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# Commentary

## Harnessing Artificial Intelligence and Emerging Technologies to Enhance Cancer Treatment

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### Commentary Overview

- Technology's potential as a catalyst for transformative change in cancer care has existed for years, but recent progress in artificial intelligence (AI) and the emergence of precision medicine makes our focus on technology timely.
- Uncovering new imaging techniques and instruments enhanced by AI can lead to earlier detection, actionable diagnoses, and ultimately, additional lives saved.
- The use of technology and data science in understanding cancer and developing precision interventions can be greatly accelerated by collaborations between basic scientists, engineers, social scientists, and clinicians.

**It's difficult to imagine life today without internet browsers, magnetic resonance imaging, or the light emitting diode. The inventors of each of these practical and widespread**

technology called The University of Illinois at Urbana-Champaign home. Now, after more than a century of technological advances that have changed society, my home institution has turned its research focus to cancer, with the expectation that society is on the cusp of a technology-driven revolution against the disease.

Today, artificial intelligence (AI) is sweeping all facets of our lives — autonomous cars are on roadways, robotic systems are used in surgery, and we can test at home for a range of conditions from pregnancy to glucose levels. We can also imagine a future where these trends converge to transform cancer understanding and care. The past year has shown us the powerful impact of what technology can do — connecting us at a distance, aiding the development of a vaccine, and implementing large-scale testing that is inexpensive and convenient. Now that our eyes are opened to these possibilities, what more can be done, and what can be done better, for cancer patients?

Progress starts with basic discovery, and discovery depends on innovation, which can be accelerated by using technology to inspire more people from diverse backgrounds to collaborate and apply their talent more effectively. Translating discoveries also depends increasingly on data and analytical methods that grow from AI.

This chain of discovery, measurement, analysis, and application can speed the delivery of improved treatments to clinicians and patients. For example, cervical cancer was once one of the deadliest cancers for American women, but the rapid pace of discovery—including increased regular testing, improved diagnostics, and development of the HPV vaccine—changed that. But even as we make strong strides in one area, many other forms of cancer demand our attention.

## Cancer Measurement and Data Science

Technology's potential as a catalyst for transformative change in cancer care has existed for years, but recent progress in AI, and the emergence of precision medicine, makes this focus on technology timely. At the Cancer Center at Illinois (CCIL), we take an even more expansive view of technology by considering how combining diverse fields—from measurement and materials science to chemistry and the biology of networks—will boost progress against cancer. Our first program, **Cancer Measurement Technology and Data Science**, seeks to harness the synergy between measurement and data science to accelerate diagnostics. Inspiring fundamental advances in measurement technology, computing, and AI, for example, we are rethinking the workhorse of biomedical research—the optical microscope—to uncover microscopic tumor and microenvironmental changes that were not accessible to humans but become understandable by using AI.

Another CCIL team, inspired by the **vision capabilities of the mantis shrimp**, has developed an enhanced image sensor for tumor detection and to guide cancer surgery. CCIL scientists are innovating **rapid cancer biomarker diagnostic tests** and uncovering new imaging techniques and instruments using artificial intelligence approaches to improve outcomes through earlier detection and more precise diagnoses.

We were able to bring the same technology-focused, collaborative spirit to developing a saliva-based COVID-19 test on our campus in mere months, where our members led the development of testing that kept the university largely open for the past year and accounting for more than 20 percent of all tests in Illinois and more than two percent of all national tests on some days. Similarly, it is possible to bring cancer diagnostics to the patient, at scale.

## The Engineering-Biology Continuum

Enabling the life cycle of technology—from initial concept to engineering design, working laboratory prototypes, and finally, translation into broadly available products or services—can have deep impacts even in more traditional areas of cancer research. Our second program, **Cancer Discovery Platforms Bridging the Engineering-Biology Continuum**, uses modern technology to accelerate understanding and the development of therapeutics. Supported by a new National Science Foundation center, our members are using AI to find novel synthetic pathways to more effective targets and drugs. Another team is creating **“microcancer” cell cultures**, allowing researchers to form hundreds of tumor avatars in a high-throughput format using a small, microfabricated chip, enabling direct measurement of cellular health or response to drugs. Even our companion animals are on board, participating as patients in these science-fueled discoveries to advance compounds that are promising for human use.

## Seeking Collaboration

Applying technology and data science to understanding cancer and developing precision interventions can be greatly accelerated by collaborations between basic scientists, engineers, social scientists, and clinicians. With a cancer center focused on technology, we welcome colleagues to challenge us, inspire new technologies, and work together to move laboratory advances to clinical use. Investing in technology today builds on the decades of amazing progress in basic and clinical sciences but is also poised to propel us forward. As a community, we must seize this momentum generating broad public awareness of scientific research with an eye toward increasing support from the new presidential administration to bring our ideas to fruition.

### Our Mission

The Association of American Cancer Institutes (AACI) comprises 102 premier academic and freestanding cancer centers in the United States and Canada. AACI is accelerating progress against cancer by empowering North America's leading cancer centers in their shared mission to alleviate suffering.

### About AACI Commentary

To promote the work of its members, AACI publishes *Commentary*, a monthly editorial series focusing on major issues of common interest to North American cancer centers, authored by cancer center leaders and subject matter experts.

