

Institute for Artificial Intelligence in Medicine

Northwestern University Feinberg School of Medicine

People-driven.
Data-powered.



Institute for Artificial Intelligence in Medicine

The ability of artificial intelligence (AI) to greatly improve our health and well-being has only just begun to be realized. Medical professionals are using the power of smart technology to think better and faster to enhance all aspects of patient care—from obtaining more accurate diagnoses to optimizing outcomes. Leveraging the problem-solving and decision-making capabilities of computers and machines, AI is poised to become an essential and indispensable tool in the clinical setting.

At Northwestern University Feinberg School of Medicine, investigators have already started exploring a variety of innovative AI-based medical applications that are yielding promising results. Our momentum in AI-powered research is growing day by day. Through our new **Institute for Artificial Intelligence in Medicine (I.AIM)**, we are creating a dynamic infrastructure not only for the development of innovative AI tools but also for setting the highest standards to ethically guide their use in healthcare. Our ultimate aim is to bridge computational methods with human expertise to advance medical science and improve human health.

Data-powered intelligence guided by the heads—and hearts—of humans ensures that we never lose sight of the humanity and compassion that is central to delivering the best patient care.



With the leadership of director Abel Kho, MD, MS, FACMI, professor of Medicine and Preventive Medicine, we are building a diverse, collaborative AI community that draws upon individuals and programs across Northwestern University. Our diverse team includes physicians, scientists, and educators with expertise in computer science, data engineering and biomedical informatics, law, policy, and ethics from across the Feinberg School, broader University campus, and our region. The mission of Feinberg's Institute for AI in Medicine is to bridge computational methods with human expertise to advance medical science and improve health. The institute continues to build the infrastructure necessary to accelerate innovation. Its work in data science has deep roots in the community and welcomes new partnerships. Partners include AI at Northwestern, Northwestern Medicine (NM), NM Bluhm Cardiovascular Institute, and the Center for Health Information Partnerships.

Focus and Structure of the Institute for Artificial Intelligence in Medicine

Seven guiding principles help steer the Institute for Artificial Intelligence in Medicine as it works to expand AI research, education, innovation, and patient care at Northwestern. Modeled on the physician's Hippocratic oath, these values provide an ethical framework that puts people first no matter where the advancements of AI take us.

- Value privacy
- Act with humility
- Endeavor ethically
- Move deliberately; don't break things patients or clinicians depend on
- Respect patients and clinicians
- Augment the physician's tools; maintain centrality of people in the practice of medicine
- Beneficence (do what's right)



"We explore the application of machine learning, artificial intelligence, pattern recognition, genetic analysis and deep phenotyping of health data to build useful, responsible tools that put people first.... AI is a tool, like a stethoscope or scalpel. And it's most powerful when guided by the hands of clinicians."

Abel Kho, MD, MS, FACMI
Director, Institute for AI in Medicine

Seven Highly Specialized Centers

Many technological tools contribute to artificial intelligence. The investigators at the Institute for AI in Medicine are exploring the application of myriad computational methods—such as machine learning, artificial intelligence, pattern recognition, genetic analysis, and deep phenotyping of health data—to build useful, responsible tools.

I.AIM features seven centers focused on various aspects of AI-powered technology. They are:

Center for Computational Imaging & Signal Analytics in Medicine - Machine learning and AI systems have a vast capability to improve patient care and clinical research. This center applies advanced analytic methods to augment clinical care using advanced imaging or sensor data.

Center for Deep Phenotyping & Precision Therapeutics - A barrier to improving health is the imprecise classification of diseases. This center focuses on high-definition phenotyping of patients, applying machine learning to reclassify heterogeneous clinical syndromes, and performing novel clinical trials to advance precision medicine.

Center for Advanced Molecular Analysis - Most human diseases are associated with a certain genetic signature, either inherited or acquired after birth due to environment or random events. This center seeks to generate and analyze high-throughput cellular and population omics data for improved diagnostics and treatment.



Center for Biomedical Informatics & Data Science - As AI and data science revolutionize our understanding of disease, these discoveries need to be transformed into tools for the everyday challenges of patients and clinicians. This center develops and supports informatics methods and tools to effectively use data in clinical settings and to train the next generation of biomedical informaticians. (This is a joint center between I.AIM and Northwestern University Clinical and Translational Sciences Institute.)

Center for Bioethics & Medical Humanities - Consideration of humanity alongside the miracles and advances of medicine is essential to the ethical and appropriate use of technology in the care of people. This already established center will launch a new program to address the evolving ethics of data, machine learning, and artificial intelligence.

Center for Medical Education in Digital Healthcare & Data Science - People are central to the use of AI in healthcare. This center aspires to impart trainees with foundational knowledge and skills in the research and application of technology to improve health.

Center for Collaborative AI in Healthcare - This center is a medical school-wide collaborative hub for research, strategic infrastructure, and training in collaborative AI. In particular, the center assists clinicians, hospital administrators, and basic scientists with successfully applying AI methods in their daily research and practice.



Collaborating across Northwestern on AI initiatives, the institute's members also work within **Northwestern Medicine Bluhm Cardiovascular Institute's Center for Artificial Intelligence in Cardiovascular Disease**. This center looks to translate internal intelligence into innovation when it comes to heart health.

Artificial Intelligence Breakthroughs at Northwestern

I.AIM is leading a number of innovative and groundbreaking research efforts to improve patient care. Initiatives expand on work of numerous faculty across Northwestern and unify programs in medicine, genetic analysis, deep phenotyping, ethics, and data science.

Recent discoveries offer promise for:

Expediting the diagnosis of lung and breast cancers—A Northwestern study in collaboration with Google showed in two separate studies that an AI tool augmented the work of radiologists by better detecting malignant lung nodules as well as more accurately predicting breast cancer in mammograms.

Enhancing the health of mothers and their newborns—A team of Northwestern scientists have created patent-pending technology that uses AI to analyze placenta images after delivery, providing critical information, such as whether the fetus received enough oxygen in the womb or if there is a risk of infection or bleeding for the mother. Currently in the U.S., only 20 percent of placentas are assessed by pathology exams after delivery, in part because the cost, time, and expertise required are prohibitive. AI offers a cost-effective tool for improving outcomes for mother and child.

Using smart stethoscopes to detect heart problems—A study led by the Northwestern Medicine Bluhm Cardiovascular Institute's Center for Artificial Intelligence in Cardiovascular Disease had clinicians testing technology that employs recordings of tens of thousands of heartbeats to detect murmurs. The AI was also used to guide the acquisition and interpretation of echocardiography. After leading the clinical trial that resulted in FDA approval, Northwestern Medicine has now deployed this application into the COVID-19 units, where frontline providers can easily image the hearts of COVID-19 patients.

Building a Community for Responsible Use of Healthcare Data

Technology has created a complex environment that requires multidisciplinary teams to arrive at the best solutions for health and for society. To build this community of responsible data scientists, I.AIM launched several initiatives to expand the network of students, researchers, and industry experts to fuel innovation in this space.

Addressing health disparity using a student competition—

The institute hosts the annual Third Coast for Augmented Intelligence for Health Bowl, which features multidisciplinary teams representing higher education institutions that compete to address health disparities. The Bowl helps cultivate the next generation of data scientists as student teams from across the country come together to develop novel solutions to address health disparities using data and advanced computing methods.



Creating a safe space for learning and developing artificial intelligence—We are building a Health Data Gymnasium as a safe environment that brings together people, data, and tools for hands-on training in data science applied to health. The I.AIM Health Data Gymnasium builds on our local and national network of experts in data science and informatics, privacy preservation, data security, data standards and integration, and ethical legal and social (ELSI) issues. Students and trainees can access a growing collection of data and software tools, organized by medical domains and mentored by clinical and digital health experts in order to develop the core skills in data engineering and analysis necessary for data-intensive research.

An Invitation to Partnership

With the creation of the Institute for Artificial Intelligence in Medicine, we have an extraordinary opportunity to take a leadership role in the rapidly unfolding field of AI. Committed to innovating new AI strategies to enhance human health, we have a bold vision as well as a great responsibility to ensure the ethical development of these powerful tools. We invite interested individuals and groups to join us as partners as we build and expand the new institute to improve patient care in ways that were once unimaginable.

Philanthropic opportunities to advance the Institute's exciting work include:

- Leadership gifts of endowment to support the I.AIM and/or each of its seven centers;
- Endowment and outright gifts that help support scholarships as well as our training of medical students, residents, and postdoctoral fellows;
- Financial or data donations to support the expansion of the Health Data Gymnasium;
- Gifts to support seed grants as well as promising research studies to fuel innovation and discovery, such as early stage trials in precision medicine;
- Philanthropic funds to attract young people to the emerging field of artificial intelligence;
- Gifts to recruit talented faculty as well as support scholars in residence.

For more information about giving to the Institute for Artificial Intelligence in Medicine, please contact:

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