Dummy Title

By Dummies

27 JUN 2020

Abstract

On 24 April, 2020, a researcher at MIT released a working paper finding that "The Subways Seeded the Massive Coronavirus Epidemic in New York City". While the analysis in the paper has been called into question, it remains true that the role of public transportation in the spread of COVID-19 is still unknown. In this paper, we introduce an agent-based model of the New York City subway and analyze how well it can predict the spread of COVID-19 through the boroughs of New York City.

Our findings that [insert findings here] should interest public health officials looking to make policy decisions about public transportation.

[Writer's Note: Of course, this is the ideal final result. We will focus on the early infection period and I give it a 50/50 that we even get to taking into account countermeasures and ridership losses. We will make a preliminary model, improve it, and see how far we can get.]

Competencies Briefing

Purpose: Brief others on competencies so we can discuss things
Transportation Networks
specifically subways, the NYC subway. mapping, passenger flow
python, networkx, mesa
we're working with these techs.
Writer's Note: Obviously to be removed before submission
This report was last pushed to OverLeaf on 30.05.2020. You will find our latest work at the link below: https://github.com/cheung-ho-lum/NS_Epidemics_ABM_Approach/blob/master/Report/ABM_NYC_Subway.pdf

Background

Epidemics and COVID-19

A Timeline of the Start of COVID-19 in NYC

[Writer's Note: I mean the honest reference is Wikipedia]
Feb 25 - Some guy came back from Iran
Mar 3 - First P2P spread
Mar 9 - 16 confirmed cases
Mar 9 (Approx.) - Metro ridership starts decreasing
Mar 16 - schools close
Mar 18? - PAUSE government order to shelter in place

Mathematical Modeling of Epidemics

SEIR Model

[Some explanation of SEIR goes here]. We're looking into more advanced models (see bibliography). The key additions are 'super-spreaders' and 'asymptomatic'. At the end of the day, we just need pure mathematically modeling to provide some parameters for how agents should behave.

Newer Compartmental Models

Agent Based Models

It's just a tool. like any model. Simulating agents in an environment. Key parameters are agent, model, and environment parameters. For example, we have the following list thus far:

```
(Agent)STATUS_SUSCEPTIBLE = 'Susceptible'
(Agent)STATUS_EXPOSED = 'Exposed'
(Agent)STATUS_INFECTED = 'Infected'
(Agent)STATUS_INFECTED_ASYMPTOMATIC = 'Asymptomatic'
(Agent)STATUS_RECOVERED = 'Recovered'
(Agent)TIME_TO_RECOVER = 10
(Agent)TIME_TO_INFECTION = 3
(Model)RUN_SPAN = 60
(Model)TOTAL_POPULATION = 50000
```

The environment is new york subway mapped as a network.
All of this is still being discussed.

Urban Transportation Networks and Subways

This guy is indispensable for figuring out how to parse some of this data:
https://en.wikipedia.org/wiki/New_York_City_Subway_nomenclature

MTA Station Data

Station, Complex, Line, Route
station 167... doubled
making edges. GTFS Data... no we do it ourselves

MTA Turnstile Data

discuss format. every 4 hours, every machine. aggregation.

MESA(Or our model)

Methodology

Results

Conclusion

References

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[4] Philip Cooley, Shawn Brown, James Cajka, Bernadette Chasteen, Laxminarayana Ganapathi, John Grefenstette, Craig R. Hollingsworth, Bruce Y. Lee, Burton Levine, William D. Wheaton, and et al. The role of subway travel in an influenza epidemic: A new york city simulation. *Journal of Urban Health*, 88(5):982–995, Sep 2011.

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[6] M. Laskowski, B. C. P. Demianyk, J. Witt, S. N. Mukhi, M. R. Friesen, and R. D. Mcleod. Agent-based modeling of the spread of influenza-like illness in an emergency department: A simulation study. *IEEE Transactions on Information Technology in Biomedicine*, 15(6):877–889, 2011.

[7] Faïçal Ndaïrou, Iván Area, Juan J Nieto, and Delfim F M Torres. Mathematical modeling of covid-19 transmission dynamics with a case study of wuhan, Apr 2020.