How AI is Driving NIH COVID-19 Response

The agency has multiple research and development programs using artificial intelligence for biomedical imaging and data-processing efforts.

Faith Ryan
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As the U.S. continues to combat the coronavirus pandemic, the National Institutes of Health has doubled down on artificial intelligence technologies and multi-institute research programs to rapidly understand how the disease affects people.
“AI has become a really important part of what we do,” said National Heart, Lung, and Blood Institute (NHLBI) CIO Alastair Thomson during the Artificial Intelligence: New Horizons in Medicine event Aug. 13. “It’s really been enabled by the technologies of the cloud, GPUs and other techniques, which have made machine-learning techniques, deep neural networks and other elements of AI feasible in ways that we’ve never thought before.”

Co-leading NHLBI’s BioData Catalyst Program — a large cloud-based infrastructure for heart, lung, blood and sleep research — Thomson explained that the agency is funding a number of health projects using AI.

Researchers are analyzing lung-related diseases like chronic obstructive pulmonary disease (COPD) and pneumonia using AI and CT scan models, which could be used to accelerate predicting, diagnosing and examining diseases like these in clinical settings, including COVID-19.

“With the University of North Carolina, we’re using deep learning to quantify pulmonary vascular remodeling in COPD,” Thomson said. “In COPD, the vasculature in the lung changes and shifts. Interestingly, we’re also seeing that in COVID-19. But that’s an area where entirely new research methods have been developed in order to actually understand what’s happening deep within the lungs from CT images. It's something we've never been able to do before.”

"We're applying [deep-learning algorithms] to CT imaging and chest X-rays to look for early detection of pneumonia, [some] things that are going to be indicative that a [COVID-19 patient] is going to end up in the ICU, and how we're going to treat them when they come out of the ICU afterward,” he added.

Providing the necessary technologies that support NHLBI's program is the National Institute of Biomedical Imaging and Bioengineering (NIBIB), which has seen a rapid expansion in AI-related tools to support biomedical research and improve clinical decision-making. This includes advanced point-of-care tools, techniques and devices that assess a patient’s COVID-19-risk and disease severity as well as identify viable treatments by analyzing the heart and lungs.
The agency recently launched a consortium with NIH-funded research institutes, called the Medical Imaging and Data Resource Center (MIDRC), specifically geared toward using AI to analyze medical imaging data to assess a patient’s disease risk and to develop innovative tools for early COVID-19 detection.

“I do not see any application that does not have the word AI in it,” NIBIB National Technology Centers Program Director Behrouz Shabestari noted, adding that the pandemic “has become a testbed for AI.”

One of the potential tools coming out of the consortium, he said, could be a COVID-19 breathalyzer and the critical scientific developments around AI have impact for CT scan and X-ray data analyses.

Supporting additional research on CT scan modeling is Nvidia, which is also involved in the White House's COVID-19 High Performance Computing Consortium.

“Health care technology is at the top of mind, especially during this time with the COVID-19 pandemic,” said the company’s Global Head of Medical AI Mona Flores. Specifically, Nvidia’s GPUs have been supporting AI efforts at the National Cancer Institute with the imaging work, she said.

Ensuring that all of the COVID-19 research literature and relevant data are easily accessible, findable and usable for the scientific community is the National Library of Medicine. The agency recently launched a new AI initiative with the Common Fund, called the Artificial Intelligence for Biomedical Excellence (AIBLE), to further develop AI-driven algorithms that support NLM’s objectives.

“This is a $160 million seven-year program designed to accelerate biomedical uses of artificial intelligence, create data design centers, develop what we call gold data sets (AI-ready data sets driven not by original hypotheses, but rather, from a discovery perspective) and to develop the ethical, legal and social guidance to make sure that the knowledge we build is reflective of and meaningful to society as a whole,” Brennan explained.

Moving forward, AI and other data analytics techniques will continue to play vital roles in the pandemic response, specifically to address long-term health issues it causes, the agency officials said.
“When this all started in December and January, we all thought that this was a respiratory disease,” Thomson explained. “But this is not your average respiratory disease — this is going to have long-term effects on the heart, the kidneys, the brain. All of these are going to be affected for a long time to come.”

“These AI techniques are being applied across the board in every area we're looking at — whether it's genomics, imaging or whatever else," Thomson added. "The applicability of models developed from one modality to another has been startling, and it's led to some tremendous progress."