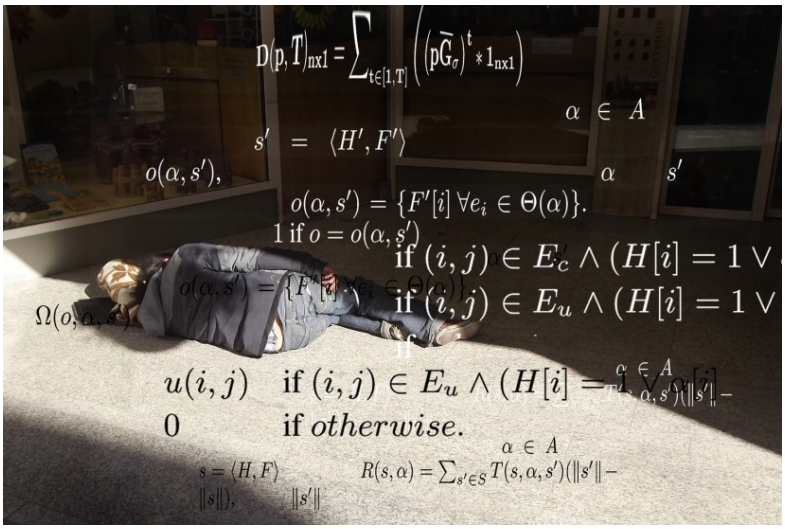
Health [/category/health/] Science/Technology [/category/science-technology/]

To prevent the spread of HIV among the homeless, researchers turn to math

Algorithm helps social workers determine how best to get their message to those at risk

by **Tanya Abrams**
[/author/tanyaabr/]
February 2, 2015



(USC photo illustration by Holly Wilder)

USC researchers have teamed up with Los Angeles social workers to address a public-health problem — the spread of HIV — using an unlikely method: mathematics.

Social workers at My Friend's Place [http://myfriendsplace.org] , a nonprofit agency that helps Los Angeles' homeless youth become more self-sufficient, have been working to prevent the spread of HIV among homeless teens and young adults.

They've relied in part on word-of-mouth, but have had limited success. Transient young adults often have fluid friendships; if two friends stop hanging out, a social worker's street campaign could come to an end.

Now, there's an algorithm for that.

To maximize the word-of-mouth campaign, USC computer scientists created an algorithm that can pinpoint the best person to spread the word while accounting for uncertainties in that person's social circle. As social workers confirm the person's friendships, the algorithm gets smarter and its answers are improved.

The algorithm results in about 60 percent more information being spread, USC researchers said.

> Amulya joined our Ph.D. program intent on working on artificial intelligence research that would benefit society. Here he has done just that.
>
> Milind Tambe

Amulya Yadav [http://teamcore.usc.edu/people/amulya] , a Ph.D. student in the computer science department [http://www.cs.usc.edu] of the USC Viterbi School of Engineering, and colleagues presented the algorithm this week at the Association for Advancement of Artificial Intelligence [http://www.aaai.org/home.html] conference in Austin, Texas.

"Amulya joined our Ph.D. program intent on working on artificial intelligence research that would benefit society," said Milind Tambe, a computer science professor at USC Viterbi and co-author of the study. "Here he has done just that, introducing a powerful new algorithm with real-world impact."

Pinpointing elusive influencers

Homelessness affects about 2 million people aged 13-24 every year in the United States. Of them, 11 percent are HIV-positive; that's 10 times the rate of infection in the general population, researchers said.

Eric Rice, an assistant professor at the USC School of Social Work and co-author of the paper, has been working with My Friend's Place since 2003 to create more effective public-health campaigns. A mathematical approach to the problem made sense.

"One of the biggest, thorniest problems when you're talking about peer-led programs is: Who's supposed to be the peer?" Rice said. "What Amulya's work does so nicely is it provides a computer algorithm that picks peers in a much more sophisticated way than we could do without that

technology."

At this stage in development, the algorithm exists only on a computer. But officials at My Friend's Place are reviewing it.

"Addressing the complex issue of youth homelessness requires both great commitment and innovation," said Heather Carmichael, the executive director of My Friend's Place.

> Addressing the complex issue of youth homelessness requires both great commitment and innovation.
>
> Heather Carmichael

"My Friend's Place is excited to collaborate with USC and its development of an algorithm that will help providers to identify peer leaders for peer-driven HIV-prevention programs. With greater need than resources, it is imperative that we be strategic in our implementation of programs for the greatest positive impact on the lives of the youth we serve."

How it works

To create the algorithm, the researchers mapped the friendships of homeless teens and young adults at My Friend's Place. Every node, or connection point, on the map represents a person, and links between each person indicates that the two are friends.

"It's a mathematical formula of people and their real friendships," Yadav said. "There are some friendships that we're not certain about, and there are some friendships that we're certain about, so we keep all of this information. This gives us input for our algorithm. We extrapolate the problem into a graph. Then, once we have our algorithm, we can translate our solutions back to the real-world network."

After analyzing what could be a very complex map of friendships, the computer algorithm can calculate which nodes (or names) are best positioned to influence their peers and maximize the message of a word-of-mouth campaign.

Unlike other word-of-mouth models, this algorithm accounts for uncertainties, which can happen if a young person provides only a vague description of their friends. The algorithm is also unique because it allows for social networks to evolve.

"One of the things that's really challenging about homeless youth is that there is a lot of uncertainty. It's not like school. This is a much more fluid population. They show up one day, they don't show up again for another month. They show up together with a friend one day, a few months later they don't talk to each other anymore — so there's a lot more noise," Rice said. "That's part of why this program's so great, is because it can extrapolate all of that noisy data and help us make better guesses."

Helping at-risk populations

The algorithm has implications for public-health campaigns for other populations, too. Once the algorithm is set up on a computer, the interventionist needs only to map out known or likely friendships of a particular population, and update the data as those relationships are confirmed. The algorithm does the rest.

"We don't differentiate," Yadav said. "As it is right now, this algorithm can be used in any domain, in viral marketing, in social networking. And it could be used in other populations."

That gives hope for social workers who work with other at-risk groups, Rice said.

> Prevention is easier when you know who everybody is. But real-life networks, particularly around young gay men, homeless youth, people who are methamphetamine users – they're hidden populations. .
>
> Eric Rice

"Prevention is easier when you know who everybody is. But real-life networks, particularly around young gay men, homeless youth, people who are methamphetamine users – they're hidden populations. They're populations that are fluid," Rice said. "People in public health and social work have recognized this uncertainty, but they don't really know how to contend with it."

As the algorithm identifies influential messengers, social workers can use that information to find other friends of that person that they didn't previously know about, and continuously improve the algorithm's data and its results.

“Our hope is that if we can use this and show that it makes us better interventionists,” Rice said. “It could really save a lot of money. It could prevent HIV. It could save some lives.”

About This Site [/about/] Contact Us [/contact/]