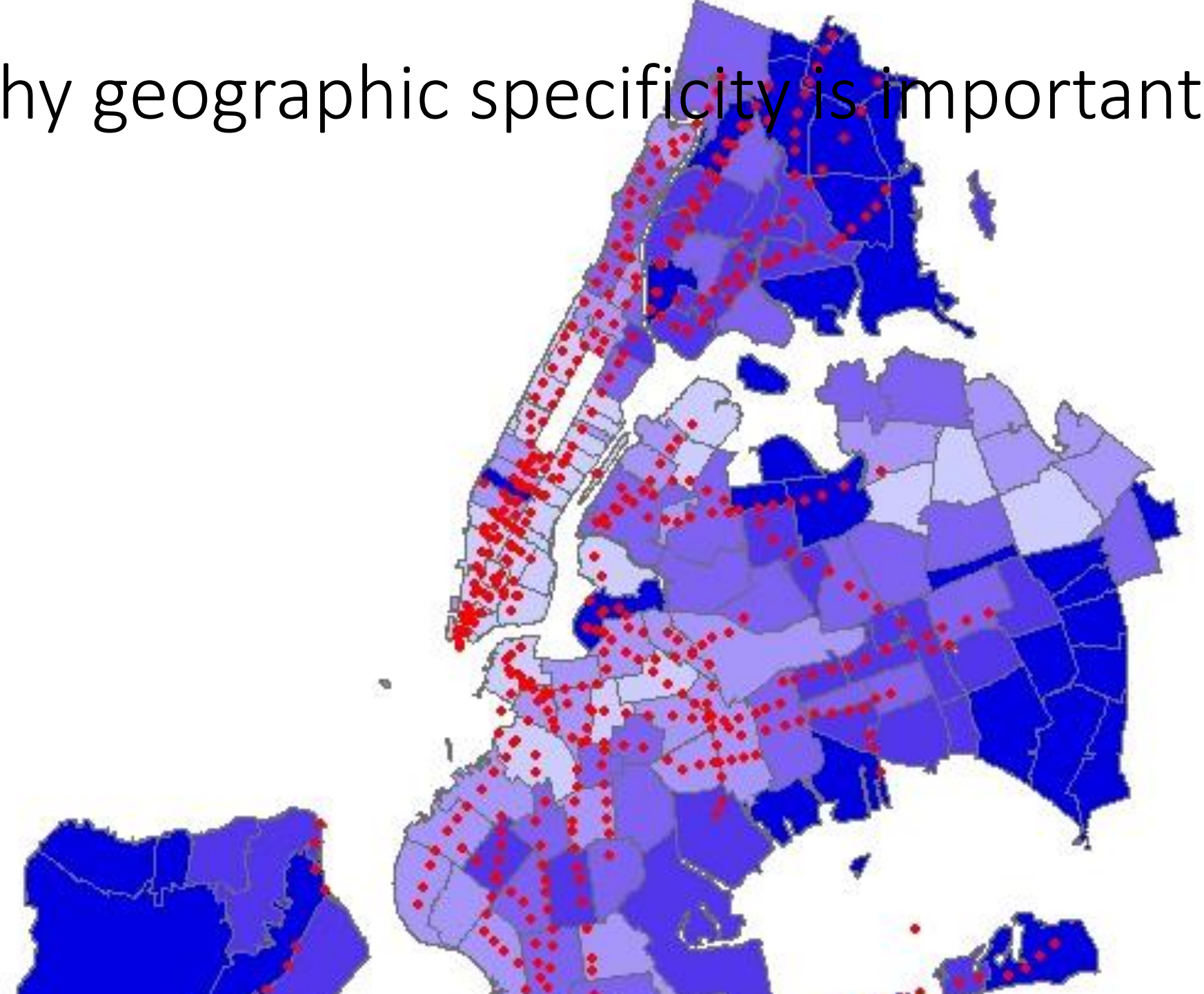
- Geo-coded data = Geographic specificity of analysis & understanding
- Create a data app for hospitals and other intake centers that doesn’t add overhead to their existing processes.
  - Ideas to insure uniform input?
    - Bar code reader of license of car registration or easy-pass?
    - Other?
- **Action item**: understand workflow and different entities involved and optional solution for obtaining “clean” address data at the “source” that minimizes overhead to the organizations.

Why geographic specificity is important

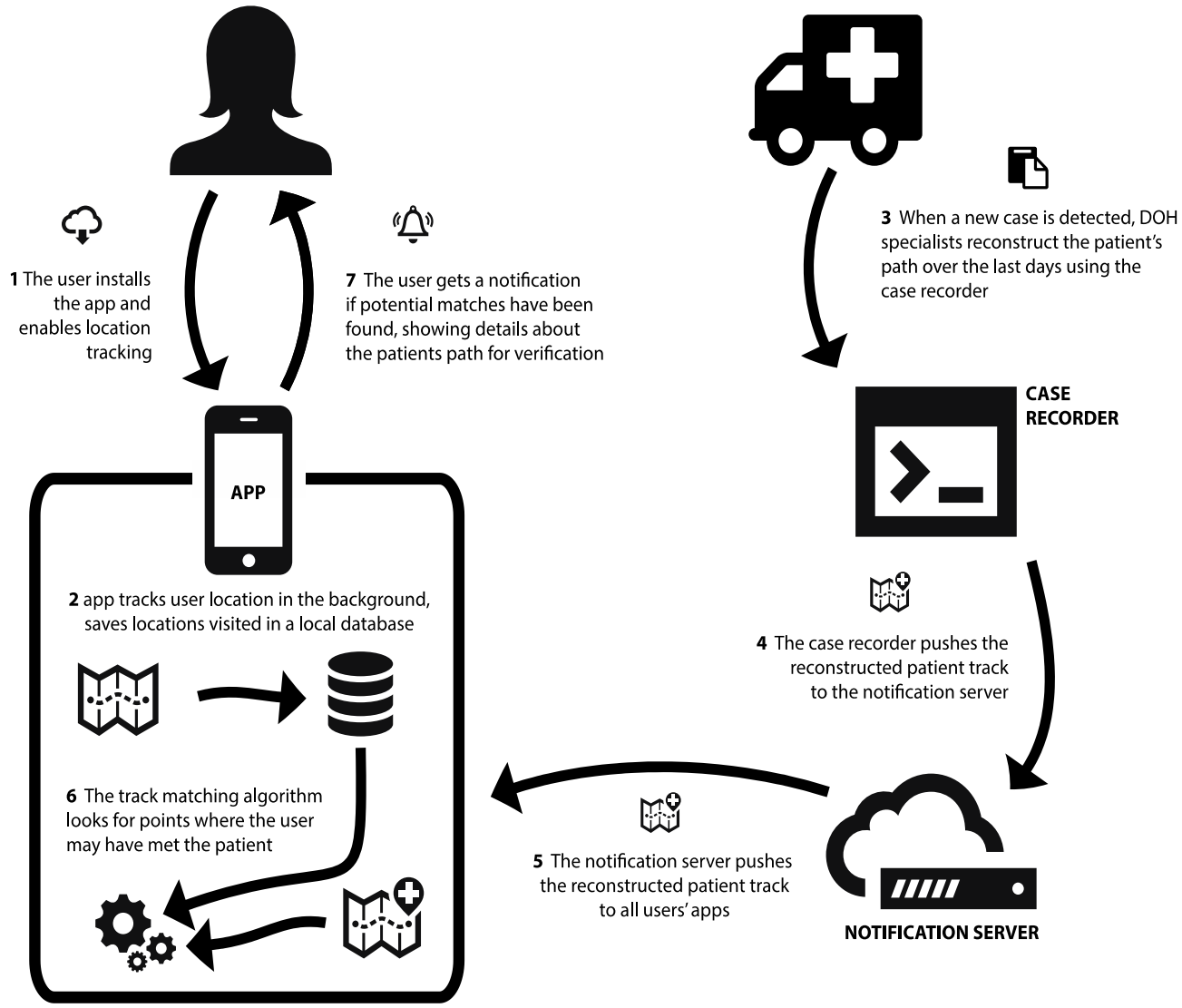


Author: Jason Urias

Why geographic specificity is important



Challenge of Contact tracing: how to maintain privacy?



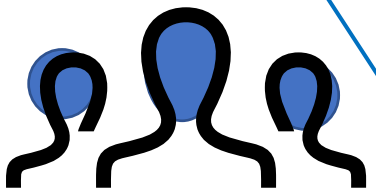
(Ahearn & Kessler)

Proposed to NYC – DOH on Feb 3, 2020

Modeling the spread and predicting the future

Embedder Recursive SIR model (CARSI model): fixed diffusion

Susceptible Individual



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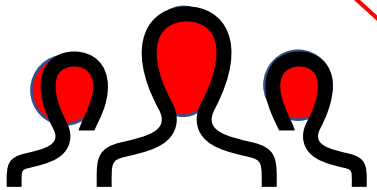

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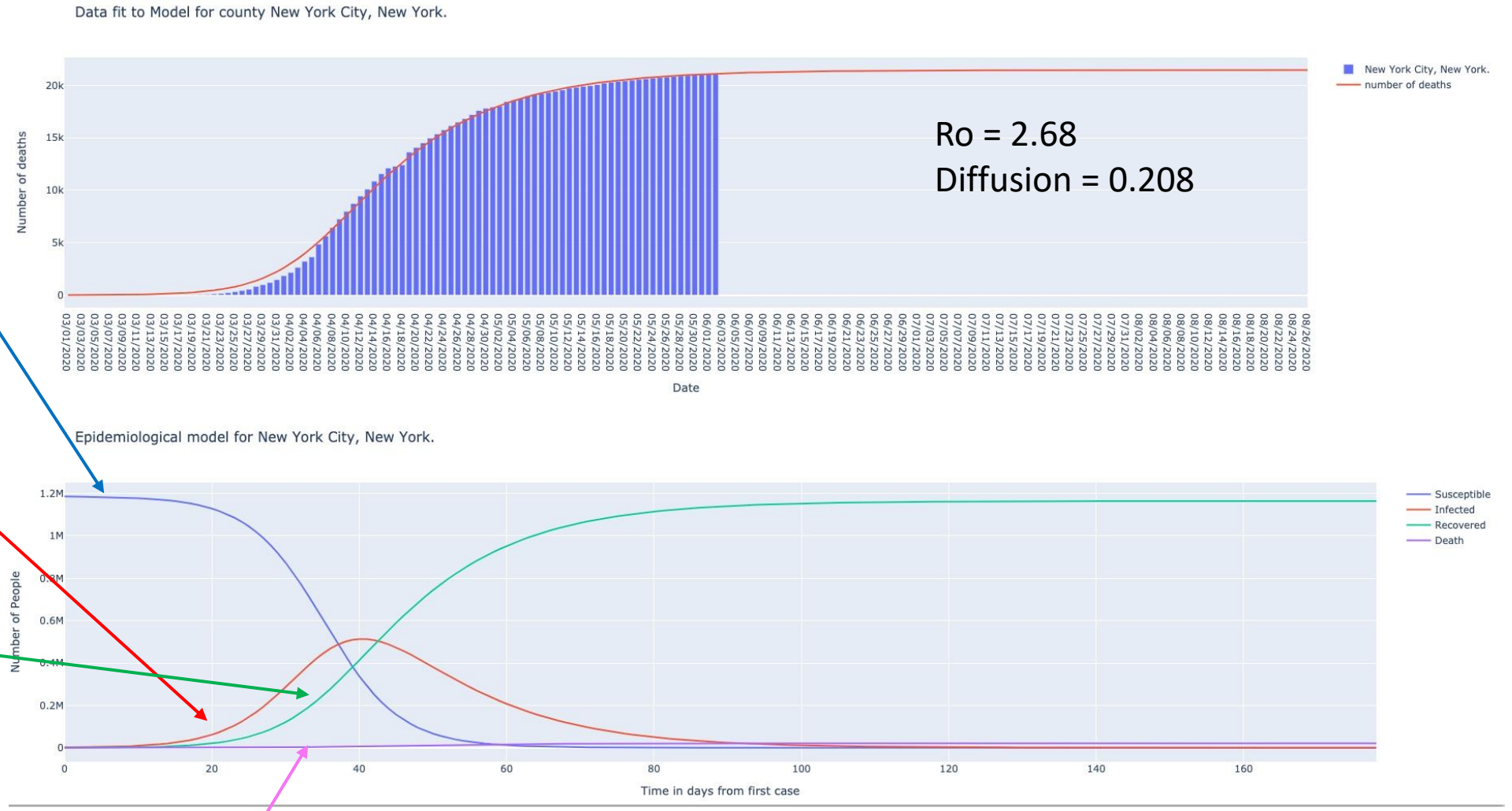

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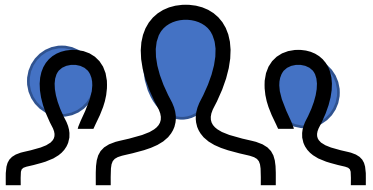
Modeling the spread and predicting the future

Embedder Recursive SIR model (CARSI model): Variable diffusion

Susceptible Individual



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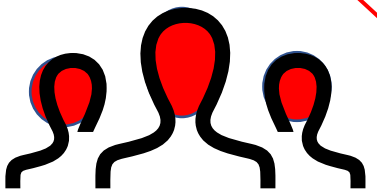

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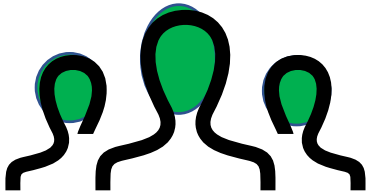

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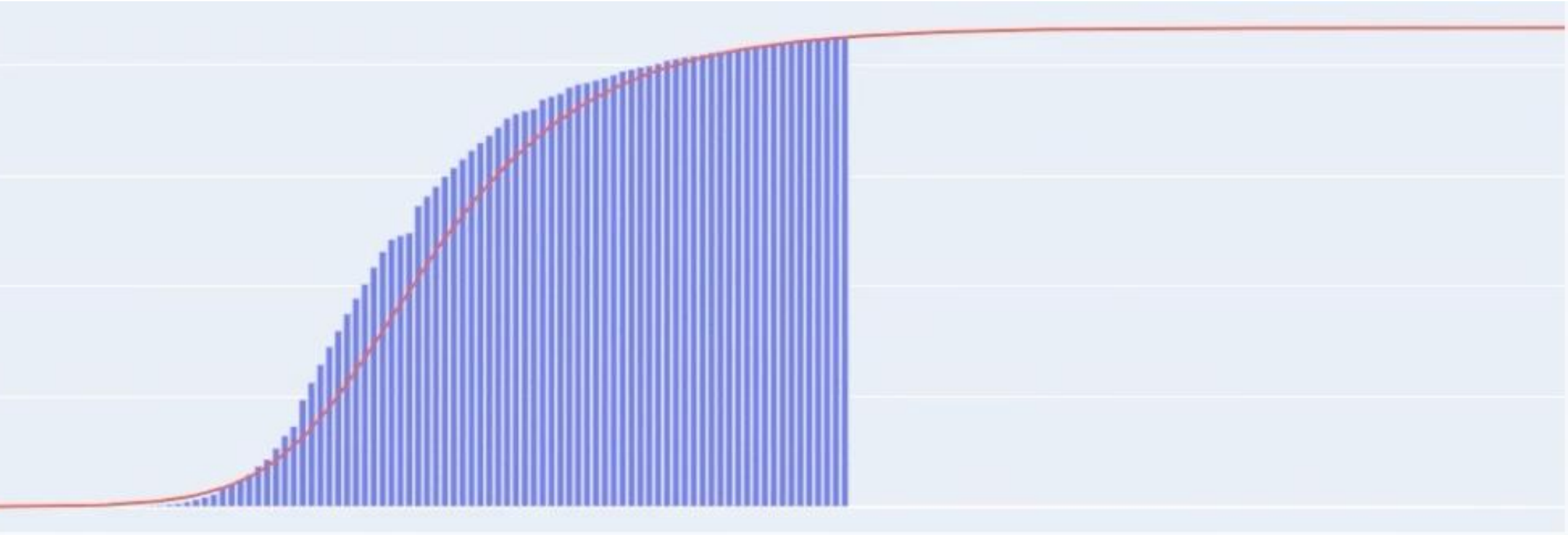
Center for Advanced Research of Spatial Information

Embedded Recursive SIR Model (CARSI Model)

Classic SIR model with Machine Learning Curve Fitting



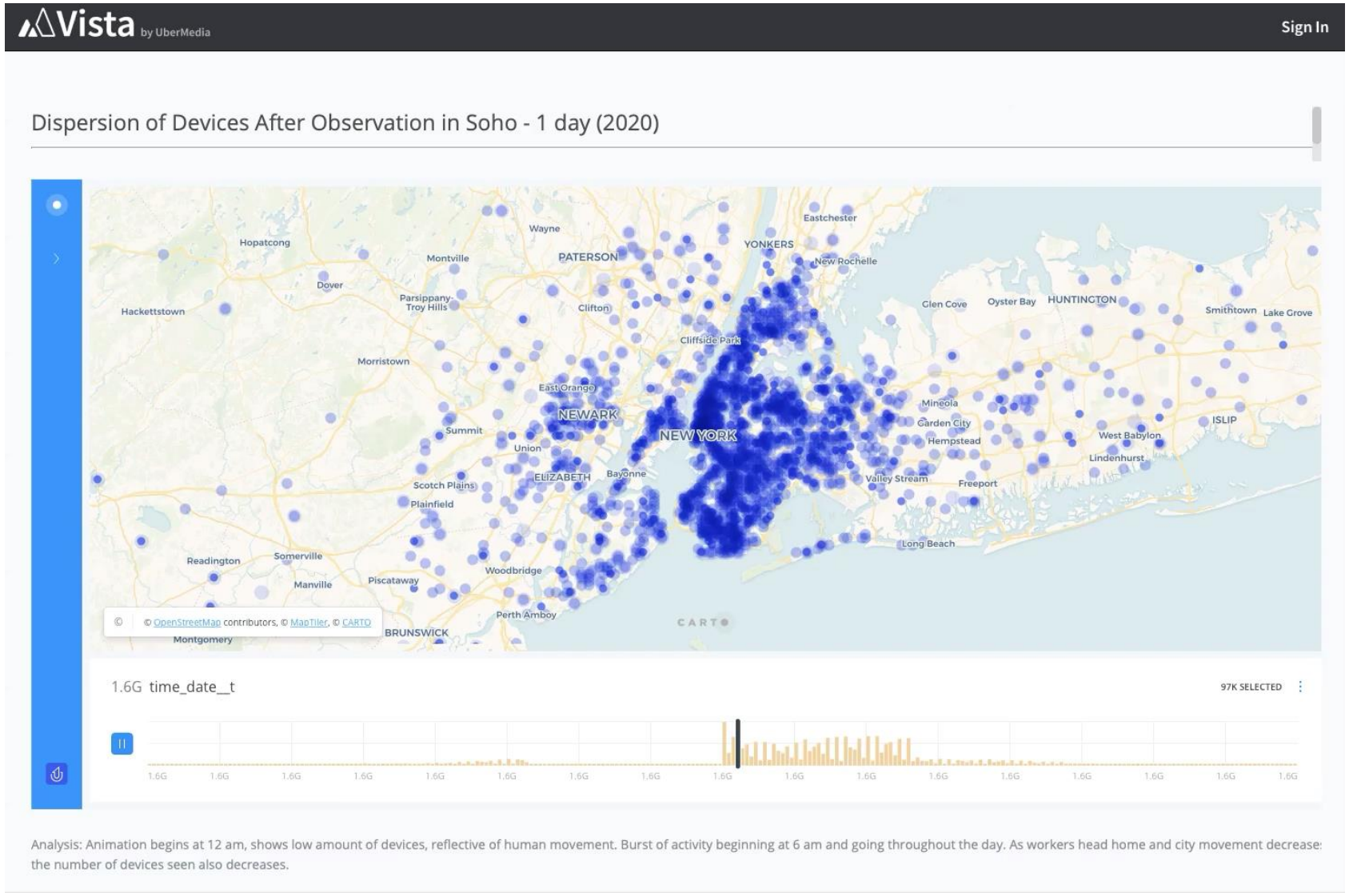
HUNTER 150 years 1870 · 2020

New Sources of Movement Data

- Movement data of individuals from apps has been consolidated to capture movement from origin to destination (*diffusion*)
- Proximity of devices (*Ro*)
- These data can be used to calibrate both *diffusion* and *Ro* going forward for specific geographic areas (i.e. building, block, etc.)

Movement data for model calibration and analysis

DIFFUSION



Courtesy of Uber Media

Proximity and estimate of ***Ro***

Social Contact

Methodology

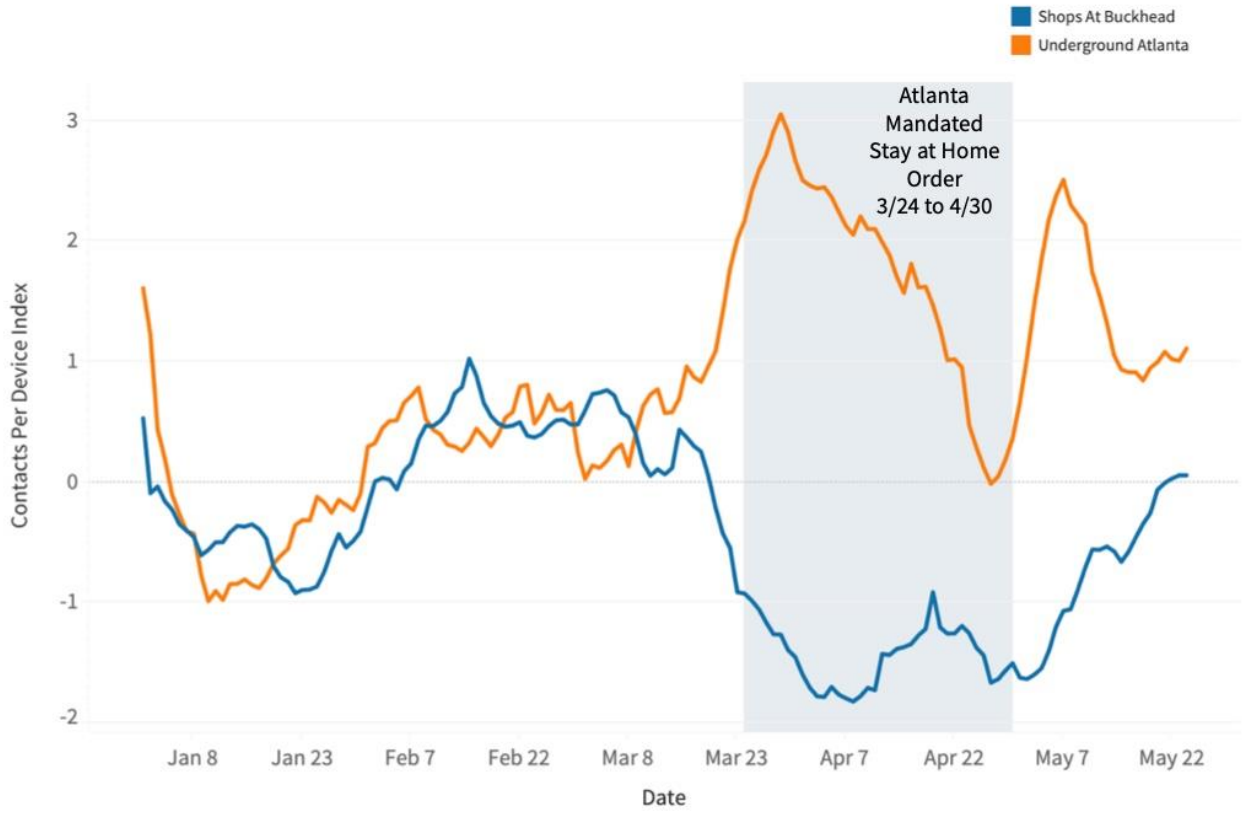
Index of contacts per device within 10 nearest block groups, baselined by period before COVID-19. Contact is defined as 2 devices within 5 meters of one another for 5 minutes

How do cities and suburbs compare in regards to social distancing?

Residents in the communities surrounding Buckhead engage in similar manner to those near Underground ATL before Covid-19. The trend changes dramatically in response to stay at home order. Those in downtown Atlanta experience much more contact than those outside of downtown.

What impact did reopening have to the communities?

Although both communities are engaging in more contact with others, those in the urban communities saw a contact surge in the days after reopening the economy.



UberMedia

Conclusion

- The tools are available for monitoring and attenuating the spread of Covid19.
- Processes need to be put in place as the City opens up to insure quality geocoded data.
- A contact/proximity application needs to be implemented.
- Data on cases and deaths needs to be available by DOH in a form compatible with modeling (i.e. as a time series).
- Real-time movement/interaction data needs to be part of the solution.