AMAZING GOAL.

Prof. Rick Stevens with Argonne National Laboratory is using deep learning to help move science closer to curing cancer.

Cancer has proven itself a formidable opponent. But every opponent has a weakness — and Rick Stevens is working to identify it, exploit it… and, ultimately, bring the disease to its knees.

How? With supercomputing-powered deep learning.

Prof. Stevens is an associate laboratory director at Argonne National Laboratory (ANL) and a principal investigator on a program that's part of the "Cancer Moonshot" — a sweeping "all government" approach to the problem of cancer.

Called the Joint Design of Advanced Computing Solutions for Cancer (JDACS4C), the program relies on team science, bringing the combined forces of U.S. Department of Energy (DOE) supercomputing labs and the National Cancer Institute (NCI) and its national laboratory to bear on cancer research.

And Stevens is helping lead the charge.

JDACS4C is focused on three critical "pilot" projects: understanding key protein interactions, predicting drug response, and automating patient information extraction to inform treatment strategies.

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All three pilots are linked together by a common thread — data. Specifically, plumbing the already copious amounts of data for new hypotheses, drug targets and treatments.

CRAY

"It's a huge computational problem," says Stevens. "We have lots of data — millions and millions of experiments and expression data. But the models we need are still an open question."

Making the kind of rapid progress the DOE-NCI partnership envisions means addressing critical needs in computing, data transfer and data management in cancer research. In other words, they need the capabilities only afforded by deep learning. So in answer, Stevens conceived of and is leading the development of a scalable deep neural network code called CANDLE — or CANcer Distributed Learning Environment — that will address the machine learning aspect of all three key projects.

"We're building a deep learning model, which is a neural network that combines all of the information that has already been gleaned about drug response in all types of cancer," says Stevens. "The idea is that this model will learn across many types of cancer, many types of drug structures and many types of data. And it would be something we could keep adding to, so it gets smarter over time."

The analysis CANDLE enables will expose cancer's vulnerabilities as never before.

In fact, Stevens' work is hitting cancer from two sides. Along with the CANDLE effort, he's leading one of the three pilot projects. His group is putting ANL's Cray supercomputer to work on the task of predicting how specific patients and tumors respond to different types of drugs.

"In the U.S., we have about 200 cancer drugs and we know combinations will outperform single applications," Stevens says. "But combining pairs and triplets is very time consuming. You could have 5 million experiments and if you want multiple treatment and dosage levels it's even more exponential."

But to Stevens, the light at the end of the tunnel just keeps getting brighter: "Every day there's progress in deep learning. It's amazing."

ARGONNE NATIONAL LABORATORY

Argonne is a multidisciplinary science and engineering research center that leads discovery in a wide range of disciplines from high-energy physics and materials science to biology and advanced computer science.

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- Aries™ interconnect with Dragonfly configuration
- 10 PB Lustre® file system