



The Computerworld Honors Program

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Final Copy of Case Study

Status:

Laureate

Year:

2013

Organization Name:

Microsoft Research

Organization URL:

<http://research.microsoft.com/en-us/collaboration/default.aspx>

Project Name:

Uncovering New Ways the Human Immune System Fights HIV

Please select the category in which you are submitting your entry:

Health

Please provide an overview of the nominated project. Describe the problem it was intended to solve, the technology or approach used, how it was innovative and any technical or other challenges that had to be overcome for successful implementation and adoption. (In 300 words or less.)

More than 1.8 million people die of HIV-related causes each year -- approximately 5,000 deaths per day. HIV is a particularly significant threat in the sub-Saharan region of Africa. In some areas, the occurrence of HIV is eight times higher for women than men; an estimated one in three women seeking care during pregnancy is HIV positive. Researchers and collaborators in South Africa are working with the Ragon Institute at Massachusetts General Hospital, MIT and Harvard, the University of KwaZulu-Natal, Centre for the AIDS Programme of Research in South Africa (CAPRISA), the KwaZulu-Natal Research Institute for Tuberculosis and HIV (K-RITH) and Microsoft Research to fight HIV. The team has amassed vast amounts of data since the beginning of the research project, but was challenged with how to analyze and parse such a large quantity of data so that they could apply it to their research. To catalog the vulnerable fragments of HIV, we're taking data from many individuals in South Africa and correlating that data with how the patient's body is reacting to the virus, noting whether it is controlling HIV or if the virus is continuing to copy itself and survive. The team must sort

through the different mutations of HIV to how the immune system attacks the virus, and how HIV mutates in response. It is a daunting task: there are millions of possible combinations to sort through. It would take years to process the volume of data we receive on a single computer, but Microsoft Research is devoting thousands of computers to this task. We are using an algorithm developed at Microsoft Research called PhyloD. Combined, our hardware and software can complete the analysis in just hours -- a critical advantage in the fight against HIV.

When was this project implemented or last updated? (Please specify month and year.) Has it incorporated new technologies and/or other innovations since its initial deployment? (In 300 words or less.)

This project was last updated August to September of 2012. Nothing has been changed since the original deployment.

If this is a previously submitted project that has been significantly updated and/or expanded, please describe the nature of the update here. (In 300 words or less.)

This project has not been previously submitted.

Is implementation of the project complete? If no, please describe the project's phases and which phase the project is now in. (In 300 words or less.)

Yes.

Please provide at least one example of how the technology project has benefited a specific individual or organization. Feel free to include personal quotes from individuals who have directly benefited from the work. (In 300 words or less.)

Bruce Walker, director of the Ragon Institute at Massachusetts General Hospital, MIT and Harvard, and a professor of medicine at Harvard Medical School, stated that by using the kinds of algorithms that David, Distinguished Scientist and manager of the eScience group at Microsoft Research, has developed, they can then look at more precisely defining the vulnerabilities of the virus and defining how to target a vaccine to do what ultimately needs to be done, which is to corner the virus such that it can't escape. "There's a tremendous amount that can be learned by the way the virus changes in response to being poked in different ways. That is such a complex process that it's not something that you or I could figure out with our own brains. This is something that takes massive computing power and that's what David has been able to apply to this," says Walker.

Would this project be considered an innovation, a best practice or other notable advancement that could be adopted by or tailored for other organizations and uses? If yes, please describe that here. (In 300 words or less.)

This HIV project should be considered as a notable advancement that could be adopted by or tailored for other organizations and uses to potentially help millions through the prevention of HIV and, perhaps one day, a cure. But it goes beyond just HIV, Walker notes. "Everything we learn studying HIV tells us how the immune system works and



how it fails. I want people to understand that the immune system, on a daily basis, is not just protecting us against infections; it's also protecting us against cancers. Everything we learn here is going to be applicable not just to HIV but to breast cancer and prostate cancer, and will ultimately change the way medicine is practiced. Because our ultimate goal is that we will learn how to harness the immune system to do a better job at what it was initially designed to do."

If there are any other details that the judges should know about this project, please note them here. (In 300 words or less.)

Beyond the science and computations lies the reason a vaccine is so desperately needed: preventing further loss of life. Individuals who don't die as a result of the virus are likely to suffer the loss of a "normal" life, asserts Zinhle Thabethe, deputy director for iTEACH in South Africa. She speaks from experience: Thabethe was diagnosed as HIV positive in 2001 at the age of 24. She began antiretroviral (AVR) therapy through a privately funded clinic a year later. Since beginning AVR therapy, her life has been dominated by the medications: remembering to take them, watching out for side effects, and dealing with the emotional stress of being infected with HIV. "Taking pills for HIV is really a challenge," Thabethe observes. "It is doable with a very positive mindset. But you can imagine every day at 6:00, or whatever time a patient chooses, you have to remember to take this particular thing. It's not like food, where you can eat whenever you're hungry. With antiretrovirals, it has to be precisely on time. You just cannot miss any tablets, irrespective of what you're doing. Your life is actually revolving around remembering that you have to take those pills, because they are the reason why you live." For more information: Watch the HIV Research Video "Seeking Solutions in Africa": <http://research.microsoft.com/apps/video/default.aspx?id=156883>. Read the case study in PDF: http://research.microsoft.com/en-us/collaboration/stories/hw_hiv_cs.pdf.