Medical Xpress

New outbreak model better predicts COVID-19 hotspots

April 28 2020

Credit: CC0 Public Domain

Viruses, such as the one that causes COVID-19, spread quickly through large cities because of a complex web of interactions between people taking place in a densely populated area. But how viruses move from person to person in smaller, rural communities is less well understood, resulting in public health and economic decisions that are made on the basis of scant information and overgeneralized modeling.

A team led by Whiting School of Engineering computer scientist and cybersecurity expert Anton Dahbura is developing a new model that more accurately understands and predicts the spread of diseases such as COVID-19 in both large and small communities.

"The bottom line is, you cannot treat a population as a big barrel of marbles; infection is a very localized and personalized process," says Dahbura, who is a member of the Malone Center for Engineering in Healthcare and the Johns Hopkins Institute of Assured Autonomy, as well as the executive director of the Johns Hopkins University Information Security Institute. "Yet current models are very generalized and don't consider different types and sizes of communities or the lag time of spread across vast geographical areas. Our model considers both."

Developed with the help of Mathias Unberath, an assistant research professor in Computer Science and a member of the Malone Center, along with Lingxin Hao and Emily Agree of the Johns Hopkins Population Center, the new model envisions populations in terms of extremely localized and specific "modules" of people, their dwellings, and shared community spaces such as offices, schools, stores, and restaurants. It takes into account that people interacting with one set of modules may also interact with another, acquiring and spreading infection.

"The idea is to connect one module to another, in a hierarchical fashion, so they fit together like LEGO bricks, creating an entire system that goes from individual dwellings and communities to cities, states, and beyond," Dahbura explains.

The researchers say that their model will not only more accurately track and predict the spread of disease, but also will perform better than current, more general models at evaluating the effects of starting and stopping mitigation efforts such as social distancing, hygiene initiatives, school and business closures, and travel restrictions. The new model will also gauge the impact of testing and vaccines based on participation by the local community.

The team's ultimate goal is to be able to run their model on a sophisticated but accessible dashboard that will simulate the spread of a virus but factor in mitigation efforts such as stay-at-home orders before reflecting how those efforts affect the rate of infection.

Dahbura's group is developing a distributed programming environment to run the model over large numbers of computers to scale up the areas that can be accurately modeled.

"We're somewhat arbitrarily starting with modeling the small community of Barnsdall, Oklahoma, with a population of about 1,500 people, 500 homes, and one Dollar General store for grocery shopping, and then working our way up from there," Dahbura said. "We want to provide decision-makers with more accurate tools instead of very high-level models and incorrect or inaccurate theories to predict and control pandemics."

Provided by Johns Hopkins University

Citation: New outbreak model better predicts COVID-19 hotspots (2020, April 28) retrieved 27 April 2024 from https://medicalxpress.com/news/2020-04-outbreak-covid-hotspots.html

provided for information purposes only.