Gravy ANALYTICS

JOHNS HOPKINS WHITING SCHOOL of ENGINEERING

Johns Hopkins University's Whiting School of Engineering: Using Location Analytics to Model COVID-19 Transmission in Anytown, USA

COVID-19 TRANSMISSION MODELING CASE STUDY

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Overview: Modeling the Impact of Interventions on COVID-19 Spread in Small Town America

THE CLIENT

Founded in 1876 and headquartered in Baltimore, Maryland, the Johns Hopkins University is America's first research university. Its Whiting School of Engineering enables its engineering students to tackle real-world challenges of importance to society under the guidance of leading scholars and scientists.

In the spring of 2020, Anton Dahbura, an associate research scientist in the Department of Computer Science at the Whiting School of Engineering, watched the COVID-19 pandemic unfold in his hometown of Hagerstown, Maryland. Despite being only an hour from the metropolitan areas of Washington, D.C. and Baltimore, some residents still thought that the virus would not reach Hagerstown. In fact, it would only be a matter of time before it spread everywhere—much like the flu.

THE PROBLEM

Realizing that the way COVID-19 would spread in a smaller town was quite different than how it would spread in a larger city, college town, or resort town, Professor Dahbura set out to build a consumer-friendly online simulator that would illustrate how COVID-19 might travel through smaller communities.

Such a simulator could be used by the general public to better understand COVID-19 transmission patterns and the value of related public health interventions.

To do so, Professor Dahbura partnered with Kimia Ghobadi, an assistant professor in the Department of Civil and Systems Engineering. Together, Professors Dahbura and Ghobadi assembled a team of approximately 30 undergraduate student researchers—designers, computer programmers, data analysts, and project managers—to tackle the project. Dubbed Anytown, USA, the platform would allow any user to simulate the spread of the virus throughout a prototypical small town, and how different mitigation strategies, such as mask wearing or vaccinations, might change the course of events.

Building such a simulator would require not only technical talent, however, but also heavily rely on models to illustrate both:

1. transmission of the COVID-19 virus, and
2. movement patterns of people within a typical, small-town environment.

But while the models for respiratory disease transmission and COVID-19 were already well-established, the model for human movement would need to be built from scratch.

The research team turned to Gravy Analytics for a trusted dataset that could be used to understand how people living in an average American town move about in the physical world. After consulting with the research team, Gravy Analytics delivered a custom Observations dataset consisting of 1 month of aggregated mobile location signals. All Observations datasets contain information about signal origin and quality, allowing research teams to segment and work with only the data meeting project needs.

BIG LOCATION ANALYTICS FOR SMALL TOWN INSIGHTS

Gravy's data helped the JHU research team to:

Understand human movement patterns in a typical small town.

Using Gravy's Observations data, the research team was able to understand how people living in a randomly selected town of approximately 6,000 residents engage with their local community. Location signals observed in and around the town used as the model for Anytown enabled researchers to understand the types of places visited in a small town and the share of foot traffic seen at each location of interest—and potential point of COVID-19 transmission—like the gym, a diner, the library, or a local park.

"Gravy Analytics' data has helped shine a light on the complicated patterns of human mobility. Our team looks forward to leveraging the insights their data provides in the pursuit of creating ever more accurate disease models."

Mathias Insley, Delineo Project Student Project Leader

Determine "convenience zones" for residents of the community.

Gravy's Observations data also allowed the team to define the typical range of movement, or "convenience zone" for town residents. Using spatial temporal clustering, JHU researchers were able to further understand the ecosystem of the model community and the size of the geographical regions its residents move around in most regularly.

"Gravy Analytics' data has helped us analyze population movement with greater resolution, factoring in devices' locations and time spent in different areas. Its filtering techniques, like its flags indicating when devices are likely driving or are spoofs, further increase the accuracy of our clusters by removing extraneous datapoints."

Oren Wei, Delineo Project Student Simulation Team Leader

REAL-WORLD RESULTS FOR COMMUNITIES

Now available to the public at https://covidweb.isi.jhu.edu/simulator, the Anytown, USA simulation follows the movement of COVID-19 infected people in a small town for sixty days, beginning with a few infected people who, as they go about their daily lives, subsequently go on to infect others. The rate of COVID-19 transmission, however, depends on user-defined parameters such as the percentage of people who wear masks and are vaccinated or capacity restrictions on restaurants and bars. Because the simulator is designed to be random, outcomes also depend—to a certain extent—on luck.

A TOOL FOR PUBLIC EDUCATION

The Anytown, USA simulator is primarily designed as a tool for awareness and education. Its user-friendly, animated interface makes it a good choice for educators who want to help their students understand how a pandemic can spread in their community, and to answer questions like: "What happens when more people wear masks?", "How do things change once more people become vaccinated?" and "What might happen if no interventions are taken at all?"

STRATEGIES TAILORED TO YOUR TOWN

While Anytown, USA is modeled on location data for a single midwestern community, the reality is that even small towns are very different. The power of the Anytown platform, coupled with data from Gravy Analytics, is that communities will no longer need to rely on a one-size-fits-all approach. With the help of the right data and research tools, every town should have the ability to design a unique mitigation plan that helps to control the spread of COVID-19 (or another virus), while minimizing disruption to the community and its local economy.

PART OF A MUCH BIGGER PICTURE

Anytown, USA can be modified to simulate the spread of new variants like Delta or Mu, as well as any other infectious respiratory illness that might emerge. All that's needed to do so is the right data. Even more importantly, Anytown, USA isn't a standalone effort: the project is an extension of Johns Hopkins' Delineo Disease Modeling Project, a multidisciplinary effort that aims to create new tools for modeling the spread of pandemics in the future.

ABOUT GRAVY ANALYTICS

Where people go and why tells the story of our world. Founded in 2011, Gravy Analytics is the enterprise location technology company providing actionable intelligence to businesses. Using its patented technology, the company brings data about people, places, and events together to understand human mobility, helping companies enhance their sales and marketing strategies and optimize business operations. Today, the company's intelligence powers leading-edge solutions for a wide range of industries—from advertising to market research, financial services to supply chain risk management—that rely on knowing how people, products, and materials move throughout the world. For more information, please visit gravyanalytics.com.

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