UCSD team is part of cutting-edge, nationwide cancer program

Grants will fund use of artificial intelligence to predict cancer evolution during treatment and better match treatments to disease

UC San Diego geneticist Trey Ideker is among a group of researchers nationwide tasked with a massive precision cancer project backed by the Advanced Research Projects Agency for Health, an agency of the U.S. Department of Health and Human Services. (UC San Diego)

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UC San Diego researchers are part of a nationwide effort to increase the precision of cancer therapy through the better and broader use of computer modeling and machine learning, often called artificial intelligence.

On Tuesday, the U.S. Department of Health and Human Services, acting through its Advanced Research Projects Agency for Health, announced up to $142 million in funding for the Advanced Analysis for Precision Cancer Therapy program. The agency named 10 different organizations to handle specific parts of the larger effort, which a statement describes as a “bleeding edge” attempt to “predict a patient’s cancer trajectory and identify the best next therapy for survival.”

UC San Diego is listed among five different organizations tasked with making therapy recommendations and techniques based on computer-enabled genetic analysis. Specifically, the local team will “build dynamic biomarkers that anticipate tumor evolution with predictions of drug response and survival times.”

UCSD geneticist Trey Ideker confirmed Wednesday afternoon that his lab is heavily involved in the effort, which involves approximately $25 million in grant funding over six years.

The researcher is known for his work using computers to map how “networks” of genetic mutations affect cell biology, training artificial intelligence models to create a “wiring map of a cancer cell” in an interview published by the National Cancer Institute.

“Overall, they are asking us to build precision oncology AIs — we call them drug-recommender engines — that will sit alongside humans on tumor boards and help provide information on how to get the right treatments to the right patients at the right time.”

The growing ability to sequence the human genome and compare thousands of genomes to each other now yields endless complexity and simultaneous opportunity for discovery. By comparing the genetic information of many patients with similar cancers, it is possible to suss out which combinations of mutations drive their growth.

But, Ideker noted, this information, when combined with medical data that shows how genes are expressed, is simply too voluminous for any one human, or group of humans, to hold in their heads. Artificial intelligence, he has shown in several recent research papers, provides the opportunity to see bigger patterns.

“The amount of data that can be collected today, even per patient, is far too vast for a single person to get their mind around,” he said.

He already has a track record of using computers to spot patterns in large amounts of genetic data. For example, he worked with a team that analyzed the genetic sequences of more than 9,000 cancer patients to better understand the epigenetic clock, the main mechanism that controls cell aging, shedding new light on the process and the interplay between random mutation and inherited characteristics. He also drew attention in 2020 for building DrugCell, an artificial intelligence model that can better match breast cancer drugs to specific patient tumor characteristics.

This model, he noted, delivers not just recommendations, but is trained to show its work, providing the references it used to reach a given conclusion.

“If I had to guess what made our proposal successful, I think, unique among others, is that we really put a lot of emphasis and focus on trust and accountability,” Ideker said. “When it comes to clinical settings, you’ve got to be accountable, you can’t be the Wizard of Oz behind a green curtain.”

AI recommendations, at least for the foreseeable future, must be fully understood by human experts before they can be used with patients.

And Ideker, whose work is affiliated with UCSD’s Moores Cancer Center, noted that this is not a static puzzle. As patients are treated, their cancer continues to change. A big part of UCSD’s task in the larger research effort is to come up with better ways to pick up on those changes and recommend treatment changes even as care is ongoing.

The effort is exciting, he added, because the National Cancer Institute has worked to coordinate the efforts of three organizations who will directly treat patients. They include the University of North Carolina Chapel Hill for breast cancer, Beckman Research Institute at the City of Hope near Los Angeles for lung cancer and the University of Texas MD Anderson Cancer Center for colon cancer.

Arizona State University, Stanford University, the Massachusetts Institute of Technology and Brigham & Women’s Hospital in Boston are the other organizations, along with UCSD, tasked with analyzing the data to come up with new treatment ideas, each bringing its own artificial intelligence expertise to bear.

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