

New Platform Uses Machine Learning to Predict Responses in Patients With Lung Cancer

Path-IO outperformed the current standard-of-care biomarker for guiding immunotherapy use in non-small cell lung cancer.

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- Path-IO is a machine learning platform that incorporates pathology data to predict how patients with non-small cell lung cancer will respond to immunotherapy.
- Unlike molecular approaches, Path-IO uses pathological data that is already routinely gathered from patients.
- Path-IO outperformed the current standard-of-care biomarker for guiding immunotherapy use in non-small cell lung cancer,

An artificial intelligence (AI) model developed by researchers at The University of Texas MD Anderson Cancer Center demonstrated the ability to accurately predict responses to [immunotherapy](#) for patients with metastatic non-small cell [lung cancer](#) (NSCLC). If clinically validated, it could give clinicians much-needed insight into one of the most pressing challenges in oncology.

Details of the model, called Path-IO, were presented today at the [American Association for Cancer Research \(AACR\) Annual Meeting 2026](#) by Rukhmini Bandyopadhyay, PhD, postdoctoral fellow in the lab of [Jia Wu, PhD](#), associate professor of [Imaging Physics](#) and [Thoracic/Head and Neck Medical Oncology](#).

“There are a number of AI-based approaches that have shown potential in recent years, but Path-IO really stands apart because we designed it from the outset for clinical translation,” Bandyopadhyay said. “For that to happen, a model has to make explainable decisions based on known factors and do it in a way that holds up across data sets. What we show here is, not only can Path-IO do that, but it can do it using data from slides that are already routinely gathered.”

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What is the significance of Path-IO and how could it contribute to clinical care?

Immunotherapy has been a transformational advancement in cancer care, but not all patients benefit from it. A significant challenge in oncology is determining who is most likely to benefit, so that physicians can tailor treatments and avoid unnecessary therapies.

The current standard-of-care biomarker for immunotherapy outcomes is PD-L1 expression, but this has demonstrated only modest predictive ability. In fact, in some of the validation groups used in this study, PD-L1 expression was as predictive as flipping a coin.

New research is showing that certain intratumoral structures, known as niches, are important biomarkers for predicting response, as well. Using pathology slides, Path-IO looks for these niches and other complex patterns that may be challenging for humans to reliably identify. The model then uses that information to stratify patients in groups based on their risk of disease progression following immunotherapy treatment.

This biology-based approach is one of the things that makes Path-IO unique. Rather than functioning as a “black box” AI that identifies entirely new and often uninterpretable patterns, Path-IO focuses on well-established tissue features and structures that, while difficult to consistently detect and quantify, are known to influence treatment response. This ability to explain the decisions it makes is an important distinction for its potential clinical adoption.

Using a historical data set from UT MD Anderson, Path-IO separated patients into high-risk and low-risk groups. Patients in the high-risk group had double the risk of death or disease progression than those in the low-risk group. For validation, the researchers tested the model on several external data sets with comparable results.

In all, Path-IO was validated in over 1,000 patients across multiple institutions and from multiple countries, and it significantly outperformed PD-L1 testing across all datasets.

What are the next steps for Path-IO?

The next crucial step for this technology will be validating it in a prospective clinical study. To prepare for that, the team already is expanding the testing cohorts to include more diverse groups of patients.

As with most AI tools, the more data Path-IO has to work from, the more accurate its predictions. In this study, researchers already have combined pathology-based predictions with radiomics and clinical data to further improve the prognostic ability of the model.

Soon, Bandyopadhyay believes the model will not only be able to predict whether patients will respond to immunotherapy but will even be able to predict the best immunotherapy strategy, such

as an immune checkpoint inhibitor alone or combined with other agents.

Further down the road, Bandyopadhyay hopes that this platform can be fully integrated with additional data into a digital twin model that includes multimodal data, CT imaging, genomic factors and other clinical variables.

“To our knowledge, this is the most rigorously validated deep-learning pathomics framework to date. But we’re really just getting started,” Bandyopadhyay said. “As we continue to integrate more data streams into the model, it will improve and become more specific in its predictive abilities, hopefully becoming a major asset for clinicians who are helping patients make important decisions about their treatment options.”

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