also aid public health officials in making decisions about the distribution of vaccinations or treatments in the earliest days of contagion.

In order to predict how fast a contagion might spread, researchers are examining variations in travel patterns among individuals, the geographic locations of airports, the disparity in interactions among airports, and waiting times at individual airports. Juanes, a geoscientist, has tapped past research on the flow of fluids through fracture networks in subsurface rock to build an algorithm for the current task. Moreover, the team plugs in cellphone usage data to understand real-world human mobility patterns. The end result is "a model that's very different from a typical diffusion model," he says. It is plugging in more data—and better data—to create a more robust model than has ever before existed.

Archimedes' Peter Alperin says that today's models are aiding and speeding policy decisions in ways that were unimaginable only a few years ago. The NIH, government agencies, pharmaceutical firms, and healthcare organizations use these models to help build more effective policies or develop treatment strategies or new medicines. Last year, the firm began building models for the U.S. Food and Drug Administration (FDA) to better understand clinical trials evaluating weight loss medications. The data is being used to better understand the benefits of weight loss against the long-term risks of cardiovascular outcomes in patients treated with weight loss drugs.

Nevertheless, computer modeling is not a fix-all, says Sandro Galea, chair of the Department of Epidemiology at Columbia University. Among other things, he has examined how policy decisions affect social problems ranging from obesity to how large-scale disasters and trauma affect mental health among various demographic groups. In the latter scenario, for example, modeling helps identify who is at greater risk and what types of treatment and services can help reduce mental illness.

However, all models are built on assumptions and have some flaws and errors. Indeed, there is no standard for how to build an effective computer model or to establish confidence in what a model produces. Mabry and her partners at NIH—a major provider of research grants—are now focusing on model "verification, validation, and uncertainty quantification." They hope to collectively produce some guidance for model builders, as well as those reviewing journal manuscripts and grant applications. Without this, the fledgling field will continue to produce models that range widely in quality, she says.

Yet, computer modeling continues to evolve and gain acceptance. "Computer modeling isn't a crystal ball," Mabry concludes. "But it is helping to illuminate the complexity of health and social problems—along with potential remedies. Success is ultimately dependent on culling huge amounts of data about the population, developing good algorithms, and harnessing the success of supercomputers to make sense of complex relationships. This information can then be used by public policymakers to do their job."

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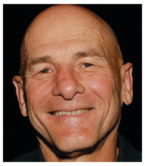
Samuel Greengard is an author and journalist based in West Linn, OR.

ACM Member News

DAVID PATTERSON'S 'BIG DATA' PROJECT TAKES AIM AT A CANCER CURE



David Patterson and his team have been working for over a year on what he describes as an odd sort of project for a computer scientist—building a software pipeline for cancer genomics that is faster, cheaper, and more accurate than ones that already exist.

Patterson, a former ACM president who has been a computer science professor at the University of California Berkeley since 1977, recalls an application was needed for the university's new AMPLab, which integrates Algorithms, Machines, and People to make sense of "big data."

"A problem in academics is that data is either small and interesting or big and dull," he says. "Interesting big data is usually proprietary. But, in the case of cancer genetics, we knew there would be lots of data and a really important use for it—helping discover treatments that might put an end to what is become the second leading cause of death in the U.S."

The pipeline uses The Cancer Genome Atlas, a repository of five petabytes of data containing the genetic sequencing of thousands of cancer tumors. It is expected to grow to millions—along with what treatments were given to patients to cure those tumors, and the outcomes. "The ultimate goal is that, by sequencing the genome of a cancer tumor, doctors will be able to prescribe a personalized, targeted therapy to stop a cancer's growth—or cure it," he says (see http://nyti.ms/rJOjeS).

Patterson, no stranger to fighting diseases, has raised over $200,000 to fight multiple sclerosis after his wife was, fortunately, *mis*diagnosed with the disease. "Helping people fight both cancer and MS are worthwhile causes that work against the unfortunate stereotype of the uncaring computer scientist," he says.

—Paul Hyman